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DIABETES & METABOLISM JOURNAL

## Abstract book

2023 International Congress of  
Diabetes and Metabolism

19 ~ 21 October 2023  
HICO, Gyeongju, Republic of Korea



# 2023 International Congress of Diabetes and Metabolism

October 19 ~ 21, 2023

HICO, Gyeongju, Republic of Korea

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# Program at a glance

Room	Room 1 (3F)	Room 2 (3F)	Room 3 (3F)
Time/Session	Clinical diabetes and therapeutics	Basic / Translational research	Diabetes complications / Epidemiology
<b>1<sup>st</sup> day (Thursday 19 October, 2023)</b>			
14:30~15:30	Sponsored session 1	Post-doctoral session 1	Sponsored session 2
15:30~16:50	Research group on development of new drug and technology on metabolic disease	Post-doctoral session 2	Research group on beta cell biology and islet transplantation & AIBS joint session
16:50~18:10	KDA-SHVM joint session	Basic research hot topic	Research group on fatty liver disease
18:10~	Welcome reception (Cocktail party) / Lobby (3F), HICO		
<b>2<sup>nd</sup> day (Friday 20 October, 2023)</b>			
08:00~09:00	Breakfast symposium 1	Breakfast symposium 2	Breakfast symposium 3
09:00~10:40	Clinical diabetes and therapeutics 1	Basic research 1	Diabetes complications 1
10:40~11:00	Coffee break / Lobby (3F), HICO		
11:00~11:10	Opening address		
11:10~11:50	Plenary lecture 1		
11:50~12:10	Break & poster viewing		
12:10~13:00	Luncheon symposium 1	Luncheon symposium 2	Luncheon symposium 3
13:00~14:00	Sponsored session 4	Sponsored session 5	Sponsored session 6
14:00~15:00			
15:00~15:40	Plenary lecture 2		
15:40~16:00	Break		
16:00~17:40	Clinical diabetes and therapeutics 2	Translational research 1	Epidemiology & genetic 1
17:40~	Dinner (Congress banquet ceremony) / Grand Ballroom (1F), Hilton Gyeongju Hotel		
<b>3<sup>rd</sup> day (Saturday 21 October, 2023)</b>			
08:00~09:00	Breakfast symposium 4	Breakfast symposium 5	
09:00~10:40	KDA-KSHF joint session	Basic research 2	Epidemiology & genetic 2
10:40~11:00	Coffee break / Lobby (3F), HICO		
11:00~11:40	Plenary lecture 3		
11:40~12:00	Break & poster viewing		
12:00~13:00	Luncheon symposium 5	Luncheon symposium 6	Luncheon symposium 7
13:00~14:40	Clinical diabetes and therapeutics 3	Translational research 2	Diabetes complications 2
14:40~	Closing ceremony		

# Program at a glance

Room	Room 4 (2F)	Room 5 (2F)	Room 101~104 (1F)
Time/Session	Education and integrated care	Committee sessions	Oral presentations
<b>1<sup>st</sup> day (Thursday 19 October, 2023)</b>			
14:30~15:30	Sponsored session 3		
15:30~16:50	Research group on energy metabolism	Research group on diabetic vascular biology	
16:50~18:10	Research group on genetics	Research group on CGM and AID	
18:10~	Welcome reception (Cocktail party) / Lobby (3F), HICO		
<b>2<sup>nd</sup> day (Friday 20 October, 2023)</b>			
08:00~09:00			
09:00~10:40	Education and integrated care - education (K)	KDA-KSGCR joint session	
10:40~11:00	Coffee break / Lobby (3F), HICO		
11:00~11:10			
11:10~11:50			
11:50~12:10	Break & poster viewing		
12:10~13:00	Luncheon symposium 4		
13:00~14:00			
14:00~15:00		Diabetes and metabolism journal session	Oral presentation 1~4
15:00~15:40			
15:40~16:00	Break		
16:00~17:40	Education and integrated care - self care (K)	K-ACCORD session	Committee of the health insurance and legislation session (K) (Room 101 (1F))
17:40~	Dinner (Congress banquet ceremony) / Grand Ballroom (1F), Hilton Gyeongju Hotel		
<b>3<sup>rd</sup> day (Saturday 21 October, 2023)</b>			
08:00~09:00			
09:00~10:40	Education and integrated care - nutrition	KDA-IAS joint session	
10:40~11:00	Coffee break / Lobby (3F), HICO		
11:00~11:40			
11:40~12:00	Break & poster viewing		
12:00~13:00	Luncheon symposium 8		
13:00~14:40	Diabetes care and education (K)	Education course (for Asian diabetes educators)	Oral presentation 5~8 * OP8: Medical trainee session (K)
14:40~			

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# Contents

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- PL1 Novel insights regarding GLP-1 receptor agonist treatment
- PL2 Hepatic fibrosis, the silent threat of the metabolic syndrome
- PL3 Endotypes of type 2 diabetes in East Asians
  
- S1-1 Artificial intelligence for causal inference: trends and future
- S1-2 AI in diabetes: prediction and control for glucose management
- S1-3 Latest trends related to digital therapeutics in diabetes
- S1-4 Application of digital twin technology to the treatment of diabetes
  
- S2-1 RNA processing: novel mechanism modulating islet beta cell secretion
- S2-2 Down-regulation of PERK in human islets for diabetes treatment
- S2-3 ER stress and its associated signaling modulate incretin receptor signaling
- S2-4 Ciliary control of islet function
  
- S3-1 The use of new technology as a simple screening tool for the detection of diabetic retinopathy
- S3-2 Association between biomarkers of diabetic kidney disease with hepatic steatosis and fibrosis
- S3-3 The recent update of cardiac MRI in diabetic patients
- S3-4 Imaging of skeletal muscle quantity and quality in relation to fatty liver disease and type 2 diabetes
  
- S4-1 Clinical characteristics and treatment strategy of young-onset type 2 diabetes
- S4-2 Education strategies using new technology of diabetes care
- S4-3 Application of special diet in young patients with diabetes
- S4-4 Exercise recommendations for young patients with diabetes
- S4-5 Psychosocial evaluation and care tips for young patients with diabetes
  
- S5-1 Characterization and subgrouping T2DM
- S5-2 Applying precision medicine for the treatment of T2DM
- S5-3 Precision treatment of T2DM
- S5-4 Genetic risk and precision medicine
  
- S6-1 Melanocortin regulation of autonomic nervous system
- S6-2 The GDF15-GFRAL axis controls systemic homeostasis in wasting syndrome
- S6-3 Prevention of diabetes by metabolic adaptation of glucose and lipid utilization via activation of wakefulness and olfactory system
- S6-4 Gastrointestinal microbiome homeostasis in health, disease, and aging
  
- S7-1 Big data and machine learning applications in diabetes care
- S7-2 Prediction of type 2 diabetes using genome-wide polygenic risk score and metabolic profiles: a machine learning analysis of population-based 10-year prospective cohort study
- S7-3 An artificial intelligence-based prediction model for diabetic kidney disease progression

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# Contents

---

- S7-4 Electronic medical record-based machine learning approach to predict the risk of cardiovascular disease
  
- S8-1 The diabetes educator's role in CGM world
- S8-2 Role of diabetes educators in lowering barriers to insulin pump therapy
- S8-3 Using smart pen and digital apps for diabetes management
  
- S9-1 Mechanisms of NASH-induced HCC
- S9-2 G13 axis in the network of liver and muscle energy metabolism
- S9-3 Sex disparity in progression of nonalcoholic fatty liver disease
- S9-4 Machine learning-driven discovery of a novel diagnostic index for NASH
  
- S10-1 Monogenic diabetes
- S10-2 Clinical overview and implications of immune checkpoint inhibitor-induced diabetes mellitus
- S10-3 Characteristics and clinical course of diabetes of the exocrine pancreas
- S10-4 Post-transplantation diabetes, current status and new treatment
  
- S11-1 Dietary assessment and monitoring in telenutrition
- S11-2 The use of telenutrition medical nutrition therapy for diabetes in the US
- S11-3 Non-face-to-face nutrition intervention for chronic disease treatment in clinic
  
- S12-1 More intensive LDL cholesterol reduction: statin and ezetimibe combination
- S12-2 Triglyceride - REDUCE-IT (DM subgroup), STRENGTH trial, PROMINENT trial
- S12-3 Antiplatelet agents in diabetes: where are we now?
- S12-4 Recent advance in hypertension management
  
- S13-1 Non-bioenergetic ether lipid synthesis by mitochondrial GPD2 promotes tumor progression
- S13-2 Glutamine metabolism in tumor immune microenvironment
- S13-3 Targeting hyperglycemia and insulin signaling for cancer therapy
- S13-4 Paradigm shift in cancer catabolism: from glucose-centric to fatty acid-centric
  
- S14-1 Overview of residual risks after adapting current prevention modalities
- S14-2 The present and future of the management of type 2 heart failure
- S14-3 What to do next to prevent diabetic retinopathy?
- S14-4 Paradigm shift in clinical treatment for diabetic kidney disease
  
- S15-1 Facilitator for diabetes prevention
- S15-2 Coaching for diabetes management
- S15-3 Supporter for problem solving
- S15-4 Partner for physical activity

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# Contents

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- KS1-1 Human muscle aging at single-cell and single-nucleus resolution
- KS1-2 Discovery and development of molecular imaging-biomarker for metabolic disease
- KS1-3 Super-resolved mitochondrial proteome map by proximity labeling
  
- JS1-1 New therapeutic targets for alleviating diastolic dysfunction in diabetic cardiomyopathy
- JS1-2  $A\beta$  efflux impairment and inflammation linked to cerebrovascular accumulation of amyloid-forming amylin secreted from pancreas
- JS1-3 Role of flow-sensitive HEG1 in endothelial function and protection against atherosclerosis
  
- JS2-1 Obesity and diabetes as two intersecting risk factors for pancreas cancer
- JS2-2 Rapid deterioration of new-onset diabetes and risk of pancreatic cancer
- JS2-3 Changes in metabolic syndrome status are associated with altered risk of pancreatic cancer: a nationwide cohort study
- JS2-4 Experimental models for the connection between pancreatic cancer and diabetes
  
- JS3-1 Evaluation and management of patients with diabetes and heart failure: a Korean Diabetes Association and Korean Society of Heart Failure consensus statement
- JS3-2 In-hospital glycemic variability and all-cause mortality among patients hospitalized for acute heart failure
- JS3-3 Intersection of heart failure and NAFLD
- JS3-4 Obesity and heart failure
  
- JS4-1 Recent updates in diabetes guidelines by the KDA: overview of cardiovascular and renal management with SGLT-2 inhibitors and GLP-1RAs
- JS4-2 Effects of glucose-lowering drugs on cardiovascular outcomes in patients with type 2 diabetes
- JS4-3 GLP 1 based therapy including its effect on cardiovascular risk and lipid profiles
- JS4-4 Precision medicine for atherosclerotic cardiovascular disease risk stratification and therapy in Familial Hypercholesterolemia
  
- CS1-1 Sex differences of visceral fat area and visceral-to-subcutaneous fat ratio for the risk of incident type 2 diabetes mellitus
- CS1-2 Efficacy and safety of self-titration algorithms of insulin glargine 300 units/ml in individuals with uncontrolled type 2 diabetes mellitus (the Korean titration study): a randomized controlled trial
- CS1-3 Reproductive life span and severe hypoglycemia risk in postmenopausal women with type 2 diabetes mellitus
- CS1-4 Serum retinol-binding protein levels are associated with nonalcoholic fatty liver disease in Chinese patients with type 2 diabetes mellitus: a real-world study
- CS1-5 Glucose profiles assessed by intermittently scanned continuous glucose monitoring system during the perioperative period of metabolic surgery
  
- CS2-1 From ACCORD to GRADE: lessons and more steps forward
- CS2-2 UKPDS vs recent CVOTs: does glycemic control still matter

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# Contents

---

- CS2-3 REMATCH: beyond ACCORD and GRADE
  
- CS3-1 Clinical usefulness of digital therapeutics on diabetes management
- CS3-2 Digital health policy direction from the corporate side
  
- RS1-1 Discovery of a new NASH clinical candidate
- RS1-2 Rho-kinase is a molecular target for fatty liver diseases
- RS1-3 ILDONG's new drug development program for metabolic diseases
- RS1-4 The searching process for biomarkers predicting diabetes and complications
  
- RS2-1 Islet xenotransplantation: unlocking the new possibility in diabetes care
- RS2-2 Endoplasmic reticulum stress causes beta cell failure in monogenic and polygenic diabetes
- RS2-3 Heterogeneity of islet cells during embryogenesis and differentiation
- RS2-4 Role of mTORC1 in the regulation of pancreatic beta cell mass
  
- RS3-1 Regulation of GPR92-mediated intercellular communication in islets
- RS3-2 Hepatic glutamate-mediated steatosis and inflammation
- RS3-3 Intestinal FXR agonism modulates inter-organ crosstalk between intestine and adipose tissue to maintain glucose homeostasis
- RS3-4 Selective hepatic insulin resistance is not selective; serotonergic regulation of hepatic insulin signaling
  
- RS4-1 Diabetic vascular complications factsheet in Korea
- RS4-2 Blood Flow-Induced Reprogramming of Endothelial cells (FIRE) in atherosclerosis
- RS4-3 Novel concepts in the pathogenesis of diabetic vasculopathy
  
- RS5-1 Fatty liver & diabetes statistics in Korea 2009-2017
- RS5-2 Building a clinical care pathway for diabetes and NAFLD
- RS5-3 Drug screening strategies using the zebrafish model for NAFLD
- RS5-4 Maladaptive regeneration - the reawakening of developmental pathways in the obese liver
  
- RS6-1 Methods for constructing polygenic risk scores
- RS6-2 Polygenic risk scores for diabetes and related complications
- RS6-3 Risk prediction with polygenic risk score and updates from commercial genome-wide scans
- RS6-4 Issues in identifying monogenic diabetes
  
- RS7-1 Empowering diabetes management: leveraging patient-driven lifestyle modification with isCGM and the SEOUL Algorithm
- RS7-2 T2DM with MDI and premixed insulin: results from the FreEdoM-2 trial
- RS7-3 Automated Insulin Delivery (AID): the first RCT evidence in Koreans

---

# Contents

---

- RS7-4 Individualized nutrition using CGM and Artificial Intelligence
  
- SS1-1 Early treatment of T2DM patients considering cardiorenal function
- SS1-2 What's new in drug treatment of diabetes
  
- SS2-1 Expanding the option of SGLT2 inhibitor and DPP4 inhibitor
- SS2-2 The effects of TZD and combination therapy with DPP4i
  
- SS3-1 Holistic approach of T2D management - Cardiorenal outcome of Forxiga
- SS3-2 Promising approach for the management of T2DM with the combination of DPP4 inhibitors and SGLT2 inhibitors
  
- SS4-1 Use of continuous glucose monitoring in insulin-treated patients with type 2 diabetes
- SS4-2 The SEOUL algorithm for managing type 2 diabetes: the PDF Study
  
- SS5-1 Treating T2D patients with empagliflozin, considering heart failure
- SS5-2 Importance of early intervention for CRM
  
- SS6-1 Why GLP-1 therapy is important from pathophysiological perspective of T2D
- SS6-2 How to integrate GLP-1RA into clinical practice
  
- BS1 Treatment of T2D patients considering renal function
- BS2 Q-Tern, SGLT2 inhibitor + DPP4 inhibitor combination therapy: efficacy, safety and patients compliance
- BS3 How to find optimal combination therapy for patients with type 2 diabetes
- BS4 What should we consider when choosing DPP-4 inhibitors for elderly patients?
- BS5 Cutting edge care of pitavastatin with ezetimibe combination therapy
  
- LS1 What's new? SGLT2 inhibitor's enhanced glucose lowering effect
- LS2 Combination of DPP-4i and SGLT-2i: new insights from recent clinical trials
- LS3 What's new in drug treatment of diabetes steps
- LS4 A new choice for diabetes treatment: advanced hybrid closed loop
- LS5 Optimal combination use of SGLT2i and DPP4i
- LS6 The newest combination therapy: SGLT2i & TZD
- LS7 The holistic management with GLP-1RA in real practice
- LS8 Ideal clinical approach to use of dapagliflozin + sitagliptin fixed-dose combination for T2D patients
  
- EC1 Diabetes management: what you need to know
- EC2 Individualized therapy of oral hypoglycemic agent in the management of diabetes
- EC3 Towards optimal outcomes: injectable treatments in the management of diabetes
- EC4 Cardiovascular disease risk assessment and management in diabetes: the latest updates

# Contents

## Post Doctoral Session

### Post doctoral session 1

- PD1-1 Pharmacological intervention to prevent progressive dysfunction of pancreatic beta cell  
Kyun Hoo Kim<sup>1\*</sup>, Hyeonkyu Lee<sup>1</sup>, Joonyub Lee<sup>1,2</sup>, Hoe-Yune Jung<sup>3,4</sup>  
KAIST, Korea<sup>1</sup>, Seoul St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Korea<sup>2</sup>, Pohang University of Science and Technology, Korea<sup>3</sup>, Novmetapharma Co., Ltd, Korea<sup>4</sup>
- PD1-2 Effect of Time Restricted Feeding (TRF) on Cyp11a1 protein expression in ileum (intestinal) epithelium cells and on rhythmic abundance of gut microbiota in prediabetic mice model  
B Anjum<sup>1,2\*</sup>, Qulsoom Naz<sup>1</sup>, Aditya Upadhyay<sup>2</sup>, Kaleem Ahmad<sup>1</sup>, Rohit Sinha<sup>2</sup>, Swasti Tiwari<sup>2</sup>, M M Godbole<sup>2</sup>  
King George's Medical University, India<sup>1</sup>, Sgpgims, India<sup>2</sup>
- PD1-3 PTPN2 regulates mitochondrial function in the context of type 1 diabetes-like stress conditions  
Yongkyung Kim\*, Lori Sussel  
University of Colorado Anschutz Medical Campus, United States
- PD1-4 Night owls are canaries in coal mine for metabolic predisposition to T2DM, obesity and cardio-metabolic disorders  
Qulsoom Naz\*, Narsingh Verma, Baby Anjum, Abbas Ali Mahdi, Kauser Usman  
King George's Medical University, India

### Post doctoral session 2

- PD2-1 Healthy lifestyle, access to primary health care, and regular T2DM screening in Java, Indonesia: a district-level analysis for type 2 diabetes prevention  
Bagas Suryo Bintoro<sup>1,2\*</sup>, Dagun Raisah Laksmi Pratiwi<sup>2</sup>, Yayi Suryo Prabandari<sup>1,2</sup>, Laksono Trisnantoro<sup>3,4</sup>, Chyi-Huei Bai<sup>5,6</sup>  
Department of Health Behavior, Environment, and Social Medicine, Indonesia<sup>1</sup>, Center of Health Behavior and Promotion, Indonesia<sup>2</sup>, Department of Health Policy and Management, Indonesia<sup>3</sup>, Center for Health Policy Management, Indonesia<sup>4</sup>, School of Public Health, Taiwan<sup>5</sup>, School of Medicine, Taiwan<sup>6</sup>
- PD2-2 Underlying mechanism of G Protein-coupled Receptor 40 (GPR40) as a novel target to control muscle atrophy caused by obesity and aging  
Joo Won Kim<sup>1\*</sup>, Hwan-Jin Hwang<sup>1</sup>, Sukhwan Yun<sup>1</sup>, Min Jeong Park<sup>2</sup>, Hyun Jung Lee<sup>2</sup>, Eyun Song<sup>2</sup>, Soo Yeon Jang<sup>2</sup>, Ahreum Jang<sup>2</sup>, Kyung Mook Choi<sup>2</sup>, Sei Hyun Baik<sup>2</sup>, Hye Jin Yoo<sup>2</sup>  
Korea University, Department of Biomedical Sciences, Korea<sup>1</sup>, Korea University, Medicine Department of Internal Medicine, Korea<sup>2</sup>
- PD2-4 Differences in metabolic syndrome-related risk factors and productivity loss between school teachers living in urban and rural area of Karawang, Indonesia  
Al Mukhlas Fikri\*, Milliyantri Elvandari, Ratih Kurniasari  
University of Singaperbangsa Karawang, Indonesia

## Oral Presentation

### Basic & translational diabetes research

- OP1-1 Sodium glucose cotransporter 2 inhibitor ameliorate thiazolidinedione-induced adipose tissue fluid overload via the regulation of vascular endothelial growth factor-VE cadherin axis  
Ji Yoon Kim<sup>1,2\*</sup>, Hye-Min Jang<sup>2</sup>, Hye-Jin Lee<sup>2</sup>, Ah Hyeon Lee<sup>2</sup>, Dong-Hoon Kim<sup>2</sup>, Sin Gon Kim<sup>2</sup>  
Samsung Medical Center, Korea<sup>1</sup>, Korea University College of Medicine, Korea<sup>2</sup>

# Contents

- OP1-2 A molecular link between diabetes and breast cancer: anti-cancer effects of incretin based antidiabetic therapies on triple-negative breast cancer cells via mitochondrial modulation**  
Hamendra Singh Parmar\*, Pooja Jaiswal  
Devi Ahilya University, India
- OP1-4 Molecular mechanism of diurnal alterations of hepatic glycogen structure in mice with time-restricted feeding**  
Liang Wang<sup>4\*</sup>, Zhang-Wen Ma<sup>1</sup>, Jing-Yi Mou<sup>1</sup>, Quan Yuan<sup>1</sup>, Zi-Yi Wang<sup>2</sup>, Qing-Hua Liu<sup>3</sup>  
Xuzhou Medical University, China<sup>1</sup>, University of Queensland, Australia<sup>2</sup>, Macau University of Science and Technology, China<sup>3</sup>, Guangdong Provincial Peoples Hospital, China<sup>4</sup>
- OP1-5 Single-cell transcriptomic and somatic mutational profiling in a non-alcoholic fatty liver disease mouse model to reveal hepatocellular carcinogenesis**  
Won Hee Lee<sup>1\*</sup>, Byung-kwan Jeong<sup>1</sup>, Won-il Choi<sup>1</sup>, Jun Yong Park<sup>2</sup>, Young Seok Ju<sup>1</sup>, Hail Kim<sup>1</sup>  
KAIST, Korea<sup>1</sup>, Yonsei University College of Medicine, Korea<sup>2</sup>
- OP1-6 Investigating the pyruvate dehydrogenase kinase 3 inhibitory potential and binding mechanism of thymoquinone: towards therapeutic management of diabetes and inflammatory diseases**  
Mohammad Hassan\*  
Jamia Millia Islamia, India

## Clinical diabetes and therapeutics 1

- OP2-1 Changes in gut microbiome after metformin use in Korean patients with type 2 diabetes**  
Eugene Han<sup>1\*</sup>, Won Jong Kim<sup>2</sup>, Jang Hyeon Kim<sup>3</sup>, Da Som Jeong<sup>3</sup>, Byung-Wan Lee<sup>3</sup>, Eun seok Kang<sup>3</sup>, Bong-soo Cha<sup>3</sup>, Insuk Lee<sup>2</sup>, Yong-ho Lee<sup>3</sup>  
Keimyung University School of Medicine, Korea<sup>1</sup>, Yonsei University, Korea<sup>2</sup>, Yonsei University College of Medicine, Korea<sup>3</sup>
- OP2-2 Predictors of Glucagon-Like Peptide 1 Receptor Agonist (GLP1-RA) treatment discontinuation among patients with type 2 diabetes in Hong Kong: real-world evidence from a prospective cohort**  
Pui Yin Au-Yeung<sup>1\*</sup>, Chow Shun Yan<sup>1</sup>, Hongjiang Wu<sup>1</sup>, Eric SH Lau<sup>1</sup>, Alice PS Kong<sup>1</sup>, Ronald CW Ma<sup>1</sup>, Andrea OY Luk<sup>1</sup>, Risa Ozaki<sup>2</sup>, Juliana CN Chan<sup>1</sup>, Elaine Chow<sup>1</sup>, Aimin Yang<sup>1</sup>  
The Chinese University of Hong Kong, China<sup>1</sup>, Prince of Wales Hospital, China<sup>2</sup>
- OP2-3 Risk of thyroid cancer associated with incretin-based drugs among patients with type 2 diabetes: a population-based cohort study**  
HeeJun Son<sup>1\*</sup>, Sungho Bea<sup>2</sup>, Jae Hyun Bae<sup>3</sup>, Sun Wook Cho<sup>1,4</sup>, Ju-Young Shin<sup>2</sup>, Young Min Cho<sup>1,4</sup>  
Seoul National University Hospital, Korea<sup>1</sup>, Sungkyunkwan University, Korea<sup>2</sup>, Korea University Anam Hospital, Korea<sup>3</sup>, Seoul National University College of Medicine, Korea<sup>4</sup>
- OP2-4 Effects of Predictive-Low-Glucose-Suspension (PLGS) insulin pump with structured algorithm for preoperative glycemic control: a propensity score matching study**  
Sun Joon Moon\*, Su Ji Lee, Yun Hee Seo, Myoung Hoon Lee, Jihee Ko, Hyemi Kwon, Se Eun Park, Eun-Jung Rhee, Won Young Lee, Ki Won Oh, Cheol Young Park  
Kangbuk Samsung Hospital, Sungkyunkwan University School of Medicine, Korea
- OP2-5 Benefits of advanced hybrid closed loop system (MiniMedTM 780G) in meal management: patients who transition from MiniMedTM 670G/770G system in Australia**  
John Shin<sup>1\*</sup>, Zheng Dai<sup>1</sup>, Fang Niu<sup>1</sup>, Sol Kwon<sup>2</sup>, Jinkyung Jeon<sup>2</sup>  
Medtronic, United States<sup>1</sup>, Medtronic, Korea<sup>2</sup>
- OP2-6 Monogenic diabetes: a one-year experience at a specialized clinical genomics clinic**  
Hye Won Yang<sup>1,2\*</sup>, Min-Seok Han<sup>2</sup>, HeeJun Son<sup>1,2</sup>, Jinsun Jang<sup>1,2</sup>, Seung Shin Park<sup>1,2</sup>, Kyong Soo Park<sup>1,2</sup>, Soo Heon Kwak<sup>1,2</sup>  
Seoul National University Hospital, Korea<sup>1</sup>, Seoul National University College of Medicine, Korea<sup>2</sup>

# Contents

## Diabetes care & education

### OP3-1 Novel clustering of dietary pattern for predicting incident diabetes

Soree Yang<sup>1\*</sup>, Minsoo Kim<sup>1</sup>, Young Jin Kim<sup>2</sup>, Myungsoo Im<sup>1</sup>, Doohwa Kim<sup>1</sup>, Jeong Mi Kim<sup>3</sup>, Min Hee Jang<sup>3</sup>, Wook Yi<sup>3</sup>, Sohyeon Jeon<sup>1</sup>, Hye Jung Je<sup>1</sup>, Hyo Eun Kwak<sup>1</sup>, Yeong Jin Kim<sup>2</sup>, In Joo Kim<sup>3</sup>, Hyuk Kang<sup>4</sup>, Joon Ha<sup>5</sup>, Jinmi Kim<sup>1</sup>, Sang Soo Kim<sup>1</sup>  
Pusan National University Hospital, Korea<sup>1</sup>, Korea Institute of Science and Technology Information, Korea<sup>2</sup>, Kim Yong Ki Internal Medicine Clinic, Korea<sup>3</sup>, National Institute for Mathematical Sciences, Korea<sup>4</sup>, Howard University, United States<sup>5</sup>

### OP3-2 Web based diabetes registration in Mongolia

Sainbileg Sonomtseren<sup>1,2,3\*</sup>, Bolor Byambatsoj<sup>1,2</sup>, Enkhjin Boldbaatar<sup>1</sup>  
Endomed Hospital, Mongolia<sup>1</sup>, Mongolian National University of Medical Sciences, Mongolia<sup>2</sup>, Mongolian Diabetes Association, Mongolia<sup>3</sup>

### OP3-4 Glycemic parameters of primigravid women with gestational diabetes mellitus

Shuhaimi Farhanah Ahmad\*  
Universiti Teknologi Mara, Malaysia

### OP3-5 Role of integrated personalized diabetes management program for Diabetes Mellitus Type 2 (T2DM) control in limited resources facility: randomized controlled trial

Burhan Gunawan\*, Soesilowati Soerachmad, Liana Dewi  
Sumber Waras Hospital, West Jakarta, Indonesia

## Diabetes complications-basic & translational

### OP4-1 Causal association of type 2 diabetes and pulmonary tuberculosis: a mendelian randomization study

Hyunsuk Lee<sup>1\*</sup>, Jaewon Choi<sup>2</sup>, Jeongeun Lee<sup>2</sup>, Jongseok Park<sup>2</sup>, Kyong Soo Park<sup>2</sup>, Soo Heon Kwak<sup>2</sup>  
Seoul National University, Korea<sup>1</sup>, Seoul National University Hospital, Korea<sup>2</sup>

### OP4-3 Clinical meaning of urinary glycosylated albumin in patients with diabetes: a prospective cohort study of residual urine samples

Minyoung Lee<sup>1\*</sup>, Ji Hoon Bae<sup>1</sup>, Arim Choi<sup>1</sup>, Dahye Min<sup>2</sup>, Hae Won Kim<sup>2</sup>, Bong-Soo Cha<sup>1</sup>, Sang-Guk Lee<sup>1</sup>  
Yonsei University College of Medicine, Korea<sup>1</sup>, Severance Hospital, Korea<sup>2</sup>

### OP4-4 Combinatorial effects of tetrahydrocurcumin (THU) and transforming growth factor-beta receptor I inhibitor on nonalcoholic steatohepatitis

Kampeebhorn Boonlroh<sup>1,2\*</sup>, Eun Soo Lee<sup>1</sup>, Su Ho Jo<sup>1</sup>, Na Won Park<sup>1</sup>, So Bin Lee<sup>1</sup>, Choon Hee Chung<sup>1</sup>  
Yonsei University Wonju College of Medicine, Korea<sup>1</sup>, Faculty of Medicine, Khon Kaen University, Thailand<sup>2</sup>

### OP4-5 A mouse model for metabolic stress-induced nonalcoholic fatty liver disease and subsequent hepatocellular carcinoma

Byung-Kwan Jeong<sup>1,2\*</sup>, Won-Il Choi<sup>1</sup>, Wonsuk Choi<sup>1,3</sup>, Jieun Moon<sup>1</sup>, Chan Choi<sup>4</sup>, Young Seok Ju<sup>1</sup>, Pilhan Kim<sup>1</sup>, Jun Young Park<sup>5</sup>, Young-An Moon<sup>6</sup>, Hail Kim<sup>1</sup>  
KAIST, Korea<sup>1</sup>, Asan Medical Center, University of Ulsan College of Medicine, Korea<sup>2</sup>, Chonnam National University Medical School, Chonnam National University Hwasun Hospital, Korea<sup>3</sup>, Chonnam National University Medical School, Chonnam National University Hwasun Hospital, Korea<sup>4</sup>, Yonsei University College of Medicine, Yonsei Liver Center, Severance Hospital, Korea<sup>5</sup>, Inha University College of Medicine, Korea<sup>6</sup>

### OP4-6 Biological importance of anthocyanin in Cardiovascular Disease (CVD): therapeutic role in diabetic cardiomyopathy with their molecular mechanism

Dinesh Kumar Patel\*  
Faculty of Health Science, Shuats, India

# Contents

## Clinical diabetes and therapeutics 2

- OP5-1 Real-world evidence of hybrid closed-loop system (MiniMed 770G) switching from predictive-low-glucose-suspension insulin pump (MiniMed 640G) in Korea: a nationwide retrospective study**  
Sun Joon Moon<sup>1\*</sup>, John Shin<sup>2</sup>, Jinkyung Jeon<sup>3</sup>, Sol Kwon<sup>3</sup>, Young Min Cho<sup>4</sup>  
Kangbuk Samsung Hospital, Sungkyunkwan University School of Medicine, Korea<sup>1</sup>, Medtronic, United States<sup>2</sup>, Medtronic, Korea<sup>3</sup>, Seoul National University College of Medicine, Korea<sup>4</sup>
- OP5-2 Real-World continuous glucose monitoring data from a population with type 1 diabetes in South Korea: single-system analysis**  
Ji Yoon Kim<sup>1\*</sup>, Sang-Man Jin<sup>1</sup>, Sarah Andrade<sup>2</sup>, Boyang Chen<sup>2</sup>  
Samsung Medical Center, Sungkyunkwan University School of Medicine, Korea<sup>1</sup>, Dexcom, Inc., United States<sup>2</sup>
- OP5-3 Solid lipid nano-particles of quercetin to abrogate renal dysfunction in experimentally induced type II diabetic rats: an anti-inflammatory therapy**  
Richa Sachan\*  
Sam Higginbottom University of Agriculture, Technology & Sciences, Faculty of Health Sciences, India
- OP5-4 Effectiveness of a protocol based automatic mobile message providing system on glycemic control in patients with type 2 diabetes: a 12-week, randomized, open-label, controlled, parallel-group trial**  
Kyuho Kim<sup>1\*</sup>, Jae-Seung Yun<sup>1</sup>, Joonyub Lee<sup>2</sup>, Yeoree Yang<sup>2</sup>, Minhan Lee<sup>3</sup>, Kyung Mi Shin<sup>1</sup>, Min Jung Gu<sup>1</sup>, Yu-Bae Ahn<sup>1</sup>, Jae Hyoung Cho<sup>2,3</sup>, Seung-Hyun Ko<sup>1</sup>  
The Catholic University of Korea, St. Vincent's Hospital, Korea<sup>1</sup>, The Catholic University of Korea, Seoul St. Mary's Hospital, Korea<sup>2</sup>, Ikoob Inc., Korea<sup>3</sup>
- OP5-6 Deep residual convolutional neural network for automated classification of diabetic retinopathy severity levels: a promising approach for early detection and diagnosis**  
Rifaldy Fajar\*, Barbara Mckenzie, Oscar Torrado Lopraz  
Karlstad University, Sweden
- OP5-7 The association between life style changes and remission in new-onset type 2 diabetes: a nationwide-cohort study**  
Jinyoung Kim<sup>1\*</sup>, Bongseong Kim<sup>2</sup>, Mee Kyoung Kim<sup>1</sup>, Jeong Min Cho<sup>1</sup>, Young Na<sup>1</sup>, Ki-Hyun Baek<sup>1</sup>, Ki-Ho Song<sup>1</sup>, Kyungdo Han<sup>2</sup>, Hyuk-Sang Kwon<sup>1</sup>  
Yeouido St. Mary's Hospital, The Catholic University of Korea College of Medicine, Korea<sup>1</sup>, Soongsil University, Korea<sup>2</sup>
- OP5-8 New users of sodium-glucose cotransporter 2 inhibitors are at low risk of incident pancreatic cancer: a nationwide propensity scorematched cohort study**  
Yun Kyung Cho<sup>1,2\*</sup>, Sehee Kim<sup>3</sup>, Myung Jin Kim<sup>1,2</sup>, Woo Je Lee<sup>1,2</sup>, Hwi Seung Kim<sup>3</sup>, Ye-Jee Kim<sup>1</sup>, Chang Hee Jung<sup>1,2</sup>  
Asan Medical Center, University of Ulsan College of Medicine, Korea<sup>1</sup>, Asan Medical Center, Korea<sup>2</sup>, Chung-Ang University Gwangmyeong Hospital, Korea<sup>3</sup>

## Diabetes complications-clinical & epidemiology

- OP6-1 Comparative effectiveness of new antidiabetic medications on major adverse cardiovascular events in people with type 2 diabetes and a prior stroke**  
Jae Hyun Bae\*, Nam Hoon Kim, Sin Gon Kim  
Korea University Anam Hospital, Korea
- OP6-2 Impact of increased interleukin-5 on information processing function and its association with mild cognitive impairment in type 2 diabetes mellitus patients: a cross-sectional study**  
Haoqiang Zhang<sup>1\*</sup>, Shuafang Yang<sup>2</sup>  
The First Affiliated Hospital of USTC, Division of Life Sciences and Medicine, University of Science and Technology of China, China<sup>1</sup>, Affiliated Zhongda Hospital of Southeast University, China<sup>2</sup>

# Contents

**OP6-3 Comparison of body composition indices that best predict new onset T2DM in Korean; based on nationwide cohort with 10-year follow up data**

Min Jeong Park\*, Min Woong Kang, Soo Yeon Jang, Ahreum Jang, Eyun Song, Nayoung Choi, Eunnyeong Choi, Kyung Mook Choi, Sei Hyun Baik, Hye Jin Yoo  
Korea University Guro Hospital, Korea

**OP6-4 High remnant cholesterol increases the risk of dementia in patients with type 2 diabetes: data from the national health insurance service health screenings**

Han Na Jung<sup>1\*</sup>, Ji Hye Huh<sup>1</sup>, Eun Rho<sup>1</sup>, Kyung-Do Han<sup>2</sup>, Seong Jin Lee<sup>1</sup>, Sung-Hee Ihm<sup>1</sup>, Jun Goo Kang<sup>1</sup>  
Hallym University Sacred Heart Hospital, Korea<sup>1</sup>, College of Natural Sciences, Soongsil University, Korea<sup>2</sup>

**OP6-5 To study the role of artificial intelligence in early prediction of acute kidney injury in pediatric patients: systematic review**

Nilesh Chavda\*, Priti Solanky  
Gmers Medical College Valsad, India

**OP6-7 Machine learning-based prediction model for cardiovascular disease in patients with diabetes: derivation and validation in two independent Korean cohorts**

Hyunji Sang<sup>1,2\*</sup>, Hojae Lee<sup>2</sup>, Myeongcheol Lee<sup>2</sup>, Jaeyu Park<sup>2</sup>, Sunyoung Kim<sup>3</sup>, Ho Geol Woo<sup>3</sup>, Sihoon Lee<sup>4</sup>, You-Cheol Hwang<sup>5</sup>, Tae Sun Park<sup>6</sup>, Hyunjung Lim<sup>7</sup>, Dong Keon Yon<sup>2,7</sup>, Sang Youl Rhee<sup>1,2,7</sup>  
Kyung Hee University Medical Center, Korea<sup>1</sup>, Medical Science Research Institute, Kyung Hee University Medical Center, Kyung Hee University College of Medicine, Korea<sup>2</sup>, Kyung Hee University Medical Center, Kyung Hee University College of Medicine, Korea<sup>3</sup>, Gachon University College of Medicine, Korea<sup>4</sup>, Kyung Hee University Hospital at Gangdong, and Kyung Hee University School of Medicine, Korea<sup>5</sup>, Research Institute of Clinical Medicine of Chonbuk National University and Chonbuk National University Hospital, Korea<sup>6</sup>, Graduate School of East-West Medical Science, Kyung Hee University, Korea<sup>7</sup>

## Others (basic & translational/clinical)

**OP7-1 Cell-specific effect of PGAM5 knockdown on insulin resistance**

Xiantong Zou\*, Chengcheng Guo, Li Li, Linong Ji  
Peking University People's Hospital, China

**OP7-2 Inhibition of de novo ceramide synthesis prevents diet-induced obesity and whitening of brown adipose tissue by activating AMPK**

Sang-Hyeok Go\*, Yun Kyung Cho, Ah-Ram Kim, Ji Young Yun, Myoung Seok Ko, Ki-Up Lee, Eun Hee Koh  
Asan Medical Center, University of Ulsan College of Medicine, Korea

**OP7-3 Irisin attenuates HSCs activation and liver fibrosis in bile duct ligation mice model via improving mitochondrial dysfunction**

Linh Lai\*, Giang Nguyen, So Young Park, Phuc Pham, Heesung Kim, Kyoungjin Min, Dae-Hee Choi, Eun-Hee Cho  
Kangwon National University, Korea

**OP7-4 Maternal outcomes and fasting blood glucose of undernourished mother rats in response to Balinese cow bone marrow microcapsules**

Umi Faza Rokhmah<sup>1,2\*</sup>, Rahma Safitri<sup>2</sup>, Ikeu Ekayanti<sup>2</sup>, Sri Estuningsih<sup>2</sup>, Ahmad Sulaeman<sup>2</sup>  
Jenderal Soedirman University, Indonesia<sup>1</sup>, IPB University, Indonesia<sup>2</sup>

# Contents

## OP7-5 Associations of sleep duration and quality with blood glucose control in type 2 diabetes mellitus: a CGM-based analysis

Sang-Hyeon Ju<sup>1\*</sup>, Joung Youl Lim<sup>1</sup>, Minchul Song<sup>1</sup>, Ji Min Kim<sup>2,3</sup>, Yea Eun Kang<sup>1,3</sup>, Hyon-Seung Yi<sup>1,3</sup>, Kyong Hye Joung<sup>2,3</sup>, Ju Hee Lee<sup>1,3</sup>, Bon Jeong Ku<sup>1,3</sup>, Eun Seok Cha<sup>4</sup>, Hyun Jin Kim<sup>1,3</sup>

Chungnam National University Hospital, Korea<sup>1</sup>, Chungnam National University Sejong Hospital, Korea<sup>2</sup>, Chungnam National University College of Medicine, Korea<sup>3</sup>, Chungnam National University, Korea<sup>4</sup>

## OP7-7 Exploration of the quiescent state and stem cell-like characteristics of pancreatic stellate cells

Chengming Ni<sup>\*</sup>, Shanhu Qiu, Zilin Sun

Southeast University, China

## OP7-8 MAFLD outperforms NAFLD in distinguishing subjects with sarcopenia and compromised muscle quality

Myung Jin Kim<sup>1\*</sup>, Yun Kyung Cho<sup>1</sup>, Eun Hee Kim<sup>1</sup>, Min Jung Lee<sup>1</sup>, Hwi Seung Kim<sup>2</sup>, Joong-Yeol Park<sup>1</sup>, Woo Je Lee<sup>1</sup>, Hong-Kyu Kim<sup>1</sup>, Chang Hee Jung<sup>1</sup>

Asan Medical Center, University of Ulsan College of Medicine, Korea<sup>1</sup>, Chung-Ang University Gwangmyeong Hospital, Korea<sup>2</sup>

## Korean medical students & medical trainees session

### OP8-1 Quality of life and patient satisfaction to treatment with continuous glucose monitoring in women with gestational diabetes mellitus

Sookyung Won<sup>\*</sup>, Joon Ho Moon

Seoul National University Bundang Hospital, Korea

### OP8-2 Alpha-tubulin deacetylation impairs angiogenesis and induces endothelial-to-mesenchymal transition

Seonbu Yang<sup>1\*</sup>, Thi Van Trang Luong<sup>1</sup>, Woo Jin Ham<sup>1</sup>, Wang Soo Lee<sup>2</sup>, Jae Taek Kim<sup>1</sup>

Chung-Ang University, Endocrinology and Metabolism, Korea<sup>1</sup>, Chung-Ang University, Cardiology, Korea<sup>2</sup>

### OP8-3 Higher plasma HDL cholesterol levels are associated with a reduced risk of cardiovascular disease: a 16-year follow-up community-based cohort study

Seung Eun Yoo<sup>1\*</sup>, Sung Hee Choi<sup>1</sup>, Nam H. Cho<sup>2</sup>, Joon Ho Moon<sup>1</sup>

Seoul National University Bundang Hospital, Korea<sup>1</sup>, Ajou University School of Medicine, Korea<sup>2</sup>

### OP8-4 The role of insulin receptor in cardiac conduction system

Thi Van Trang Luong<sup>1\*</sup>, Sangmi Ock<sup>1</sup>, Seon boo Yang<sup>1</sup>, Wang Soo Lee<sup>2</sup>, Jaetaek Kim<sup>1</sup>

Chung-Ang University, Endocrinology and Metabolism, Korea<sup>1</sup>, Chung-Ang University, Cardiology, Korea<sup>2</sup>

### OP8-5 Cases of Maturity Onset Diabetes of the Young (MODY)

Sejun Jeon<sup>\*</sup>, Joonho Moon

Seoul National University Bundang Hospital, Korea

# Contents

## Poster exhibitions

### Basic & translational diabetes research

- PE001 Exploring molecular pathway involved in microglial activation in diabetic rats to improve cognition  
Dharmendra Kumar Khatri\*, Anika Sood, Shashi Bala Singh  
Niper Hyderabad, India
- PE004 Nephroprotective potential of gallic acid metformin against streptozotocin induced diabetic nephropathy in Wistar rats via inhibition of DPP-4 and TGF-beta  
Vikas Kumar<sup>1\*</sup>, Firoz Anwar<sup>2</sup>  
Sam Higginbottom University of Agriculture, Technology & Sciences, India<sup>1</sup>, King Abdulaziz University, Saudi Arabia<sup>2</sup>
- PE005 A meta-analysis on the association between the mnSOD Val16Ala polymorphism and the development of diabetic nephropathy  
Ivy Cayabyab\*, Joey Kyle Mallari, Arch Raphael Manalac, Rima Pabalan, Archie Policarpio, Gestrelle Lides Sarmiento, Joanna Marie Sison, Raphael Enrique Tiongco  
Angeles University Foundation, Philippines
- PE006 Serum ferritin as a potential complementary marker to fasting blood glucose in diagnosing type 2 diabetes mellitus: a pilot study among Kapampangans  
Raphael Enrique Tiongco\*, Daryll Nicole Romero, Clarice Cabague, Eloisa Joy Escoto, Kyla Alexis Miranda, Dena Marie Nicole Nulud, Alvin Mark Pabalan, Jamie Vergara, Merlyn Cruz  
Angeles University Foundation, Philippines
- PE008 Association of selected climatological variables with the incidence of new-onset hypertension and type 2 diabetes in Central Luzon, Philippines  
Annalyn Navarro<sup>1\*</sup>, Aila Mae Canlas<sup>1</sup>, Ivy Cayabyab<sup>1</sup>, Edgar Anthony Lacanlale<sup>1</sup>, Jan Clarence Salinas<sup>1</sup>, Russell Rivera<sup>2</sup>, Raphael Enrique Tiongco<sup>1</sup>  
Angeles University Foundation, Philippines<sup>1</sup>, Pampanga State Agricultural University, Philippines<sup>2</sup>
- PE009 Endoc-BH5, primary-like human beta cell model: finally!! a robust and reliable cell line for T1D and T2D disease modeling  
Hamza Olleik\*, Bruno Blanchi  
Human Cell Design, France
- PE010 Phenolic acids in the management of diabetes and its associated complications  
Md. Shahidul Islam\*, Veronica Salau  
University of Kwazulu-Natal, South Africa
- PE011 Swietenia macrophylla king extract extenuate streptozotocin-induced diabetic infertility in male Sprague Dawley rats  
Muhammad Fattah Fazel<sup>1,2\*</sup>, Muhamad Razin Mohd Razali<sup>1</sup>, Yanti Rosli<sup>3</sup>, Hiang Lian Hing<sup>4</sup>, Hanan Kumar Gopalan<sup>1</sup>  
Universiti Kuala Lumpur, Malaysia<sup>1</sup>, Mahsa University, Malaysia<sup>2</sup>, Universiti Kebangsaan Malaysia, Malaysia<sup>3</sup>, No 1. Persiaran Bukit Utama, Malaysia<sup>4</sup>
- PE013 Dynamical modeling of chronic inflammation-induced insulin resistance: insights into molecular pathways and therapeutic targets  
Prihantini Prihantini<sup>1\*</sup>, Priyanka Aruan<sup>2</sup>, Asfirani Umar<sup>1</sup>  
Yogyakarta State University, Indonesia<sup>1</sup>, Bandung Institute of Technology, Indonesia<sup>2</sup>
- PE015 Protective effects of ellagic acid and its fabricated solid lipid nanoparticles on diabetic nephropathy induced by streptozotocin-nicotinamide in mice via alteration of oxidative stress and apoptosis  
Deepika Singh\*  
Shuats, India

# Contents

- PE016 Type II diabetes mellitus patients from the North Indian population and OCT-1 gene polymorphism**  
 Hina Parveen\*, Dilutpal Sharma  
 King George's Medical University, India
- PE017 Oestrogen receptor in insulin resistance and type 2 diabetes mellitus: from molecular mechanism to clinical evidence**  
 Muhammad Zulfiqah Sadikan<sup>1\*</sup>, Haryati Ahmad Hairi<sup>1</sup>, Putri Ayu Jayusman<sup>2</sup>, Nurul Izzah Ibrahim<sup>2</sup>, Ahmad Nazrun Shuid<sup>3</sup>  
 Faculty of Medicine, Manipal University College Malaysia, Jalan Batu Hampar, Bukit Baru, 75150 Melaka, Malaysia<sup>1</sup>, Faculty of Dentistry, Universiti Kebangsaan Malaysia, Jalan Yaacob Latif, Bandar Tun Razak, Cheras, 56000 Kuala Lumpur, Malaysia<sup>2</sup>, Faculty of Medicine, Universiti Teknologi Mara (UiTM), Jalan Hospital, 47000 Sungai Buloh, Selangor, Malaysia<sup>3</sup>
- PE018 2-Deoxy-D-ribose induces ferroptosis in renal tubular epithelial cells via ubiquitin-proteasome system-mediated xCT protein degradation**  
 Gwanpyo Koh<sup>1,2\*</sup>, Miyeon Kim<sup>1,2</sup>, Ju Young Bae<sup>1</sup>, Soyeon Yoo<sup>1,2</sup>, Jisun Bang<sup>2</sup>, Hyun Woo Kim<sup>1,2</sup>, Sang Ah Lee<sup>1,2</sup>  
 Jeju National University College of Medicine, Korea<sup>1</sup>, Jeju National University Hospital, Korea<sup>2</sup>
- PE019 The impact of obesity & modern lifestyle on stress, anxiety and depression in North Indian adult population**  
 Diksha Devi\*, Sandeep Bhattacharya  
 Phd Scholar, India
- PE020 Biological effect of plantamajoside in sepsis-regulated organ dysfunction, Chronic Heart Failure (CHF) and Hypoxia-Reoxygenation (H/R) injury with their molecular mechanism**  
 Dinesh Kumar Patel\*  
 Faculty of Health Science, Shuats, India
- PE022 Therapeutic potential of kakkalide in the medicine for the treatment of diabetes and related secondary complications through their effectiveness on insulin resistance, insulin-resistant endothelial dysfunction and aldose reductase enzyme**  
 Dinesh Kumar Patel\*, Kanika Patel  
 Sam Higginbottom University of Agriculture, Technology and Sciences, India
- PE023 Biological potential of cirsimaritin for the treatment of diabetes and associated secondary complications through its therapeutic effectiveness on cell viability and protection of INS-1 cells**  
 Dinesh Kumar Patel\*  
 Sam Higginbottom University of Agriculture, Technology and Sciences, India
- PE025 Impact of type 2 diabetes-associated PAX4 variant on pancreatic beta cell function**  
 Jungsun Park<sup>1\*</sup>, Kyun Hoo Kim<sup>1</sup>, Joon Ho Moon<sup>1,2</sup>, Hyunsuk Lee<sup>2</sup>, Jong Il Kim<sup>2</sup>, Kyong Soo Park<sup>2</sup>, Hail Kim<sup>1</sup>  
 KAIST, Korea<sup>1</sup>, Seoul National University College of Medicine, Korea<sup>2</sup>
- PE026 The association of miR-302 expression levels and non-alcoholic fatty pancreas disease**  
 Chih-Li Lin<sup>1\*</sup>, Sing-Hua Tsou<sup>2</sup>, Lee-Kuo Chang<sup>3</sup>, Hsu-Heng Yen<sup>3</sup>, Hsuan-Kai Lee<sup>1</sup>, Ying Chen<sup>1</sup>, Chien-Ning Huang<sup>1</sup>  
 Chung Shan Medical University, Taiwan<sup>1</sup>, Chung Shan Medical University Hospital, Taiwan<sup>2</sup>, Changhua Christian Hospital, Taiwan<sup>3</sup>
- PE027 Genistein synergically increases the protection of liraglutide against beta cell apoptosis induced by glucolipototoxicity**  
 Sing-Hua Tsou<sup>1\*</sup>, Chien-Ning Huang<sup>2</sup>, Ying-Jui Ho<sup>1</sup>, Chih-Li Lin<sup>1,2</sup>, Sheng-Chieh Lin<sup>1,2</sup>, Chien-Yin Kuo<sup>1,2</sup>, I-Ting Cheng<sup>1</sup>, Zong-Han Lin<sup>1</sup>  
 Chung Shan Medical University Hospital, Taiwan<sup>1</sup>, Chung Shan Medical University, Taiwan<sup>2</sup>
- PE028 An ethno-medicinal study of medicinal plants used for the treatment of diabetes and related complications in Dhaka City, Bangladesh**  
 Mahmudur Rahman\*, Zulkhairi HJ. Amom, Farrah Shafeera Ibrahim  
 Universiti Teknologi Mara, Puncak Alam Campus, Malaysia

# Contents

---

- PE029** Biological effectiveness of gossypin against diabetes and associated secondary complication through their effectiveness on Hba1c levels and plasma insulin level  
 Dinesh Kumar Patel\*, Kanika Patel  
 Sam Higginbottom University of Agriculture, Technology and Sciences, India
- PE030** Profiling of changes in gene expression associated with epigenetic changes in peripheral blood cells under hyperinsulinemic euglycemic clamp condition  
 Dae Ho Lee<sup>2\*</sup>, Minjae Joo<sup>1</sup>, Seungyoon Nam<sup>1,2</sup>  
 Gachon University, Korea<sup>1</sup>, Gachon University Gil Medical Center, Korea<sup>2</sup>
- PE031** Pancreatic beta cell dysfunction in clinical stages of T2DM  
 Bolor Byambatsooj<sup>1,2\*</sup>, Altaisaikhan Khasag<sup>1</sup>, Sainbileg Sonomtseren<sup>2</sup>  
 Mongolian National University of Medical Science, Mongolia<sup>1</sup>, Endomed Hospital, Mongolia<sup>2</sup>
- PE032** An attempt to investigate antimony mediated therapy for an optimal insulin secretion during visceral leishmaniasis infection  
 Sukrat Sinha\*  
 Nehru Gram Bharati, India
- PE034** The association of angiotensin converting enzyme insertion/deletion gene polymorphism with diabetes and diabetic nephropathy patients in North Indian population  
 Mohammad Kaleem Ahmad\*, Sanchit Tiwari, Israr Ahmad  
 King George's Medical University, India
- PE035** Effect of gymnemagenin on GLUT 4 translocation  
 Senthil Kumar Subramani<sup>1,2\*</sup>, Pratibha Chauhan<sup>2</sup>, Akhilesh Kumar Tamrakar<sup>3</sup>, Prasad GBKS<sup>2</sup>  
 Tropilite, India<sup>1</sup>, Jiwaji University, India<sup>2</sup>, Central Drug Research Institute, India<sup>3</sup>
- PE036** Effect of sodium glucose cotransporter-2 inhibitor on hepatic glucose metabolism and hepatic autophagy  
 Si Woo Lee<sup>1\*</sup>, Hyun Ki Park<sup>2</sup>, Hang Kyu Lee<sup>2</sup>, Eun Seok Kang<sup>3</sup>  
 Graduated of School of Medicine, Yonsei University, Korea<sup>1</sup>, Yonsei University College of Nursing, Korea<sup>2</sup>, Yonsei University College of Medicine, Korea<sup>3</sup>
- PE039** Vitamin D supplementation alleviates sarcopenia by modulating myokine expression  
 Yoo Jeong Lee\*, Gyu Hee Kim, Hyeon-Ju Jeong, Dankyu Yoon, Soo Kyung Koo, Joo Hyun Lim  
 National Institute of Health, Korea
- PE040** Two different ways to replace beta cell mass after partial pancreatectomy  
 Byung Joon Kim<sup>1\*</sup>, Heekyoung Park<sup>1</sup>, Jun-Seop Shin<sup>2</sup>  
 Gachon University, Korea<sup>1</sup>, Tascom, Korea<sup>2</sup>
- PE042** Factors influencing North Indian diabetics' knowledge and attitudes: cross-sectional study  
 Rahul Kumar\*  
 NGB, India
- PE044** Among university teachers, the risk of type 2 diabetes mellitus is high regardless of gender in Darkhan-Uula provinve in Mongolia  
 Tegshjargal Lkhamdorj\*, D Oyuntsetseg, L Ganchimeg, E Ariuntsetseg, Nandinsuren Tseden  
 Darkhan General Hospital, Mongolia

# Contents

---

- PE045** An updated meta-analysis on the association of plasminogen activator inhibitor-1 levels in post-gestational diabetes mellitus  
 Miljun Catacata<sup>1\*</sup>, Raphael Enrique Tiongco<sup>1</sup>, Genevieve Dizon<sup>1</sup>, Michael John Dominguez<sup>1</sup>, Annalyn Navarro<sup>1</sup>, Adrian Villavieja<sup>2</sup>,  
 Pineda-Cortel Maria Ruth<sup>2</sup>  
 Angeles University Foundation, Philippines<sup>1</sup>, University of Santo Tomas, Philippines<sup>2</sup>
- PE048** Association of serum ferritin with inflammatory markers and red meat intake in individuals with type 2 diabetes  
 Munkhuchral Nordog<sup>\*</sup>, Bao Syua, Odgerel Tsogbadrakh, Oyutugs Byambasukh, Otgonbat Altangerel  
 Mongolian National University of Medical Sciences, Mongolia
- PE049** Direct effect of teneligliptin on the brown adipocytes  
 Kyong Hye Joung<sup>1,2\*</sup>, Sorim Choung<sup>1</sup>, Mikyung Song<sup>2</sup>, Ji Min Kim<sup>1,2</sup>, Hyun Jin Kim<sup>1</sup>, Bon Jeong Ku<sup>1</sup>  
 Chungnam National University School of Medicine, Korea<sup>1</sup>, Chungnam National University Sejong Hospital, Korea<sup>2</sup>
- PE050** Factors influencing baseline blood cortisol variations among hospitalized patients in a medicine department  
 Gireesh Dayma<sup>\*</sup>  
 Rama Medical College, India
- PE051** Preventing diabetes in gestational diabetes: what is the dietary culprit?  
 Barakatan-Nisak Mohd Yusof<sup>1\*</sup>, Farah Yasmin Hasbullah<sup>1</sup>, Sangeetha Sham<sup>3</sup>, Rohana Abdul Ghani<sup>2</sup>  
 Lecturer, Malaysia<sup>1</sup>, Consultant, Malaysia<sup>2</sup>, Research Fellow, Spain<sup>3</sup>
- PE052** Serotonin is a novel player in selective hepatic insulin resistance  
 Jung Eun Nam<sup>1\*</sup>, Inseon Hwang<sup>2</sup>, Won Gun Choi<sup>3</sup>, Won-Il Choi<sup>1</sup>, Minju Lee<sup>1</sup>, Wonsuk Choi<sup>4</sup>, Young-Ah Moon<sup>5</sup>, Hail Kim<sup>1</sup>  
 KAIST, Korea<sup>1</sup>, Daejeon Health Institute of Technology, Korea<sup>2</sup>, The Catholic University of Korea, Korea<sup>3</sup>, Chonnam National University Medical School, Korea<sup>4</sup>, Inha University School of Medicine, Korea<sup>5</sup>
- PE053** MPO gene expression in first trimester RNA samples from Filipino pregnant women  
 Mariejim Diane Lee<sup>\*</sup>, Maria Ruth Pineda-Cortel, Clarenz Sarit Concepcion, Adrian Villavieja  
 University of Santo Tomas, Philippines
- PE054** Vitamin D ameliorates age-induced nonalcoholic fatty liver disease by increasing the mitochondrial function  
 Gyu Hee Kim<sup>\*</sup>, Hyeon-Ju Jeong, Yoo Jeong Lee, Dankyu Yoon, Soo Kyung Koo, Joo Hyun Lim  
 National Institute of Health, Korea
- PE055** Determination of serum ferritin levels in Mongolian men and its relationship with serum lipids and glucose  
 Dolzodmaa Baybayar<sup>\*</sup>, Munkhjargal Baasan, Battsetseg Dorj, Anujin Surenjav, Azbayar Sukhbaatar, Alimaa Balgansuren, Myadagmaa Jargal,  
 Amgalanbayar Tumendelger  
 Erdenet Medical Hospital, Mongolia
- PE058** Estimation of salivary -amylase among type 2 diabetics: potential for non-invasive diagnostics  
 Miljun Catacata<sup>\*</sup>, Raphael Enrique Tiongco, Clarisse Arianne Sico, Princess Marie Avonne Autur, Carl Joshua Guzman, Kimberly Joy Paule,  
 Michaela Soriano, Catherine Bacani, Ivy Cayabyab, Kim Darrel Galang  
 Angeles University Foundation, Philippines
- PE059** Melatonin prevents obesity by modulating gut microbiota-derived metabolites in high-fat diet-fed mouse  
 Hae-Jung Kim<sup>\*</sup>, Hye Min Shim, Jae-Hyung Park  
 Keimyung University School of Medicine, Korea
- PE061** A study of associations between eating habit and hypertension in a healthcare workforce  
 Undraa Boldkhuu<sup>1,3\*</sup>, Oyuntugs Byambasukh<sup>1</sup>, Yanjmaa Sankhuu<sup>1,2</sup>, Sainbileg Sonomtseren<sup>1</sup>  
 Mongolian National University of Medical Science, Mongolia<sup>1</sup>, First Central Hospital, Mongolia<sup>2</sup>, Khan Uul District Hospital, Mongolia<sup>3</sup>

# Contents

---

- PE062 PDPN-knockdown alleviate islet fibrosis in T2DM mice**  
 Xiaohang Wang<sup>1,2\*</sup>, Qianqian Wang<sup>2</sup>, Chenming Ni<sup>2</sup>, Jinbang Wang<sup>2</sup>, Zilin Sun<sup>2</sup>  
 Yangzhou University, China<sup>1</sup>, Southeast University, China<sup>2</sup>
- PE063 Sialic acids as potential inhibitors against targeted proteins for diabetes: insight from in silico approaches**  
 Der Jiun Ooi\*  
 Mahsa University, Malaysia
- PE064 Follow-up after direct-acting antiviral therapy in patients with type 2 diabetes and chronic hepatitis C**  
 Mandukhai Munkhbaatar\*, Ariunbold Dorjgotov, Gerelchuluun Mendbayar  
 Darkhan General Hospital, Mongolia
- PE068 Association between ABO blood type and gestational diabetes mellitus development: an updated meta-analysis**  
 Miljun Catacata<sup>1\*</sup>, Benjie Clemente<sup>2</sup>, Michelle Charina Gomez<sup>1</sup>, Michael John Dominguez<sup>1</sup>, Shamar Lo Lasta<sup>3</sup>, Jefferyl Kae Pandac<sup>3</sup>,  
 Maria Ruth Pineda-Cortel<sup>2</sup>, Raphael Enrique Tiongco<sup>1</sup>  
 Angeles University Foundation, Philippines<sup>1</sup>, University of Santo Tomas, Philippines<sup>2</sup>, Silliman University, Philippines<sup>3</sup>
- PE072 Effects of dehydroepiandrosterone administration on metabolic homeostasis and antioxidant status after sleeve gastrectomy in male rats**  
 Ankush Kumar\*, Anil Gaur  
 Shakuntla Hospital and Research Center, India
- PE073 Hypolipidemic potential of ocosahexaenoic acid in high fat-diet/alloxan-induced diabetes in liver of male rats**  
 Sumit Rajput\*, Priya Tiwari  
 BV Deemed University, India
- PE075 The implication of locally-delivered NECA-releasing microspheres on a murine myocardial infarction model**  
 Shibo Wei\*, Tiep Nguyen Tien<sup>1</sup>, Yunju Jo<sup>2</sup>, Yan Zhang<sup>1</sup>, Eun-Ju Jin<sup>2</sup>, Jee-Heon Jeong<sup>1</sup>, Dongryeol Ryu<sup>2</sup>  
 Sungkyunkwan University, Korea<sup>1</sup>, GIST, Korea<sup>2</sup>
- PE076 Glucagon-like peptide receptor agonist inhibits angiotensin II-induced proliferation and migration in vascular smooth muscle cells and ameliorates phosphate-induced vascular smooth muscle cells calcification**  
 Jinmi Lee\*, Seok-Woo Hong, Eun-Jung Rhee  
 Kangbuk Samsung Hospital, Sungkyunkwan University School of Medicine, Korea
- PE077 Effects of inhalation of ultrafine Particulate Matter (PM2.5) during aerobic exercise on high-fat diet-induced impaired glycemic and inflammatory responses**  
 Jinhan Park<sup>1\*</sup>, Junho Jang<sup>1</sup>, Byunghun So<sup>1</sup>, Kanggyu Lee<sup>1</sup>, Dongjin Yeom<sup>1</sup>, Ziyi Zhang<sup>2</sup>, Chounghun Kang<sup>1</sup>  
 Inha University, Korea<sup>1</sup>, Tianjin University of Sport, China<sup>2</sup>
- PE078 Transcriptional variation in adipose tissue of morbidly obesity: comparing diabetic and non-diabetic women**  
 Hyemee Kim<sup>1\*</sup>, Byungyong Ahn<sup>2</sup>, Mi Kyung Kim<sup>3</sup>  
 Pusan National University, Korea<sup>1</sup>, University of Ulsan, Korea<sup>2</sup>, Keimyung University, School of Medicine, Korea<sup>3</sup>
- PE079 Detection of RNA biomarkers and potential regulatory mechanisms and therapeutic focal points for type 1 diabetes through analysis of a competitive endogenous RNA regulatory network**  
 MD. Zubair Malik\*, Mohammed Dashti, Fahd AH-Mulla, Thangavel Alphonse Thanaraj  
 Dasman Diabetes Institute, Kuwait
- PE080 Cystatin C: significance in cardiovascular disease among Indian diabetic patients**  
 Asgar Ali\*, Sadhana Sharma  
 All India Institute of Medical Sciences, India

# Contents

- PE082** Amelioration of beta-cell function, HOMA-1R, HOMA-beta and antioxidant properties from dipeptidyl peptidase-IV(CD26) inhibitors from isoflavones rich fraction of soybean (glycine max) for type 2 diabetic mellitus: in-vivo & in-silico  
Anand Krishna Singh\*, Purnima Tripathi  
Shri Vaishnav Vidyapeeth Vishwavidyalaya, India
- PE086** The changes of serum glucagon like-peptide 1 level in type 2 diabetic patients  
Enkhchimeg Tserendorj\*, Badral Ganbaatar<sup>1</sup>  
Darkhan General Hospital, Mongolia
- PE088** The therapeutic potential of a phytochemical drug in the treatment of type 2 diabetes  
Ayushi Dubey\*  
Barkatullah University, India
- PE089** CREBH-C hepatokine promotes triglyceride clearance and uptake by boosting lipoprotein lipase activity  
Hyunbae Kim<sup>1\*</sup>, Zhenfeng Song<sup>1</sup>, Ren Zhang<sup>1</sup>, Brandon Davies<sup>2</sup>, Kezhong Zhang<sup>1</sup>  
Wayne State University, United States<sup>1</sup>, University of Iowa, United States<sup>3</sup>
- PE091** Single-nucleus RNA-seq reveals common and unique variations of neurons expressing hormonal receptors in the area postrema across rodents and non-human primates  
Jung Tae Kim<sup>1\*</sup>, Jeong Ho Hwang<sup>2</sup>, Hyung-Sun Kim<sup>2</sup>, Daesoo Kim<sup>1</sup>, Minho Shong<sup>1</sup>  
KAIST, Korea<sup>1</sup>, Korea Institute of Toxicology, Korea<sup>2</sup>

## Clinical diabetes and therapeutics

- PE092** Risk of type 2 diabetes mellitus in COPD and COPD with T2DM and its association with adipokines and gene polymorphism  
Seema Singh\*  
King Georges Medical University Lucknow Up India, India
- PE093** Insulin pump therapy in type 2 diabetes with empagliflozin improved glucose control  
Soobong Choi\*, Eunsil Hong, Joonho Wang, Hyunju An  
Konkuk University Medical School, Korea
- PE094** The effect of consuming sago to cholesterol levels and waist circumference as incidence of prediabetes; a case study in Kepulauan Meranti Regency, Riau province  
Syartiwidya Syariful\*  
National Research and Innovation Agency, Indonesia
- PE095** Efficacy and safety of pioglitazone add-on in patients with type 2 diabetes mellitus inadequately controlled with metformin and dapagliflozin: a multicenter, randomized, double-blind, and placebo-controlled study  
Yun Kyung Cho<sup>1,2\*</sup>, Kyung-Soo Kim<sup>3</sup>, Byung-Wan Lee<sup>4</sup>, Jun Hwa Hong<sup>5</sup>, Jae Myung Yu<sup>6</sup>, Soo Lim<sup>7</sup>, Ye An Kim<sup>8</sup>, Chang Beom Lee<sup>9</sup>, Sang Soo Kim<sup>10</sup>, Soo Heon Kwak<sup>11</sup>, Woo Je Lee<sup>12</sup>  
Asan Medical Center, University of Ulsan College of Medicine, Korea<sup>1</sup>, Asan Medical Center, Korea<sup>2</sup>, Cha Bundang Medical Center, Cha University, Korea<sup>3</sup>, Severance Hospital, Yonsei University College of Medicine, Korea<sup>4</sup>, Eulji University Hospital, Korea<sup>5</sup>, Hallym University College of Medicine, Korea<sup>6</sup>, Seoul National University Bundang Hospital, Korea<sup>7</sup>, Veterans Health Service Medical Center, Korea<sup>8</sup>, Hanyang University Guri Hospital, Hanyang University College of Medicine, Korea<sup>9</sup>, Pusan National University Hospital, Korea<sup>10</sup>, Seoul National University Hospital, Korea<sup>11</sup>
- PE096** A longitudinal study of the effect of time restricted meal intake on anthropometric, glycemic markers and lipid parameters in patients of type 2 diabetes mellitus: a chronobiological concept  
Smriti Rastogi\*, Narsingh Verma, Virendra Atam, Dileep Kumar Verma  
King George's Medical University, India

# Contents

---

- PE098** Histopathological manifestations of diabetic dermopathy: a single center study at Kathmandu University Hospital  
Binod Dhakal\*  
Kathmandu University Hospital, Nepal
- PE099** Assessing the interplay between risky sexual behaviors and incident type 2 diabetes mellitus among HIV-infected adults in Jakarta Metro City, Indonesia: a cross-sectional study  
Sahnaz Vivinda Putri\*, Maria Helena, Tessa Mariska, Wahyu Wahyudam Jur  
International University Semen Indonesia, Indonesia
- PE100** A new discovery on the role of PAK4 in lipid metabolism  
Hwang Chan Yu\*, Eunju Bae, Byung-Hyun Park  
Jeonbuk National University, Korea
- PE101** A meta-analysis of randomized clinical trials on the effect of metformin vs. pioglitazone monotherapy on plasma adiponectin levels  
Raphael Enrique Tiongco<sup>1\*</sup>, Roselle Arbas<sup>1</sup>, Sofia Alexis Dayrit<sup>1</sup>, Arah Dimalanta<sup>1</sup>, John Ashley Flores<sup>1</sup>, Arch Raphael Manalac<sup>1</sup>, Dinah Rose Soriano<sup>1</sup>, Johana Vallo<sup>1</sup>, Maria Ruth Pineda-Cortel<sup>2</sup>  
Angeles University Foundation, Philippines<sup>1</sup>, University of Santo Tomas, Philippines<sup>2</sup>
- PE104** Impact of gut microbiota diversity on glucose regulation and psychological health in type 2 diabetes patients: a prospective interventional study  
Rifaldy Fajar<sup>1\*</sup>, Trixie Barbara Jimenez<sup>2</sup>, Pedro Borgez<sup>2</sup>, Myerni Xiu Hoang<sup>2</sup>, Sarah Labrader<sup>2</sup>, Ruth Cristine Hannah<sup>2</sup>, Christine Evaline Mckanzie<sup>1</sup>  
Karlstad University, Sweden<sup>1</sup>, Central Hospital Karlstad, Sweden<sup>2</sup>
- PE105** Clinical evaluation of fenugreek seed extract in patients with type-2 diabetes  
Vandana Awasthi\*  
King George Medical University, India
- PE106** Association of glutathione S-transferases (GSTT1 and GSTM1) genes polymorphism and its expression with the risk of Gestational Diabetes Mellitus (GDM) in North Indian women population  
Amreen Shamsad<sup>1\*</sup>, Ashwin Kumar Shukla<sup>1</sup>, Renu Singh<sup>3</sup>, Monisha Banerjee<sup>1,2</sup>  
University of Lucknow, India<sup>1</sup>, Institute of Advanced Molecular Genetics & Infectious Diseases, Omg Centre for Advanced Studies, University of Lucknow, India<sup>2</sup>, King George's Medical University, India<sup>3</sup>
- PE108** Comparison of glimepiride vs voglibose as add on to metformin in diabetes: a randomized open label controlled trial  
Jaykaran Charan\*, SV Suman, Ravindra Shukla, Surjit Singh, Sneha Ambwani  
AIIMS Jodhpur, India
- PE109** Therapeutic effects of switching to anagliptin from other DPP-4 inhibitors in T2DM patients with inadequate glycemic control: sub-group analysis of multicenter observational study (SSUG study)  
Young-Sang Lyu<sup>1\*</sup>, Sang-Yong Kim<sup>1</sup>, Sungrae Kim<sup>2</sup>  
Chosun University Hospital, Korea<sup>1</sup>, Bucheon St. Mary's Hospital, Korea<sup>2</sup>
- PE110** The road less taken: a scoping review of the utilisation of hand assessments in individuals with diabetes mellitus  
Nayan Noor Aziella Mohd\*, Daud Ahmad Zamir Che  
Universiti Teknologi Mara, Malaysia
- PE111** Examining the impact of Artificial Light At Night (ALAN) on sleep quality and duration in patients with metabolic syndrome: a comparative study on light pollution as a zeitgeber  
Smriti Rastogi\*, Narsingh Verma  
King George's Medical University, India

# Contents

- PE113 A prospective study to evaluate the effectiveness of walking in women with gestational diabetes mellitus**  
Ali Fayaz Ahmed Mubarak\*  
Guwahati Medical College, India
- PE114 The impact of meal timing on sleep quality, duration, and hormonal parameters in patients with type 2 diabetes mellitus**  
Shiv Srivastav\*, Narsingh Verma, Smriti Rastogi  
King George's Medical University, India
- PE115 Resveratrol: a potent phytochemical drug in prevention and therapy of diabetes**  
Shiv Kumar Yadav\*  
Govt Lbs Pg College Sironj, Barkatulla University, Bhopal, India
- PE116 Sodium-glucose transporter-2 as a therapeutic target for the prevention and treatment of diabetes**  
Shiv Kumar Yadav\*  
Govt Lbs Pg College Sironj, Barkatulla University, Bhopal, India
- PE117 Association of Diabetes Mellitus (DM) - type 2 in patients with Primary Open Angle Glaucoma (POAG)**  
Sunita Timilsina<sup>1\*</sup>, Dakki Sherpa<sup>2</sup>  
Bhim Hospital, Ministry of Health, Province, Nepal<sup>1</sup>, Nepal Eye Hospital, Nepal<sup>2</sup>
- PE118 Antibiotics use of hospitalized diabetic patients**  
Otgontsetseg Purevsed\*, Sanchir Batbayar, Sainbileg Sonomtseren  
Endomed Hospital, Mongolia
- PE119 The association between glucagon-like peptide-1 receptor based therapies and the incidence of asthma or chronic obstructive pulmonary disease in patients with type 2 diabetes and/or obesity: a meta-analysis**  
Mengqing Zhang\*, Chu Lin, Ruoyang Jiao, Shuzhen Bai, Zonglin Li, Suiyuan Hu, Fang Lv, Wenjia Yang, Linong Ji, Xiaoling Cai  
Peking University People's Hospital, China
- PE120 Anti-diabetic agents and the risks of cognitive disorder in patients with type 2 diabetes: a systematic review and network meta-analysis**  
Zonglin Li\*, Chu Lin, Fang Lv, Wenjia Yang, Linong Ji, Xiaoling Cai  
Peking University People's Hospital, China
- PE121 The association between the eGFR slope and cardio-renal prognosis in patients with renoprotective treatments: a systematic review and meta-analysis**  
Shuzhen Bai\*, Chu Lin, Han Wu, Ruoyang Jiao, Suiyuan Hu, Wenjia Yang, Linong Ji, Xiaoling Cai  
Peking University People's Hospital, China
- PE122 Behavioral risk factors and prevalence of Type 2 Diabetes Mellitus (T2DM) and Cardiovascular Diseases (CVD) among teachers in selected schools in Quezon city Philippines**  
Kim Leonard Dela Luna<sup>1\*</sup>, Reynaldo Jr. Magpantay<sup>2</sup>, Lyka Lagunero<sup>3</sup>, John Mark Margate<sup>3</sup>, Sheena Polinar<sup>3</sup>, Jervin Edward Tayag<sup>3</sup>  
College of Public Health, University of The Philippines Manila, Philippines<sup>1</sup>, College of Human Ecology, Philippines<sup>2</sup>, Polytechnic University of The Philippines, Philippines<sup>3</sup>
- PE124 Identifying candidate variants associated with dependence on sulfonylureas using UK biobank**  
Sunah Yang<sup>1\*</sup>, Jaewon Choi<sup>1</sup>, Hyunah Kim<sup>1</sup>, Sooheon Kwak<sup>1</sup>, Kwangsoo Kim<sup>1,2</sup>, Hyeeseung Jung<sup>1</sup>  
Seoul National University Hospital, Korea<sup>1</sup>, Seoul National University, Korea<sup>2</sup>
- PE125 Health-related quality of life and physical activity levels among select older adults with diabetes and hypertension in Angeles City, Philippines**  
Pia Vanessa Basilio\*, Anita Esperanza Arias, Raphael Enrique Tiongco, Annalyn Navarro  
Angeles University Foundation, Philippines

# Contents

---

- PE126 Treatment patterns and beta cell reserve in patients with type 2 diabetes mellitus: a hospital-based study**  
 Bilguun Erdenechuluun<sup>1,2\*</sup>, Sergelen Battulga<sup>1,2</sup>, Ariuntsetseg Myagmardorj<sup>1</sup>, Oyuntugs Byambasukh<sup>1</sup>, Altaisaikhan Khasag<sup>1</sup>  
 Mongolian National University of Medical Science, Mongolia<sup>1</sup>, Central Hospital of Mongolian National University of Medical Science, Mongolia<sup>2</sup>
- PE127 Deletion mutation in the glutathione s-transferase gene (GSTM1 and GSTT1) and their association with gestational diabetes development: a meta-analysis**  
 Pia Vanessa Basilio\*, Raphael Enrique Tiongco, Imoan Shallom Aguas, Chastene Christopher Flake, Maria Angelica Manao, Francess Leigh Ayson, Angela Kristine Malig, Sunshine Miranda  
 Angeles University Foundation, Philippines
- PE128 Therapeutic options of diabetic inpatients of endomed clinic**  
 Uuganzaya Batbold\*, Bolor Byambatsooj, Sainbileg Sonomtseren, Sanchir Batbayar  
 Endomed Hospital, Mongolia
- PE130 The impact of probiotics on clinical and metabolic outcomes in individuals diagnosed with type II diabetes**  
 Senthil Kumar Subramani<sup>1,2\*</sup>, Lalitha Kushwah<sup>2</sup>, Shailendra Raghuwanshi<sup>1</sup>, GBKS Prasad<sup>2</sup>  
 Tropilite, India<sup>1</sup>, Jiwaji University, India<sup>2</sup>
- PE132 Status of body mass index, blood pressure and their determinants among the high school going adolescents: a cross sectional study in Pokhara, Western Nepal**  
 Shankar Baral<sup>1\*</sup>, Anup Baral<sup>2</sup>, Sapana Bhandari<sup>3</sup>  
 Motherland Secondary School, Nepal<sup>1</sup>, Himalaya Eye Institute, Nepal<sup>2</sup>, Gandaki Medical College, Nepal<sup>3</sup>
- PE133 Potential impact of add on omega 3 fatty acid supplementation on glycaemic profile in T2DM patients**  
 Anjali Singh\*, Narsingh Verma  
 King George's Medical University, India
- PE134 P21-activated kinase 4 suppresses fatty acid -oxidation and ketogenesis by phosphorylating NCoR1**  
 Hwang Chan Yu\*, Eun-ju Bae, Min Yan Shi, Byung-Hyun Park  
 Jeonbuk National University, Korea
- PE135 Newly diagnosed type 2 diabetes mellitus and upper gastrointestinal disease of patients in Darkhan-Uul province, Mongolia**  
 Mandukhai Munkhbaatar\*, Mendbayar Gerelchuluun  
 Darkhan General Hospital, Mongolia
- PE136 Factor associated with remission of type-2 diabetes mellitus after bariatric surgery in obese adults: 1 year follow-up of Korean**  
 Mihae Seo<sup>1\*</sup>, Seunghee Yu<sup>1</sup>, Sang Hyun Kim<sup>1</sup>, Dong Won Byun<sup>2</sup>, Sang Joon Park<sup>2</sup>, Hye Jeong Kim<sup>2</sup>, Kyoil Suh<sup>2</sup>, Hyeong Kyu Park<sup>2</sup>, Soon Hyo Kwon<sup>1,2</sup>  
 Soonchunhyang University Hospital, Gumi, Korea<sup>1</sup>, Soonchunhyang University Hospital, Seoul, Korea<sup>2</sup>,
- PE137 The metabolic storm after the standard meal in diabetes. can we do better?**  
 Nur Maziah Hanum Osman<sup>1\*</sup>, Azrina Azlan<sup>1,2</sup>, Amin Ismail<sup>1,2</sup>, Wakisaka Minato<sup>3</sup>, Zhi Ching Lau<sup>4</sup>, Barakatun Nisak Mohd Yusof<sup>1,2</sup>  
 Faculty of Medicine and Health Science, Universiti Putra Malaysia, Malaysia<sup>1</sup>, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Malaysia<sup>2</sup>, Fukuoka Women's University, Japan<sup>3</sup>, Faculty of Science, Universiti Tunku Abdul Rahman, Malaysia<sup>4</sup>
- PE139 Association of Cluster of Differentiation 36 (CD36): a fatty acid transporter gene variant rs1761667 (G>A) with Type 2 Diabetes Mellitus (T2DM) in North Indian population**  
 Raza Ansari<sup>1\*</sup>, Kausar Usman<sup>2</sup>, Amritesh Chandra Shukla<sup>3</sup>  
 Sri Jai Narain Misra Pg College, India<sup>1</sup>, King George's Medical University, India<sup>2</sup>, University of Lucknow, India<sup>3</sup>
- PE140 Omega 3 plus vitamin D or vitamin E co-supplementation in women with gestational diabetes: a meta-analysis**  
 Rao Nargis Jahan\*, Yasmin Sultana, Mohammad Azharuddin  
 Jamia Hamdard, India

# Contents

- PE141 Mobile health intervention on glycemic control and quality of life in type 1 diabetes mellitus: a meta-analytic synthesis**  
Md Azharuddin\*, Manju Sharma  
Pharmacology, Jamia Hamdard, India
- PE142 Effect of saxagliptin as add-on therapy to metformin in type 2 diabetes mellitus**  
Rao Nargis Jahan\*, Yasmin Sultana, Mohammad Azharuddin  
Jamia Hamdard, India
- PE143 The association between Gamma-Glutamyl Transferase (GGT), High-Density Lipoprotein Cholesterol (HDL-C) and GGT/HDL-C Ratio with type 2 diabetes mellitus: a systematic review and meta-analysis**  
Made Lady Adelaida Purwanta\*, Anak Agung Istri Sri Kumala Dewi, Ketut Suryana  
Wangaya Hospital, Indonesia
- PE144 TyG index is a simple and early predictor of type 2 diabetes in adults with normal glucose tolerance**  
Ji Hyun Bae\*, Ah Reum Khang, Dongwon Yi, Yang Ho Kang, Min Jin Lee  
Pusan National University Yangsan Hospital, Pusan National University School of Medicine, Korea
- PE145 No association between the GST gene GSTP1 genotypes and gestational diabetes mellitus: a meta-analysis of 1306 pregnant women**  
Raphael Enrique Tiongco\*, Imoan Shallom Aguas, Chastene Christopher Flake, Maria Angelica Manao, Frances Leigh Ayson, Pia Vanessa Basilio, Angela Kristine Malig, Sunshine Miranda  
Angeles University Foundation, Philippines
- PE146 Analyzing neopterin patterns in COVID-19 patients with coinciding diabetes mellitus: a retrospective study at saiful anwar general hospital, Malang, Indonesia**  
Dearikha Karina Mayashinta\*, Catur Suci Sutrisnani, Agustin Iskandar  
Universitas Brawijaya / Dr. Saiful Anwar General Hospital, Indonesia
- PE147 Impact of diabetes on COVID-19 susceptibility: a nationwide propensity score matching study**  
Han Na Jang<sup>1\*</sup>, Sun Joon Moon<sup>2</sup>, Jin Hyung Jung<sup>3</sup>, Kyung-Do Han<sup>4</sup>, Eun-Jung Rhee<sup>2</sup>, Won Young Lee<sup>2</sup>  
Seoul National University Bundang Hospital, Korea<sup>1</sup>, Kangbuk Samsung Hospital, Sungkyunkwan University School of Medicine, Korea<sup>2</sup>, Catholic University of Korea, Korea<sup>3</sup>, Soongsil University, Korea<sup>4</sup>
- PE148 Multicenter, randomized, double blind, three-arm parallel group study to evaluate efficacy and safety of alogliptin and pioglitazone combination therapy on glucose control in type 2 diabetes subjects who have inadequate control with metformin monotherapy in Korea: the PEAK trial (The practical evidence of antidiabetic combination therapy in Korea)**  
Joonyub Lee<sup>1\*</sup>, Ji-Yeon Park<sup>1</sup>, Yoon-Hee Choi<sup>1,9</sup>, Kyung Wan Min<sup>2</sup>, Kyung Ah Han<sup>2</sup>, Kyu Jeung Ahn<sup>3</sup>, Soo Lim<sup>4</sup>, Young-Hyun Kim<sup>5</sup>, Chul Woo Ahn<sup>6</sup>, Kyung Mook Choi<sup>7</sup>, Kun-Ho Yoon<sup>1,8</sup>  
Seoul St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Korea<sup>1</sup>, Eulji General Hospital, Eulji University School of Medicine, Korea<sup>2</sup>, Kyung Hee University Hospital at Gangdong, Kyung Hee University School of Medicine, Korea<sup>3</sup>, Seoul National University Hospital at Bundang, Seoul National University School of Medicine, Korea<sup>4</sup>, Bundang Jesaeng Hospital, Korea<sup>5</sup>, Gangnam Severance Hospital, College of Medicine, Yonsei University, Korea<sup>6</sup>, Korea University Guro Hospital, Korea<sup>7</sup>, College of Medicine, The Catholic University of Korea, Korea<sup>8</sup>, Medicaexcellence, Korea<sup>9</sup>
- PE149 Trends in prevalence of lean diabetes in Korea over 20 years**  
Ji Min Kim<sup>1,2\*</sup>, Milyung Song<sup>1</sup>, Kyoung Hye Joung<sup>1,2</sup>, Hyun Jin Kim<sup>2</sup>, Bon Jeong Ku<sup>2</sup>, Sukyoung Jung<sup>3</sup>, Ju Hee Lee<sup>2</sup>  
Chungnam National University Sejong Hospital, Korea<sup>1</sup>, Chungnam National University College of Medicine, Korea<sup>2</sup>, Chungnam National University Hospital, Korea<sup>3</sup>
- PE150 Distinct metabolic profiles of young-onset type 2 diabetes: single center, cross-sectional study**  
Il Rae Park\*, Eun Yeong Ha, Seung Min Chung, Jun Sung Moon, Ji Sung Yoon, Kyu Chang Won, Hyoung Woo Lee  
Yeungnam University Medical Center, Korea

# Contents

- PE151** Effects of trigonella foenum graecum seed extract on oxidative stress and hepatic function in type 2 diabetic patients  
Sumit Rajput\*, Priya Tiwari  
B V Deemed University, India
- PE152** Chronotherapeutic optimization of metformin administration for enhanced glycemic control and insulin sensitivity in type 2 diabetes patients: a randomized controlled trial  
Sahnaz Vivinda Putri<sup>1\*</sup>, Firstriana Putriawati<sup>2</sup>, Aldella Ita Magdalena<sup>1,2</sup>  
International University Semen Indonesia, Indonesia<sup>1</sup>, Pratama Serawaih Hospital, Indonesia<sup>2</sup>
- PE153** Effects of calorie restriction diet on blood glucose regulator treatment for patients with post-gastric bypass  
Rohit Rajput\*, Anil Gaur  
Shakuntla Hospital and Research Center, India
- PE154** Study of pharmacological therapy on hydration status and glomerular filtration rate in post-menopausal women with chronic kidney disease  
Rohit Rajput\*, Anil Gaur  
Shakuntla Hospital and Research Center, India
- PE155** Amelioration of Insulin resistance after delivery is associated with reduced risk of postpartum type 2 diabetes in women with gestational diabetes mellitus  
Heejun Son<sup>1\*</sup>, Joon Ho Moon<sup>2</sup>, Sung Hee Choi<sup>2</sup>, Nam H. Cho<sup>3</sup>, Hak Chul Jang<sup>2</sup>, Soo Heon Kwak<sup>4</sup>  
Seoul National University Hospital, Korea<sup>1</sup>, Seoul National University Bundang Hospital, Seoul National University College of Medicine, Korea<sup>2</sup>, Ajou University School of Medicine, Korea<sup>3</sup>, Seoul National University Hospital, Seoul National University College of Medicine, Korea<sup>4</sup>
- PE156** Risk factors of prediabetes among sago consumption communities in Kepulauan Meranti district, Riau province  
Tika Rahmi Syafitri\*  
Riau Province, Indonesia
- PE157** Impact of the hyperpersonalized smart education platform, doctorvice for remote intensive care in first insulin user after discharge in T2DM patients: randomized clinical study  
Jin Yu<sup>1\*</sup>, Joonyub Lee<sup>1</sup>, Ja Hyun Kim<sup>2</sup>, Yeoree Yang<sup>1</sup>, Eun-Young Lee<sup>1</sup>, Seung-Hwan Lee<sup>1,3</sup>, Hun-Sung Kim<sup>1,3</sup>, Jae-Hyoung Cho<sup>1,3</sup>  
Seoul Saint Mary's Hospital, College of Medicine, The Catholic University of Korea, Korea<sup>1</sup>, The Catholic University of Korea, Korea<sup>2</sup>, College of Medicine, The Catholic University of Korea, Korea<sup>3</sup>
- PE158** Effects of rebound therapy on HbA1c, quality of life, and balance in the patients with diabetic neuropathy  
Mahdi Hosseini\*, Gholamali Ghasemi  
University of Isfahan, Iran, Islamic Republic of
- PE160** Efficacy and safety of a fixed dose combination of dapagliflozin and linagliptin[AJU-A51] in patients with type-2 diabetes mellitus: a multi center, randomized, double-blind, parallel group. placebo-controlled phase III study  
Jun Hwa Hong<sup>1\*</sup>, Kyung Wan Min<sup>2</sup>, Jong chul Won<sup>3</sup>, Tae Nyun Kim<sup>4</sup>, Byung Wan Lee<sup>5</sup>, Jun Goo Kang<sup>6</sup>, Kim Jae Hyun<sup>7</sup>, Jung Hwan Park<sup>8</sup>, Bon Jeong Ku<sup>9</sup>, Chang Bum Lee<sup>8</sup>, Sang Yong Kim<sup>10</sup>, Ho Sang Shon<sup>11</sup>, Sung Rae Kim<sup>12</sup>, Joong Yeol Park<sup>13</sup>, Woo Je Lee<sup>13</sup>  
Daejeon Eulji Medical Center, Eulji University, Korea<sup>1</sup>, Diabetes Center, Eulji Hospital, Korea<sup>2</sup>, Inje University College of Medicine, Korea<sup>3</sup>, Haeundae Paik Hospital, Inje University College of Medicine, Korea<sup>4</sup>, Yonsei University College of Medicine, Korea<sup>5</sup>, Hallym University College of Medicine, Korea<sup>6</sup>, Samsung Medical Center, Sungkyunkwan University School of Medicine, Korea<sup>7</sup>, Hanyang University College of Medicine, Korea<sup>8</sup>, Chungnam National University College of Medicine, Korea<sup>9</sup>, Chosun University College of Medicine, Korea<sup>10</sup>, Catholic University of Daegu School of Medicine, Korea<sup>11</sup>, Catholic University of Korea Bucheon St. Mary's Hospital, Korea<sup>12</sup>, Asan Medical Center, University of Ulsan College of Medicine, Korea<sup>13</sup>
- PE161** Reduced severe hypoglycemia risk with SGLT2 inhibitors compared to DPP4 inhibitors in type 2 diabetes  
Eun Sook Kim<sup>1\*</sup>, Yunjung Cho<sup>1</sup>, Kwanhoon Cho<sup>1</sup>, Kyung Do Han<sup>2</sup>, Mee Kyoung Kim<sup>3</sup>, Ki-Hyun Baek<sup>3</sup>, Sung Dae Moon<sup>1</sup>, Je-Ho Han<sup>1</sup>, Ki-Ho Song<sup>3</sup>, Hyuk-Sang Kwon<sup>3</sup>  
Incheon St. Mary's Hospital The Catholic University of Korea, Korea<sup>1</sup>, Soongsil University, Korea<sup>2</sup>, Yeouido St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Korea<sup>3</sup>

# Contents

- PE162 Real-world discontinuation, persistence, and adherence of glucagon-like peptide 1 receptor agonists among patients with diabetes in Hong Kong**  
 Shun Yan Chow<sup>1\*</sup>, Pui yin Au-Yeung<sup>1</sup>, Hongjiang Wu<sup>1</sup>, Eric SH Lau<sup>1</sup>, Alice PS Kong<sup>1</sup>, Ronald CW Ma<sup>1</sup>, Andrea Luk<sup>1</sup>, Risa Ozaki<sup>2</sup>, Juliana Chan<sup>1</sup>, Aimin Yang<sup>1</sup>  
 The Chinese University of Hong Kong, China<sup>1</sup>, Prince of Wales Hospital, China<sup>2</sup>
- PE165 Artificial pancreas system for patients with type 2 diabetes: a meta-analysis**  
 Jihee Ko<sup>1\*</sup>, Sun Joon Moon<sup>1</sup>, Jung Hoon Lee<sup>2</sup>, Shin Je Moon<sup>2</sup>, Cheol Young Park<sup>1</sup>  
 Kangbuk Samsung Hospital, Sungkyunkwan University School of Medicine, Korea<sup>1</sup>, Sungsim Hospital, University of Hanrym College of Medicine, Korea<sup>2</sup>
- PE166 2 vs. 1: SGLT2 inhibitor & thiazolidinedione's impact on brain diseases - real clinical data insights**  
 Sang Joon Park<sup>\*</sup>, Hye Jeong Kim, Dong Won Byun, Kyo-II Suh  
 Soonchunhyang University Hospital, Korea

## Diabetes care & education

- PE167 Impact of diabetes-related knowledge, attitudes, and practices on glycemic control in type 2 diabetes: a comprehensive study**  
 Saroj Thapa<sup>\*</sup>, Purnima Adhikari, Prabodh Risal  
 Kathmandu University School of Medical Sciences, Nepal
- PE168 The relationships between activities supporting health product literacy and food consumption behaviors of school age children with risk factors of diabetes in Thailand**  
 Thidarat Apinya  
 Pharmacist, Thailand
- PE170 The impacts of physiotherapeutic interventions on balance and mobility in patients with diabetes**  
 Reena Ranjana<sup>2\*</sup>, Khan Abdur Raheem<sup>3</sup>, Suraj Kumar<sup>1</sup>  
 Jamia Millia Islamia, India<sup>1</sup>, Uttar Pradesh University of Medical Sciences, India<sup>2</sup>, Integral University, India<sup>3</sup>
- PE171 Machine learning prediction model for depression in patients with diabetes mellitus after COVID-19 pandemic**  
 Haewon Byeon<sup>\*</sup>  
 Inje University, Korea
- PE172 Investigation of risk factors for impaired fasting glucose in middle-aged people living in South Korean communities using machine learning**  
 Haewon Byeon<sup>\*</sup>  
 Inje University, Korea
- PE173 Exploring factors affecting testing for diabetes complications during the COVID-19 pandemic using machine learning**  
 Haewon Byeon<sup>\*</sup>  
 Inje University, Korea
- PE177 Associated factors of type 2 diabetes mellitus in Indonesian adolescents**  
 Ramlah Ramlah<sup>\*</sup>  
 Sulawesi Barat University, Indonesia
- PE178 Effect of education on glycemic control after using continuous glucose monitoring system in patients with diabetes**  
 Nayoung Choi<sup>1\*</sup>, Juneyoung Lee<sup>2</sup>  
 Korea University Guro Hospital, Korea<sup>1</sup>, Korea University, Korea<sup>2</sup>

# Contents

- PE179** What they know and how we help them: a qualitative study on healthcare professionals perceptions of patient health literacy and health promotion for the prevention of diabetic foot ulcers  
Paul Victor Patinadan<sup>1\*</sup>, Muhammad Daniel Azlan Mahadzir<sup>2</sup>, Sui Jing Lim<sup>2</sup>, Austin Chin Siang Ang<sup>2</sup>, Anita Pienkowska<sup>2</sup>, Shilpi Tripathi<sup>2</sup>, Iva Bojic<sup>2</sup>, Huiling Liew<sup>3</sup>, Josip Car<sup>2</sup>, Andy Hau Yan Ho<sup>1,2</sup>  
Nanyang Technological University, Singapore<sup>1</sup>, Lee Kong Chian School of Medicine, Singapore<sup>2</sup>, Tan Tock Seng Hospital, Singapore<sup>3</sup>
- PE181** Patterns of insulin use and its cost in managing diabetes in Mongolia: preliminary results  
Enkhтуул Batkhuyag<sup>\*</sup>, Altaisaikhan Khasag<sup>1</sup>, Bolormaa Demberelsaikhan<sup>2</sup>, Davaadulam Dashnyam<sup>3</sup>, Mungunchimeg Shandas<sup>4</sup>, Enkhjargal Yanjmaa<sup>5</sup>, Oyuntugs Byambasukh<sup>1</sup>  
Mongolian National University of Medical Sciences, Mongolia<sup>1</sup>, Khan-Uul District Hospital, Mongolia<sup>2</sup>, Bayanzurkh District Hospital, Mongolia<sup>3</sup>, Chingeltei District Hospital, Mongolia<sup>4</sup>, Mongolian National University of Medical, Mongolia<sup>5</sup>
- PE182** Diabetes care: the impact of COVID 19 pandemic and economic status on diabetes care in Sudan  
Mazin Osman<sup>\*</sup>  
University of Gezira Faculty of Medicine, Sudan
- PE183** The impact of social engagement among community-dwelling older people with type II diabetics: an interpretative phenomenological analysis study  
Tengku Mohd Asri Tengku Makhtar<sup>1,4\*</sup>, Mohd Zulkifli Abdul Rahim<sup>1</sup>, Akehsan Dahlan<sup>3</sup>, Shaharum Shamsuddin<sup>1</sup>, Siti Nurbaya Mohd Nawati<sup>2</sup>  
Universiti Sains Malaysia, Malaysia<sup>1</sup>, Universiti Sains Malaysia, Malaysia<sup>2</sup>, Universiti Teknologi Mara, Malaysia<sup>3</sup>, Ministry of Health Malaysia, Malaysia<sup>4</sup>
- PE185** The impact of people's purchasing power on healthy food in the increasing the number of diabetics; case study in Pekanbaru City, Riau province  
Mikha Melina Harahap<sup>\*</sup>  
Riau Province, Indonesia
- PE186** Assessment of inappropriate retesting of glycated hemoglobin (HbA1c) in a tertiary hospital of Nepal  
Saroj Thapa<sup>\*</sup>  
Kathmandu University School of Medical Sciences, Nepal
- PE187** Estimated cost of CGMS for T1DM patients in Mongolia  
Boldbaatar Enkhjin<sup>\*</sup>, Sonomtseren Sainbileg  
Endomed Hospital, Mongolia
- PE188** Direct and in-direct cost of diabetes care among individuals with type 2 diabetes mellitus  
Harshi Gunawardena<sup>\*</sup>, Shehani Rathnayake, Manuja Ariyapperuma  
Wayamba University of Sri Lanka, Sri Lanka
- PE189** Human development and accessibility for screening diabetes: an analysis of district level on Java island  
Dagun Raisah Laksmi Pratiwi<sup>1\*</sup>, Chyi-Huey Bai<sup>3,4</sup>, Bagas Suryo Bintoro<sup>1,2</sup>  
Center of Health Behavior and Promotion, Indonesia<sup>1</sup>, Department of Health Behavior, Environment, and Social Medicine, Indonesia<sup>2</sup>, School of Public Health, Taiwan<sup>3</sup>, School of Medicine, Taiwan<sup>4</sup>
- PE192** Impact of the hyperpersonalized smart education platform for chronic disease management, doctorvice on T2DM management: randomized clinical study  
Jin Yu<sup>1\*</sup>, Joonyub Lee<sup>1</sup>, Ja Hyun Kim<sup>2</sup>, Yeoree Yang<sup>1</sup>, Eun-Young Lee<sup>1</sup>, Seung-Hwan Lee<sup>1,3</sup>, Hun-Sung Kim<sup>1,3</sup>, Jae-Hyoung Cho<sup>1,3</sup>  
Seoul Saint Mary's Hospital, College of Medicine, The Catholic University of Korea, Korea<sup>1</sup>, The Catholic University of Korea, Korea<sup>2</sup>, College of Medicine, The Catholic University of Korea, Korea<sup>3</sup>
- PE193** Utilization of diabetes care services during COVID 19-pandemic in Pokhara Metropolitan, Nepal: a cross sectional study from the perspectives of diabetes mellitus patients  
Anup Baral<sup>1\*</sup>, Bimala Bhatta<sup>2</sup>, Sapana Bhandari<sup>2</sup>  
Gandaki Medical College, Nepal<sup>1</sup>, School of Health & Allied Sciences, Pokhara Uni, Nepal<sup>2</sup>

# Contents

---

- PE194 Evaluation on nursing home compliance towards diabetes care for elderly in Klang Valley, Kuala Lumpur**  
 Faiz Azim Bin Rosli\*  
 Utm Puncak Alam, Faculty of Business Administrative, Malaysia
- PE195 Glucose control practices of patients with diabetes mellitus in Angeles city, Philippines: a cross-sectional study**  
 Pia Vanessa Basilio\*, Sophie Tranate, Justine David, Andrelyn Dungca, Joy Andrea Gomez, Patricia Malabanan, Jeric Pantig, Aldrian Ronquillo, Allyssa Marielle Yusi, Raphael Enrique Tiongco  
 Angeles University Foundation, Philippines
- PE196 Healthy plate diet and physical activity effect during the diabetes school**  
 Unurbayar Sumiya\*, Bolor Byambatsooj, Sainbileg Sonomtseren  
 Endomed Hospital, Mongolia
- PE197 Nurturing healthier futures: the empowering journey of the sobat diabet academy for the youth**  
 Rudy Kurniawan\*, Machrosin Machrosin, Christian Tricaesario, Elisabeth Susianiwati, Onnyavia Onnyavia, Mutiara Ramadhaniah, Silvie Yuliana  
 Sobat Diabet Community, Indonesia
- PE198 Development of digital education materials for women with hyperglycaemia in pregnancy**  
 Harshi Gunawardena<sup>1\*</sup>, Shivanthi Dharmapala<sup>1</sup>, Thakshila Samaraweera<sup>1</sup>, Dinusha Ganegoda<sup>2</sup>, Chandrika Wijeratne<sup>3</sup>, Asanka Jayawardane<sup>3</sup>  
 Wayamba University of Sri Lanka, Sri Lanka<sup>1</sup>, De Soyza Maternal Hospital, Sri Lanka<sup>2</sup>, University of Colombo, Sri Lanka<sup>3</sup>
- PE199 An integrative review of diabetes care on middle-aged and older women with type 2 diabetes**  
 You Lee Yang\*, Jung Min Choi, Yu Jeong Choi  
 Eulji University, Korea
- PE200 Development of a personalized dietary advice website as a solution to reduce food waste for individuals with diabetes**  
 Fredy Estofany<sup>1,2\*</sup>, Utami Wulandari<sup>2</sup>  
 Fatmawati General Hospital, Indonesia<sup>1</sup>, Gizi Diabetes Indonesia, Indonesia<sup>2</sup>
- PE202 Deciding the measures on most influential determinants of diabetes prevention among mothers and children in underprivileged community: evidence using a health promotion approach in Sri Lanka**  
 Naradi Baduge<sup>1\*</sup>, Laksi Mathankumar<sup>1</sup>, Eshan Madumadhawa<sup>1</sup>, Sulochana Dissanayake<sup>1</sup>, Sonali Gunasekara<sup>2</sup>, Duminda Guruge<sup>1</sup>  
 Faculty of Applied Sciences, Rajarata University of Sri Lanka, Sri Lanka<sup>1</sup>, Faculty of Medicine and Allied Sciences, Rajarata University of Sri Lanka, Sri Lanka<sup>2</sup>
- PE205 Association of mental health conditions with suicide risk among patients with type 2 diabetes: a nationwide population-based cohort study**  
 Han-Sang Baek<sup>1\*</sup>, Kyungdo Han<sup>2</sup>, Jae-Seung Yun<sup>3</sup>, Jang Won Son<sup>4</sup>, Mee Kyoung Kim<sup>5</sup>, Hyuk-Sang Kwon<sup>5</sup>, Seung-Hwan Lee<sup>6</sup>  
 Uijeongbu St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Korea<sup>1</sup>, Soongsil University, Korea<sup>2</sup>, St. Vincent's Hospital, College of Medicine, The Catholic University of Korea, Korea<sup>3</sup>, Bucheon St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Korea<sup>4</sup>, Yeouido St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Korea<sup>5</sup>, Seoul St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Seoul, Korea<sup>6</sup>
- PE206 Comprehensive community health screenings: a holistic approach to diabetes care and education**  
 Satyaprakash Tiwari\*  
 Diabetes Singapore, Singapore
- PE207 Necessity of education on continuous glucose monitoring in type 1 patients with hypoglycemia insensitivity/objective**  
 Misun Yu\*  
 Soonchunhyang University Bucheon Hospital, Korea

# Contents

## Diabetes complications-basic & translational

- PE208** The effect of glycerol blanked triglyceride assays on calculated LDL-Cholesterol levels in patients with diabetes mellitus- a cross-sectional study  
Sojit Tomo\*, Mohini Rathore, Maya Gopalakrishnan, Shrimanjanath Sankanagoudar, Mithu Banerjee, Praveen Sharma  
All India Institute of Medical Sciences, Jodhpur, India
- PE210** The complexity of diabetic foot problem screening and management: serial case  
Winda Atika Sari<sup>1\*</sup>, Eva Niamuzisilawati<sup>2</sup>  
Faculty of Medicine of Universitas Sebelas Maret/ Universitas Sebelas Maret Hospital, Indonesia<sup>1</sup>, Faculty of Medicine of Universitas Sebelas Maret/ Dr. Moewardi General Hospital, Indonesia<sup>2</sup>
- PE212** Overweight, obesity and dietary practices among adolescents aged: a cross-sectional online survey in central region of Malaysia  
Nur Shazwaniza Binti Yahya<sup>1\*</sup>, DAUD Ahmad Zamir Che<sup>1</sup>, Fauziah Ahmad<sup>2</sup>, Zamzaliza Abdul Mulud<sup>1</sup>  
Universiti Teknologi Mara, Malaysia<sup>1</sup>, Ministry of Health, Malaysia<sup>2</sup>
- PE214** Study of vitamin D levels, pancreatobiliary diseases factors and inflammation data in school going adolescents relation to non-alcoholic fatty liver disease patients  
Vikas Sharma\*, Madhu Gautam  
S N Medical College and Hospital, India
- PE217** Antifibrotic effect of mefloquine, an antimalarial medicine, on renal fibrosis  
Yeo Jin Hwang\*, Kyeong-Min Lee  
DGIST, Korea
- PE219** Metixene hydrochloride hydrate inhibits TGF-beta-induced renal fibrosis  
Kyeong-Min Lee\*, Yeo Jin Hwang  
Daegu Gyeongbuk Institute of Science and Technology, Korea
- PE220** Role of mucin-1 in diabetic neuropathy in type 2 diabetes  
Hye Min Shim<sup>1,2\*</sup>, Ho Chan Cho<sup>2</sup>, Jae-Hyung Park<sup>1</sup>  
Keimyung University School of Medicine, Korea<sup>1</sup>, Keimyung University Dongsan Hospital, Korea<sup>2</sup>
- PE221** Role of protein z in hypercoagulable state in type 2 diabetes  
Hae-Jung Kim<sup>1\*</sup>, Ho Chan Cho<sup>2</sup>, Jae-Hyung Park<sup>1</sup>  
Keimyung University School of Medicine, Korea<sup>1</sup>, Keimyung University Dongsan Hospital, Korea<sup>2</sup>
- PE222** A random forest algorithm-based discovery of hepatokine as biomarker of NASH  
Tami Dao<sup>1\*</sup>, E.Kang Baek<sup>1</sup>, Shibo Wei<sup>1</sup>, Eun-Ju Jin<sup>1</sup>, Yunju Jo<sup>2</sup>, Dae-Ho Lee<sup>3</sup>, Seungyeon Nam<sup>4</sup>, Thanh Nguyen<sup>2</sup>, Dongryeol Ryu<sup>2</sup>  
Sungkyunkwan University, School of Medicine, Korea<sup>1</sup>, GIST, Korea<sup>2</sup>, Gil Medical Center, Gachon University College of Medicine, Korea<sup>3</sup>, GAIHST, Gachon University, Korea<sup>4</sup>
- PE223** Characterizing diurnal fluctuations in gut microbiota composition: insights into temporal patterns, disrupted rhythms, and potential links to metabolic dysregulation in type 2 diabetes mellitus  
Prihantini Prihantini<sup>1\*</sup>, Asfiranita Hasan Umar<sup>2</sup>, Noor Lela<sup>3</sup>, Angel Kiya Salehwati<sup>4</sup>  
Yogyakarta State University, Indonesia<sup>1</sup>, Yogyakarta State University, Indonesia<sup>2</sup>, Berahim Regional Hospital, Indonesia<sup>3</sup>, Berahim Regional Hospital, Indonesia<sup>4</sup>
- PE224** Relationships between IMT and diabetic complications in Mongolian patients with type 2 diabetes mellitus  
Oyunsaikhan Shiiperlii\*, Orgil Sengeragchaa  
Darkhan General Hospital, Mongolia

# Contents

## Diabetes complications-clinical & epidemiology

- PE225 Is diabetes a predictor of mortality in hemodialysis patients with cardiovascular disease?**  
Mega Febrianora\*  
Hasan Sadikin General Hospital, Indonesia
- PE226 Predictors of breastfeeding self-efficacy among gestational diabetes mellitus mothers in Malaysia: a cross sectional**  
Syahrul Bariah Abdul Hamid\*, Shuhaimi Farhanah Ahmad  
Universiti Teknologi Mara, Malaysia
- PE230 Metabolic Syndrome (MetS) and type 2 diabetes mellitus among Filipino adults**  
Cherry Ann Durante<sup>1,2\*</sup>, Estrella San Juan<sup>2</sup>  
Emilio Aguinaldo College, Philippines<sup>1</sup>, University of Perpetual Help - Dr. Jose G. Tamayo Medical University, Philippines<sup>2</sup>
- PE234 Prediction of bone resection of presepsin in diabetic foot ulcer**  
Eun Yeong Ha\*, Il Rae Park, Seung Min Chung, Young Nam Roh, Chul Hyun Park, Tae Gon Kim, Woong Kim, Ji Sung Yoon, Kyu Chang Won, Hyoung Woo Lee, Jun Sung Moon  
Yeungnam University, Korea
- PE236 The association between perceived body image and dysglycemia in Korean adult population**  
Suji Yoo\*, Jong Ha Baek  
Gyeongsang National University Changwon Hospital, Korea
- PE238 The prevalence and risk factors of chronic kidney disease amongst type 2 diabetes at Cambodia Korea diabetes center**  
Malineat Ung\*  
Cambodia-Korea Diabetes Center, Cambodia
- PE239 Prevalence's of overweight and obesity among type 2 diabetes mellitus with insulin therapy in primary health care Malaysia: a population cross-sectional descriptive study**  
Nur Shazwaniza Binti Yahya<sup>1\*</sup>, Ahmad Zamir Che Daud<sup>1</sup>, Fauziah Ahmad<sup>2</sup>, Zamzaliza Abdul Mulud<sup>1</sup>  
Universiti Teknologi Mara, Malaysia<sup>1</sup>, Ministry of Health, Malaysia<sup>2</sup>
- PE240 Prevalence and determinants of depression among type 2 diabetes mellitus patients with insulin therapy at primary health care in Malaysia: a cross sectional study**  
Nur Shazwaniza Binti Yahya<sup>1\*</sup>, Ahmad Zamir Che Daud<sup>1</sup>, Fauziah Ahmad<sup>2</sup>, Zamzaliza Abdul Mulud<sup>1</sup>  
Universiti Teknologi Mara, Malaysia<sup>1</sup>, Ministry of Health, Malaysia<sup>2</sup>
- PE241 Morbidity and mortality patterns in diabetic kidney disease based on KDIGO stratification**  
Seung Eun Lee\*, Jiyun Jung, Jae Yoon Park, Saebom Kim, Kyoung-Ah Kim  
Dongguk University Ilsan Hospital, Korea
- PE242 Long-term effectiveness of the national diabetes quality assessment program in South Korea**  
Kyoung Hwa Ha<sup>1\*</sup>, Ji Hye Huh<sup>2</sup>, Serim Kwon<sup>3</sup>, Gui Ok Kim<sup>3</sup>, Bo Yeon Kim<sup>3</sup>, Dae Jung Kim<sup>1</sup>  
Ajou University School of Medicine, Korea<sup>1</sup>, Hallym University Sacred Heart Hospital, Korea<sup>2</sup>, Health Insurance Review and Assessment Service, Korea<sup>3</sup>
- PE243 Diabetes and other metabolism related adverse events reported after the use of COVID-19 vaccines: a descriptive study**  
Rimple Jeet Kaur\*, Jaykaran Charan  
All India Institution of Medical Sciences, India
- PE244 Risk factor of worsening kidney function in elderly veteran population according to glycemic status**  
Jin Seon Jeong\*  
Veterans Health Service Medical Center, Korea

# Contents

- PE245 Diabetic foot ulcer: 6 years follow-up study**  
Telmen Boldbaatar\*, Sainbileg Sonomtseren  
Endomed Hospital, Mongolia
- PE246 HbA1C variability and the risk of renal progression in type 2 diabetes mellitus**  
So-hyeon Hong\*, Yeon-Ah Sung, Young Sun Hong, Do Kyeong Song, Hyein Jung, Hyejin Lee  
Ewha Womans University School of Medicine, Korea
- PE247 Metabolic dysfunction-associated steatotic liver disease increases the risk of incident cardiovascular disease: a nationwide cohort study**  
Joon Ho Moon<sup>1\*</sup>, Seongsong Jeong<sup>2</sup>, Heejoon Jang<sup>3</sup>, Bo Kyung Koo<sup>3</sup>, Won Kim<sup>3</sup>  
Seoul National University Bundang Hospital, Korea<sup>1</sup>, Cha University, Korea<sup>2</sup>, Seoul Metropolitan Government Boramae Medical Center, Korea<sup>3</sup>
- PE248 Handgrip strength dynamics pre- and post-dialysis in diabetic patients: implications for nutritional status and overall well-being**  
Munkh-Od Battsoḡ<sup>1,2\*</sup>, Munkhzaya Daramzagd<sup>2</sup>, Chuluuntsetseg Dorj<sup>1</sup>, Altaisaikhan Khasag<sup>2</sup>, Oyuntugs Byambasukh<sup>2</sup>  
First Central Hospital of Mongolia, Mongolia<sup>1</sup>, Mongolian National University of Medical Science, Mongolia<sup>2</sup>
- PE249 The association between blood pressure reduction mediated by blood pressure lowering agents and the risk of peripheral arterial disease: a systematic review and meta-analysis of randomized controlled trial**  
Ruoyang Jiao<sup>1\*</sup>, Chu Lin<sup>1</sup>, Xingyun Zhu<sup>2</sup>, Hu Suiyuan<sup>1</sup>, Fang Lv<sup>1</sup>, Wenjia Yang<sup>1</sup>, Linong Ji<sup>1</sup>, Xiaoling Cai<sup>1</sup>  
Peking University People's Hospital, China<sup>1</sup>, Beijing Jishuitan Hospital, China<sup>2</sup>
- PE250 Optimal LDL cholesterol levels in young and old patients with type 2 diabetes for secondary prevention of cardiovascular diseases are different**  
Chaiho Jeong<sup>1\*</sup>, Bongseong Kim<sup>2</sup>, Jinyoung Kim<sup>1</sup>, Hansang Baek<sup>1</sup>, Mee Kyoung Kim<sup>1</sup>, Tae-Seo Sohn<sup>1</sup>, Ki-Hyun Beak<sup>1</sup>, Ki-Ho Song<sup>1</sup>, Hyun-Shik Son<sup>1</sup>, Kyungdo Han<sup>2</sup>, Hyuk-Sang Kwon<sup>1</sup>  
College of Medicine, The Catholic University of Korea, Seoul, Korea<sup>1</sup>, Soongsil University of Korea, Seoul, Korea<sup>2</sup>
- PE251 Complete blood count parameters in type 2 diabetes mellitus: a matched case-control study**  
Su Ya\*, Jagdag Enkhbaatar, Munkh-Uchral Nordog, Narkhajid Galsanjigmid, Odgerel Tsogbadrakh, Oyuntugs Byambasukh, Otgonbat Altangerel  
Mongolian National University of Medical Sciences, Mongolia
- PE252 Cardiac autonomic neuropathy screening in diabetic patients**  
Sainbileg Sonomtseren\*, Bolor Byambatsooj, Telmen Boldbaatar, Saran Tserensodnom  
Endomed Hospital, Mongolia
- PE254 Association of metabolic dysfunction-associated fatty liver disease with brain white matter changes and cognitive decline: a longitudinal cohort study**  
Inha Jung<sup>1\*</sup>, So Young Park<sup>1</sup>, Da Young Lee<sup>1</sup>, Hyunjoo Cho<sup>1</sup>, Eyun Song<sup>1</sup>, Kyeong Jin Kim<sup>1</sup>, Nam Hoon Kim<sup>1</sup>, Hye Jin Yoo<sup>1</sup>, Ji A Seo<sup>1</sup>, Sin Gon Kim<sup>1</sup>, Kyung Mook Choi<sup>1</sup>, Sei Hyun Baik<sup>1</sup>, Nan Hee Kim<sup>1</sup>, Chol Shin<sup>2</sup>, Na Hyun Park<sup>2</sup>, Jae Hyun Yoo<sup>2</sup>, Ji Hee Yu<sup>1</sup>  
Korea University College of Medicine, Korea<sup>1</sup>, Korea University Ansan Hospital, Korea<sup>2</sup>
- PE255 The metabolic characteristics and carotid intima-media thickness of lean metabolic dysfunction associated steatotic liver disease in patients with type 2 diabetes mellitus**  
Youngjoon Kim<sup>1\*</sup>, Yongin Cho<sup>1</sup>, Hye-sun Park<sup>2</sup>, Yong-ho Lee<sup>2</sup>, Yoonji Kim<sup>1</sup>, Hyun Ju Jo<sup>1</sup>, Eun Kyoung Park<sup>1</sup>, Hyeon Jeong Kim<sup>1</sup>, Da Hea Seo<sup>1</sup>, Seong Hee Ahn<sup>1</sup>, Seongbin Hong<sup>1</sup>  
Inha University College of Medicine, Korea<sup>1</sup>, Gangnam Severance Hospital, Korea<sup>2</sup>
- PE256 Diabetic kidney disease, cerebral structural changes, and cognitive decline**  
Inha Jung<sup>1\*</sup>, So Young Park<sup>1</sup>, Da Young Lee<sup>1</sup>, Hyunjoo Cho<sup>1</sup>, Eyun Song<sup>1</sup>, Kyeong Jin Kim<sup>1</sup>, Nam Hoon Kim<sup>1</sup>, Hye Jin Yoo<sup>1</sup>, Ji A Seo<sup>1</sup>, Sin Gon Kim<sup>1</sup>, Kyung Mook Choi<sup>1</sup>, Sei Hyun Baik<sup>1</sup>, Nan Hee Kim<sup>1</sup>, Chol Shin<sup>2</sup>, Jee-In Heo<sup>2</sup>, Jiae Kim<sup>2</sup>, Ji Hee Yu<sup>1</sup>  
Korea University College of Medicine, Korea<sup>1</sup>, Korea University Ansan Hospital, Korea<sup>2</sup>

# Contents

---

- PE257 Wound, ischemia, and foot infection (WIFI) classification for risk stratification in diabetic foot ulcer patients: a systematic review and meta-analysis**  
I Pande Putu Deny Heriwijaya<sup>1\*</sup>, Made Lady Adelaida Purwanta<sup>2</sup>, Putu Astri Novianti<sup>1</sup>  
Udayana University Hospital, Indonesia<sup>1</sup>, Wangaya Hospital, Indonesia<sup>2</sup>
- PE260 A meta-analytic synthesis of metformin for advanced or inoperable non-small cell lung cancer in patients with and without diabetes**  
Md Azharuddin\*, Manju Sharma  
Pharmacology, Jamia Hamdard, India
- PE261 Acute glycemic variability as the risk factor for mortality in Diabetes Mellitus Type 2 (T2DM) Patient with sepsis: prospective observational study**  
Burhan Gunawan\*, Raymond Sebastian  
Sumber Waras Hospital, West Jakarta, Indonesia
- PE262 Reasons for hospitalization among patients with type 2 diabetes in Cambodia-Korea diabetes center from January 1 to June 30, 2023**  
Videm Chea\*, Khun Touch  
Cambodia-Korea Diabetes Center, Cambodia
- PE263 The risk of cardiovascular disease according to the disabilities in patients with type 2 diabetes**  
Jin Hyung Jung<sup>1\*</sup>, Eunkyung Jeong<sup>2</sup>, Kyu Na Lee<sup>1</sup>, Bongseong Kim<sup>1</sup>, Kyungdo Han<sup>3</sup>  
Sungkyunkwan University School of Medicine, Korea<sup>1</sup>, College of Medicine, Catholic University of Korea, Korea<sup>2</sup>, Soongsil University, Korea<sup>3</sup>
- PE264 Sex differences in the prevalence and factors associated with metabolic syndrome in the general population of Mongolia**  
Lkham-Erdene Byambadoo<sup>1\*</sup>, Eiko Yamamoto<sup>2</sup>  
Ministry of Health, Mongolia<sup>1</sup>, Nagoya University Graduate School of Medicine, Japan<sup>2</sup>
- PE265 Disparities in treatment targets attainment and medication use in a multi-ethnic population with type 2 diabetes in Malaysia**  
Yubi Mamiya<sup>1\*</sup>, Tinney Mak<sup>1</sup>, Anis Syazwani Bt Abd Raof<sup>2</sup>, Samuel JW. Lee-Boey<sup>2</sup>, Ru-Jin Lim<sup>2</sup>, Singh A/L. Jeswender Singh Sarkaaj<sup>2</sup>, Lee-Ling Lim<sup>2,3,4</sup>  
Princeton University, United States<sup>1</sup>, University of Malaya, Malaysia<sup>2</sup>, The Chinese University of Hong Kong, China<sup>3</sup>, Asia Diabetes Foundation, China<sup>4</sup>
- PE266 Predictive model to classify early-onset vs late-onset type 2 diabetes**  
Yubi Mamiya\*, Tinney Mak, Lee-Ling Lim  
University of Malaya, Malaysia
- PE267 Different associations between lipid levels and risk of heart failure according to the progression of diabetes**  
Seung-Hwan Lee<sup>1,2\*</sup>, Kyu Na Lee<sup>3</sup>, Kyungdo Han<sup>3</sup>, Mee Kyoung Kim<sup>4</sup>  
Seoul St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Korea<sup>1</sup>, College of Medicine, The Catholic University of Korea, Korea<sup>2</sup>, Soongsil University, Korea<sup>3</sup>, Yeouido St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Korea<sup>4</sup>
- PE268 Correlation of glycemic control with severity of chronic small vessel ischemic disease in brain MRI of diabetic patients**  
Bigyan Paudel\*  
Chitwan Medical College, Nepal
- PE269 Associations between alcohol consumption and cause-specific mortalities in Metabolic dysfunction-Associated Fatty Liver Disease (MAFLD) patients: a nationwide population-based study**  
So Hyun Cho<sup>1\*</sup>, Rosa Oh<sup>1</sup>, Ji Yoon Kim<sup>1</sup>, Gyuri Kim<sup>1</sup>, You-bin Lee<sup>1</sup>, Sang-Man Jin<sup>1</sup>, Kyu Yeon Hur<sup>1</sup>, Seohyun Kim<sup>2</sup>, Jae Hyeon Kim<sup>1</sup>  
Samsung Medical Center, Korea<sup>1</sup>, Sungkyunkwan University, Korea<sup>2</sup>

# Contents

- PE270 Fasting glucose level and cardiovascular outcomes according to menopausal status: a nationwide population-based study**  
 Kyunho Kim<sup>1\*</sup>, Yebin Park<sup>2</sup>, Chae Eun Yong<sup>1</sup>, Min Hyang Youn<sup>1</sup>, Yu-Bae Ahn<sup>1</sup>, Seung-Hyun Ko<sup>1</sup>, Kyungdo Han<sup>2</sup>, Yun Jae-Seung<sup>1</sup>  
 The Catholic University of Korea, St. Vincent's Hospital, Korea<sup>1</sup>, Soongsil University, Korea<sup>2</sup>
- PE271 Endothelial nitric oxide synthase rs2070744 T/C gene polymorphism with risk of coronary artery disease in population with type 2 diabetes: update meta-analysis**  
 William Djauhari<sup>1\*</sup>, Bisuk Silalahi<sup>2</sup>  
 Eka Hospital Bsd, Indonesia<sup>1</sup>, Weda General Hospital, Indonesia<sup>2</sup>
- PE274 The incidence of lower extremity amputations in South Korea, 2003-2021**  
 Ja Young Jeon<sup>1\*</sup>, Na young Kim<sup>2</sup>, Joung Hwan Back<sup>1</sup>, Na mi Lee<sup>1</sup>, Seung Jin Han<sup>1</sup>, Hae Jin Kim<sup>1</sup>, Dae Jung Kim<sup>1</sup>, Tae Ho Kim<sup>3</sup>, So Yeon Ahn<sup>4</sup>, Kwan Woo Lee<sup>1</sup>  
 Ajou University School of Medicine, Korea<sup>1</sup>, National Health Insurance Service, Korea<sup>2</sup>, Seoul Medical Center, Korea<sup>3</sup>, Busan Bumjin Hospital, Korea<sup>4</sup>
- PE275 Association between fatty liver index and incident diabetes according to alcohol consumption status in young people**  
 Jin Yu<sup>1\*</sup>, Joonyub Lee<sup>1</sup>, Hun-Sung Kim<sup>1,2</sup>, Jae-Hyung Cho<sup>1,2</sup>, Bong Seong Kim<sup>3</sup>, Kyungdo Han<sup>3</sup>, Seung-Hwan Lee<sup>1,2</sup>  
 Seoul Saint Mary's Hospital, College of Medicine, The Catholic University of Korea, Korea<sup>1</sup>, College of Medicine, The Catholic University of Korea, Korea<sup>2</sup>, Soongsil University, Korea<sup>3</sup>
- PE276 Association between metabolic syndrome and suicide: a nationwide population-based cohort study**  
 Ye Bin Park<sup>1\*</sup>, Jin Hwa Kim<sup>2</sup>, Jin Hyung Jung<sup>3</sup>, Bongseong Kim<sup>3</sup>, Kyu Na Lee<sup>3</sup>, Ju Yeong Park<sup>3</sup>, Hyuk-Sang Kwon<sup>4</sup>, Kyungdo Han<sup>1</sup>  
 Soongsil University, Korea<sup>1</sup>, Chosun University Hospital, Korea<sup>2</sup>, Sungkyunkwan University School of Medicine, Korea<sup>3</sup>, The Catholic University of Korea, Korea<sup>4</sup>
- PE277 Percentage of diabetic nephropathy among type 2 diabetes patients admitted in Cambodia-Korea Diabetes Center (CKDC) from January 1 to June 30, 2023**  
 Sreymey Seng<sup>\*</sup>  
 Cambodia-China Friendship Preah Kossamak Hospital, Cambodia
- PE278 Metabolic syndrome, obesity, and their association with moyamoya vasculopathy in the young adults**  
 Joonyub Lee<sup>1\*</sup>, Seung-Hwan Lee<sup>1</sup>, Mee-Kyoung Kim<sup>2</sup>, Hyuk-Sang Kwon<sup>2</sup>, Jae-Seung Yun<sup>3</sup>, Yeoree Yang<sup>1</sup>, Kun-Ho Yoon<sup>1</sup>, Jae-Hyung Cho<sup>1</sup>, Kyungdo Han<sup>4</sup>, Jang Won Son<sup>5</sup>  
 Seoul St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Korea<sup>1</sup>, Yeouido St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Korea<sup>2</sup>, St. Vincent's Hospital, College of Medicine, The Catholic University of Korea, Korea<sup>3</sup>, Soongsil University, Korea<sup>4</sup>, Bucheon St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Korea<sup>5</sup>
- PE279 Risk factors for diabetic retinopathy: the Korea national health and nutrition examination survey**  
 Jisun Lim<sup>1\*</sup>, Seung Woo Choi<sup>2</sup>, Minji Sohn<sup>1</sup>, Soo Lim<sup>1</sup>, Se Joon Woo<sup>2</sup>  
 Seoul National University Bundang Hospital, Korea<sup>1</sup>, Retimark, Korea<sup>2</sup>
- PE280 Remnant-C predicts risk of developing end-stage renal disease in patients with type 2 diabetes**  
 Eun Roh<sup>1\*</sup>, Ji Hye Huh<sup>1</sup>, Seong Jin Lee<sup>1</sup>, Sung-Hee Ihm<sup>1</sup>, Kyung-Do Han<sup>2</sup>, Jun Goo Kang<sup>1</sup>  
 Hallym University College of Medicine, Korea<sup>1</sup>, College of Natural Sciences, Soongsil University, Korea<sup>2</sup>
- PE281 Associations between type 2 diabetes and suicide risk; a nationwide population-based cohort study**  
 Yunjung Cho<sup>1,4\*</sup>, Kook-Rye Kim<sup>2</sup>, Mi-Jin Shim<sup>2</sup>, Kwan Hoon Jo<sup>1,4</sup>, Eun Sook Kim<sup>1,4</sup>, Sung-dae Moon<sup>1,4</sup>, Je Ho Han<sup>1,4</sup>, Kyungdo Han<sup>3</sup>, Jae-Seung Yun<sup>1,4</sup>  
 Incheon St. Mary's Hospital, Korea<sup>1</sup>, St. Vincent's Hospital, Korea<sup>2</sup>, Soongsil University, Korea<sup>3</sup>, The Catholic University, Korea<sup>4</sup>
- PE282 Association between weight-adjusted waist index and muscle strength**  
 Jung A Kim<sup>\*</sup>, Eun Kyeong Song, Min Kyoung Ryu, Donghyun Shin, Yonghyun Kim  
 Daejin Medical Center, Bundang Jesaeng Hospital, Korea

# Contents

- PE283 The association between lipid profile and diabetic retinopathy: a systematic review and meta-analysis**  
Ni Putu Ayu Pande Arista Dewi<sup>1\*</sup>, Made Lady Adelaida Purwanta<sup>2</sup>  
Bali Mandara Eye Hospital, Indonesia<sup>1</sup>, Wangaya Hospital, Indonesia<sup>2</sup>
- PE284 Effect of hypoglycemia during dialysis on atherosclerotic cardiovascular disease in patients with diabetes**  
In Sun Goak\*, Yu Ji Kim, Heung Yong Jin Jin, Tae Sun Park, Kyung Ae Lee  
Jeonbuk National University Hospital, Korea
- PE285 Diffusion tensor imaging of the tibial nerve can detect nerve damage in type 2 diabetes**  
Hyeong-Kyu Park\*, Eun-Sun Oh, Sang-Joon Park, Hye-Jung Kim, Dong-Won Byun, Kyo-il Suh  
Soonchunhyang University Hospital, Korea
- PE287 Elevated frequency of MODY genetic variants in diabetes in pregnancy: insights from the UK biobank**  
Jeongeun Lee\*, Hyunsuk Lee<sup>1,2</sup>, Jaewon Choi<sup>3</sup>, Jongseok Park<sup>1</sup>, Heejun Son<sup>1</sup>, Jinsun Jang<sup>1</sup>, Haewon Yang<sup>1</sup>, Kyong Soo Park<sup>1</sup>, Soo-Heon Kwak<sup>1</sup>  
Seoul National University Hospital, Korea<sup>1</sup>, Seoul National University College of Medicine, Korea<sup>2</sup>, Seoul National University Hospital, Korea<sup>3</sup>
- PE288 The risk of type 2 diabetes and persistent hypertriglyceridemia across subgroups**  
Min Kyung Lee<sup>1\*</sup>, Kyungdo Han<sup>2</sup>, Jung Heo<sup>1</sup>, Jiyeon Ahn<sup>1</sup>, Yoon Kyung Lee<sup>1</sup>, Hye Jin Ma<sup>1</sup>, Jae-Hyuk Lee<sup>1</sup>  
Myongji Hospital, Hanyang University College of Medicine, Korea<sup>1</sup>, Soongsil University, Korea<sup>2</sup>

## Others (basic & translational)

- PE289 Investigating metabolic pathways and metabolite expression changes in obese individuals during a weight management program**  
Norazmir Md Nor\*, Syazana Arinatul Afiqah Mohiddin, Nur Izatul Hanisah Abdul Halim, Norashimah Rajab, Ummi Mohlisi Mohd Asmawi  
Universiti Teknologi Mara, Malaysia
- PE292 A comparison of female students who live at home vs. in hostels based on chronotype for depression, anxiety, and stress**  
Preeti Gupta<sup>1\*</sup>, Ankit Sinha<sup>2</sup>, Shalie Malik<sup>2</sup>, Dileep Kumar Verma<sup>1</sup>, Narsingh Verma<sup>1</sup>  
King Georges Medical University, India<sup>1</sup>, University of Lucknow, India<sup>2</sup>
- PE294 ATF5 modulates brown adipose tissue thermogenesis and differentiation under cold exposure**  
Hyo Ju Jang\*, Jingwen Tian, Hyon-Seung Yi  
Chungnam National University School of Medicine, Korea
- PE295 Exploring emerging threat of Non-Communicable Diseases (NCDs) with special focus on diabetes in tribal population in developing country: a community based study through health belief model**  
Priti Solanky\*, Hitesh Shah  
Gmers Medical College, Valsad, India
- PE296 Biological potential and therapeutic effectiveness of paeonol against high blood pressure and Heart Failure (HF) in medicine with their underline molecular mechanism**  
Dinesh Kumar Patel\*  
Faculty of Health Science, Shuats, India
- PE297 Effect of Ipeglimin on NLRP3 inflammasome activation in macrophages**  
Jiyeon Lee\*, Yup Kang, Ja Young Jeon, Hae Jin Kim, Dae Jung Kim, Kwan Woo Lee, Seung Jin Han  
Ajou University School of Medicine, Korea

# Contents

---

- PE298 Serum/cord blood levels and mRNA expression of cytokines and adipokines in adipose tissue and placenta in pregnant women with GDM and mice with high fat diet**  
 Joung Youl Lim<sup>1\*</sup>, Ok Soon Kim<sup>1</sup>, Sang Hyeon Ju<sup>1</sup>, Min Chul Song<sup>1</sup>, Ji Min Kim<sup>2,3</sup>, Hyon Seung Yi<sup>1,3</sup>, Kyong Hye Joung<sup>2,3</sup>, Ju Hee Lee<sup>1,3</sup>,  
 Bon Jeong Ku<sup>1,3</sup>, Mina Lee<sup>3</sup>, Hyun Jin Kim<sup>1,3</sup>  
 Chungnam National University Hospital, Korea<sup>1</sup>, Chungnam National University Sejong Hospital, Korea<sup>2</sup>, Chungnam National University School of  
 Medicine, Korea<sup>3</sup>
- PE299 The role of creatine during liver regeneration after partial hepatectomy**  
 Linh Nguyen Thi\*, Hyon-Seung Yi  
 Chungnam National University School of Medicine, Korea
- PE300 Mitochondrial carrier, SLC25A33, mediates M1 macrophage polarization through mtDNA synthesis and cytosolic release**  
 Jonghwa Jin<sup>1\*</sup>, Hyang Sook Kim<sup>1</sup>, Bitna Ha<sup>1</sup>, Nayoung Kim<sup>1</sup>, Jun-Kyu Byun<sup>3</sup>, Jimin Hong<sup>1</sup>, Jung-Guk Kim<sup>1</sup>, Yeon-Kyung Choi<sup>2</sup>, Keun-Gyu Park<sup>1</sup>  
 Kyungpook National University Hospital, Korea<sup>1</sup>, Kyungpook National University Chilgok Hospital, Korea<sup>2</sup>, Kyungpook National University, Korea<sup>3</sup>
- PE301 Functional food seaweed caulerpa lentillifera as natural anti-diabetic agent**  
 Mohamad Fauzi Mahmud<sup>1\*</sup>, Faisal Ahmad<sup>1</sup>, Tuan Zainazor Tuan Chitek<sup>1</sup>, Hafiz Ibrahim<sup>2</sup>, Noraznawati Ismail<sup>3</sup>, Azwan Awang<sup>4</sup>,  
 Mohd Nazri Ismail<sup>2</sup>  
 University Malaysia Terengganu, Malaysia<sup>1</sup>, Universiti Sains Malaysia, Malaysia<sup>2</sup>, University Malaysia Terengganu, Malaysia<sup>3</sup>, University Malaysia  
 Sabah, Malaysia<sup>4</sup>
- PE303 Effects of irisin on the islet stellate cells activation and its mechanisms**  
 Qianqian Wang\*, Tingting Li, Shanhu Qiu, Zilin Sun  
 Southeast University, China
- PE304 Considerations for mhealth intervention development: lessons learned from two diabetes education apps**  
 Anita Pienkowska<sup>1\*</sup>, Daniel Mahadzir<sup>1</sup>, Iva Bojic<sup>1</sup>, Liew Huiling<sup>2</sup>, Chew Ek Kwang Daniel<sup>2</sup>, Josip Car<sup>1</sup>, Andy Ho<sup>1</sup>  
 Nanyang Technological University, Singapore<sup>1</sup>, Tan Tock Seng Hospital, Singapore<sup>2</sup>
- PE308 Unexplored agro-industrial residues of Malaysian fruits as a potential sources for formulating nutraceuticals and functional food**  
 Suhana Samat<sup>1\*</sup>, Jalipah Latip<sup>2</sup>  
 Universiti Sains Malaysia, Malaysia<sup>1</sup>, Universiti Kebangsaan Malaysia, Malaysia<sup>2</sup>
- PE309 Hepatoprotective effects of white sesame oil extract in cholesterol diet induced hyperlipidemia in male rats**  
 Ankush Kumar\*, Anil Gaur  
 Shakuntla Hospital and Research Center, India
- PE310 Pandemic pressures: student stress and weight responses in the COVID-19 era**  
 Purevsod Lkhagvasuren\*, Gerelt-Od Erdenesuren, Anujin Tuvshinjargal, Baigal Naratuya, Anar Bayamunkh, Oyuntugs Byambasukh  
 Mongolian National University of Medical Sciences, Mongolia
- PE311 Enavogliflozin, an SGLT2 inhibitor, ameliorates high-fat high-cholesterol diet-induced nonalcoholic steatohepatitis**  
 Phuc Pham\*, So Young Park, Giang Nguyen, Thuy Linh Lai, Kyoungbo Yu, Dae-Hee Choi, Eun-Hee Cho  
 Kangwon National University, Korea
- PE312 Taurine ameliorates diabetic complications by improving serum adiponectin levels and inflammation in ob/ob mice**  
 Kainat Ahmed\*, YIM Jung-Eun  
 Changwon National University, Korea
- PE313 The Study of Thai people in the diabetes mellitus and overweight risk group and their health product literacy**  
 Bemjamas Nakkarach\*, Thidarat Apinya  
 Public Health Officer, Thailand

# Contents

- PE315 Effects of sargassum miyabei yendo on the hepatic fibrosis in LX-2 cells**  
 Bohkyung Kim<sup>1\*</sup>, Jinkyung Kim<sup>1</sup>, Kyung-Ah Kim<sup>2</sup>, Sang Gil Lee<sup>3</sup>  
 Pusan National University, Korea<sup>1</sup>, Chungnam National University, Korea<sup>2</sup>, Pukyong National University, Korea<sup>3</sup>
- PE316 Effect of bee keeping and wild harvesting honey in anthropometrical, insulin resistance and also reversing metabolic changes in rats fed with high-fat diet: a comparative study**  
 Suhana Samat<sup>1\*</sup>, Wan Iryani Wan Ismail<sup>2</sup>, Zolkapli Eshak<sup>2</sup>  
 Universiti Sains Malaysia, Malaysia<sup>1</sup>, Universiti Teknologi Mara, Malaysia<sup>2</sup>, Universiti Malaysia Terengganu, Malaysia<sup>3</sup>
- PE317 Harnessing AI and digital innovations for enhanced diabetes management**  
 Satyaprakash Tiwari<sup>\*</sup>  
 Diabetes Singapore, Singapore

## Others (clinical)

- PE318 Exploring role of newer anti diabetic drug terzepatide in management of obesity**  
 Dr Nilesh Chavda<sup>\*</sup>, Dr Priti Solanki  
 Gmers Medical College Valsad, India
- PE320 Robust deep learning method for early detection of diabetes using image-based representation**  
 Rifaldy Fajar<sup>1\*</sup>, Moa Hannah<sup>1</sup>, Beatrice Gomes Luice<sup>2</sup>, Cincilla Caroline Xairea<sup>2</sup>  
 Karlstad University, Sweden<sup>1</sup>, Central Hospital Karlstad (centralsjukhuset Karlstad), Sweden<sup>2</sup>
- PE321 Enhancing type 2 diabetes diagnosis accuracy using learning vector quantization: a machine learning approach**  
 Rifaldy Fajar<sup>\*</sup>, Barbara Mckenzie, Oscar Torrado Lopraz, Hannah Wohlan Koutakas  
 Karlstad University, Sweden
- PE322 Gut microbiota and metabolites as mediators in the bidirectional relationship between sleep disturbances and insulin resistance in type 2 diabetes: a cross-sectional study**  
 Prihantini Prihantini<sup>1\*</sup>, Tia Pakusadewo<sup>1</sup>, Martina Tiara Arafuru<sup>2</sup>, Betril Mubin Ritonga<sup>2</sup>, Asfirani Umar<sup>1</sup>  
 Yogyakarta State University, Indonesia<sup>1</sup>, Ende General Hospital, Indonesia<sup>2</sup>
- PE323 Association between minority stress factors and diabetes risk among LGBTQ+ individuals in Jakarta: a cross-sectional study**  
 Sahnaz Vivinda Putri<sup>1\*</sup>, Metta Permadi<sup>2</sup>, Sonya Algiabil Hamajaya<sup>1</sup>, Evita Rosi Zabidin<sup>1</sup>, Andi Tenri Ajeng<sup>2</sup>  
 International University Semen Indonesia, Indonesia<sup>1</sup>, Trisakti University, Indonesia<sup>2</sup>
- PE324 Lifestyle management is a non-pharmacological intervention against high fat diet induced obesity**  
 Nazmin Fatima<sup>\*</sup>, Gyanendra Kumar Sonkar  
 King George's Medical University, India
- PE325 Wearable technology and geo-fencing device are a boon for hypertension patients with type 2 diabetes**  
 Vikas Sharma<sup>\*</sup>, Madhu Gautam  
 S N Medical College and Hospital, India
- PE326 Medical nutrition therapy provision improves clinical outcomes in a patient with type 2 diabetes at district hospital: a case study**  
 Hanee Fakhruzai<sup>1\*</sup>, Barakatun-nisak Mohd Yusof<sup>2</sup>  
 Hospital Kulim, Malaysia<sup>1</sup>, Universiti Putra Malaysia, Malaysia<sup>2</sup>

# Contents

- PE327 Relationship between physical activity frequency, obesity, and diabetes risk: a population-based non-timeline study**  
 Oyuntugs Byambasukh<sup>1,2\*</sup>, Indra Altankhuyag<sup>1,2</sup>, Batmanlai Byambadorj<sup>2</sup>, Agiimaa Byambaa<sup>1</sup>, Anar Bayarmunkh<sup>1</sup>, Puntsagdulam Byambajav<sup>2</sup>, Tsolmontuya Amartuvshin<sup>1</sup>, Tsolmon Jadamba<sup>2,3</sup>  
 Mongolian National University of Medical Sciences, Mongolia<sup>1</sup>, Timeline Research Center, Mongolia<sup>2</sup>, Mongolian Academy of Sciences, Mongolia<sup>3</sup>
- PE329 Diabetes visits in endomed hospital, Ulaanbaatar, Mongolia**  
 Munkhtsetseg Gombosuren\*, Bolor Byambatsooj, Sainbileg Sonomtseren  
 Endomed Hospital, Mongolia
- PE331 Preoperative skeletal muscle quality as a predictor of metabolic status change following bariatric surgery**  
 Eunsun Oh\*, Sang Hyun Kim, Hyeong Kyu Park, Soon Hyo Kwon  
 Soonchunhyang University Seoul Hospital, Korea
- PE333 T2DM and central obesity**  
 Nansaldorj Erdenebileg\*, Bolor Byambatsooj, Sainbileg Sonomtseren  
 Endomed Hospital, Mongolia
- PE336 Comparative study of diabetes risk factors in Mongolian adults between 1999 and 2019, focusing on central obesity and hypertension**  
 Altaisaikhan Khasag\*  
 Mongolian National University of Medical Sciences, Mongolia
- PE337 Study prevalence of obesity in hypertension people**  
 Nomundari Usukhbayar<sup>1\*</sup>, Davaakhuu Vandannyam<sup>2</sup>  
 Central Hospital of MNUMS, Mongolia<sup>1</sup>, School of Nursing, MNUMS, Mongolia<sup>2</sup>
- PE338 Type 2 diabetes mellitus and biological age**  
 Gerelmaa Khureldee\*, Bolor Byambatsooj, Sainbileg Sonomtseren  
 Endomed Hospital, Mongolia
- PE340 Prevalence of arterial hypertension among Mongolian nurses**  
 Zoljargal Avirmed<sup>1\*</sup>, Davaakhuu Vandannyam<sup>2</sup>  
 4th Hospital, Mongolia<sup>1</sup>, School of Nursing, MNUMS, Mongolia<sup>2</sup>
- PE341 Detection of peripheral artery disease in citizens aged 50-69 years and determining the prevalence of risk factors**  
 Narantsetseg Enkhtuya\*, Davaakhuu Vandannyam  
 Mongolian National University of Medical School, Mongolia
- PE342 Relationship of cycling exercise with decreasing blood sugar levels in patients with diabetes mellitus**  
 Marina Indriasari\*  
 Binawan University, Indonesia
- PE344 Thyroid hormone alterations in COVID-19 patients: implications for disease severity and diabetes-related associations**  
 Dariimaa Dorj<sup>1,2\*</sup>, Altaisaikhan Khasag<sup>1</sup>, Baatarkhuu Oidov<sup>1</sup>, Oyuntugs Byambasukh<sup>1</sup>  
 Mongolian National University of Medical Sciences, Mongolia<sup>1</sup>, First Central Hospital, Mongolia<sup>2</sup>
- PE346 Research cardiometabolic comorbidity and noncommunicable disease risk in a central obesity population**  
 Sergelentsetseg Bat-Erdene\*, Davaadulam Bayanmunkh, Mendbayar Gerelchuluun, Ariunaa Yura  
 Darkhan General Hospital, Mongolia
- PE347 Handgrip strength and mini-mental state examination scores: a study from the montimeline study**  
 Baigal Narantuya<sup>1\*</sup>, Purevsod Lkhagvasuren<sup>1</sup>, Indra Altankhuyag<sup>2</sup>, Batmanlai Byambadorj<sup>2</sup>, Puntsagdulam Byambajav<sup>2</sup>, Tsolmon Jadamba<sup>2,3</sup>, Byambasuren Dagvajantsan<sup>1</sup>, Oyuntugs Byambasukh<sup>1</sup>  
 Mongolian National University of Medical Sciences, Mongolia<sup>1</sup>, Timeline Research Center, Mongolia<sup>2</sup>, Mongolian Academy of Sciences, Mongolia<sup>3</sup>

# Contents

- PE348 Assessing the impact of meat consumption on 24-hour urinary creatinine levels among Mongolian adults**  
Anar Bayarmunkh\*, Enkhtuya Ulambayar, Delgermaa Bor, Odmaa B, Anujin Tuvshinjargal, Uranbaigal Enkhbayar, Oyuntugs Byambasukh  
Mongolian National University of Medical Sciences, Mongolia
- PE349 Investigating fruit and vegetable consumption among university students in Mongolia and its correlation with body mass index**  
Anujin Tuvshinjargal\*, Baigal Narantuya, Anar Bayarmunkh, Namuunzul Ganbat, Anudari Vanya, Oyuntugs Byambasukh  
Mongolian National University of Medical Sciences, Mongolia
- PE350 Wolfram syndrome: case report**  
Sainbileg Sonomtseren\*, Bolor Byambatsooj, Dashtseren Bayarsaikhan, Telmen Boldbaatar, Saran Tsrensodnom  
Endomed Hospital, Mongolia
- PE351 Differences in Red cell Distribution Width (RDW) between subjects with Type 2 Diabetes Mellitus (T2DM) and subjects without T2DM: a systematic review and meta-analysis**  
W. Riski Widya Mulyani<sup>1</sup>\*, I Gede Gita Sastrawan<sup>2</sup>, Ni Komang Vina Indriyani<sup>1</sup>, Made Lady Adelaida Purwanta<sup>3</sup>  
Negara General Hospital, Indonesia<sup>1</sup>, Uptd Pekutatan Health Center (Public Health Center), Indonesia<sup>2</sup>, Wangaya Hospital, Indonesia<sup>3</sup>
- PE352 Machine learning-driven identification of plasma biomarkers for sarcopenia in the elderly**  
Yunju Jo<sup>1</sup>\*, Juewon Kim<sup>2</sup>, Heewon Jung<sup>3</sup>, Donghyun Cho<sup>2</sup>, Seungyoon Nam<sup>4</sup>, Beom-Jun Kim<sup>3</sup>, Dongryeol Ryu<sup>1</sup>  
GIST, Korea<sup>1</sup>, Amore Pacific, Korea<sup>2</sup>, Asan Medical Center, University of Ulsan, College of Medicine, Korea<sup>3</sup>, Gachon University, Korea<sup>4</sup>
- PE353 Machine learning using time series analysis better predict future diabetes**  
Myungsoo Im<sup>1</sup>\*, Kyeongjun Lee<sup>2</sup>, Soree Ryang<sup>1</sup>, Doohwa Kim<sup>1</sup>, Sohyeon Jeon<sup>1</sup>, Hye Jung Je<sup>1</sup>, Hyo Eun Kwak<sup>1</sup>, Eun Hye Jung<sup>1</sup>, Yeong Jin Kim<sup>2</sup>, Joon Ha<sup>3</sup>, Jinmi Kim<sup>1</sup>, Sang Soo Kim<sup>1</sup>  
Pusan National University Hospital, Korea<sup>1</sup>, Kumoh National Institute of Technology, Korea<sup>2</sup>, Howard University, United States<sup>3</sup>
- PE355 Exploring age- and gender-specific characteristics of diabetes among young adults in Korea: the Korea national health and nutrition examination survey 2019-2020**  
Chae Won Chung\*, Jaetaek Kim  
College of Medicine, Chung-Ang University, Korea

## Diabetes education case

- PE359 Medical nutrition therapy for the management of cellulitis with diabetes mellitus, chronic kidney disease and hypertension**  
Mohd Ramadan Ab Hamid\*, Nur Hidayah Ghazali  
Universiti Teknologi Mara, Malaysia
- PE363 The effect of the education method using the calculation of glucose and continuous blood glucose measurement on blood sugar in patients with type 1 diabetes**  
Ji Youn Park\*  
Chung-Ang University Hospital, Korea
- PE364 A case of glycemic control using the CGM in a pregnant type 2 diabetes patient**  
Soeun Lee\*  
Chung-Ang University Hospital, Korea
- PE365 Nutritional education using continuous glucose monitoring system in type 2 diabetes**  
Meera Kweon<sup>1</sup>\*, Kisun Lee<sup>1</sup>, Jeonghyun Lim<sup>1</sup>, Sun Joon Moon<sup>3</sup>, Young Min Cho<sup>2</sup>  
Seoul National University Hospital, Korea<sup>1</sup>, Seoul National University, Korea<sup>2</sup>, Sungkyunkwan University, Korea<sup>3</sup>

# Contents

---

- PE366 Education for type 1 diabetes patients  
Youngjin Choi\*  
Kyung Hee University Hospital at Kangdong, Korea
- PE368 Blood glucose level effect of diabetic carrot and cheese cake  
Odontuya Chuluunbat\*, Sainbileg Sonomtseren  
Endomed Hospital, Mongolia
- PE369 Strengthening diabetes care through general practitioner engagement: bridging the gap to diabetes technology  
Satyaprakash Tiwari\*  
Diabetes Singapore, Singapore
- PE370 Cases of continuous blood glucose measurement use in patients with type 1 diabetes  
Hana Choi\*  
Bucheon Soonchunhyang University, Hospital, Korea

**PL1****Novel insights regarding GLP-1 receptor agonist treatment****Michael A Nauck**

St. Josef Hospital, Ruhr University Bochum, Germany

Incretin-based therapy has been a central place in the treatment of diabetes for its solid benefits regarding not only weight reduction and cardioprotective effects. Michael A. Nauck is a one of the world-renowned scholar in diabetes and incretin research field. He has a particular research interest in the role and impact of gastrointestinal peptide hormones in the physiological and therapeutic stimulation of insulin secretion. He has been honoured with several awards for his research, including Claude Bernard Prize (2022). In this meeting, his lecture will take you on a journey through the historic discovery and drug development of incretins, providing novel insights into the current and future treatment of diabetes.

By organizer

of HFD. Pax4 mutant mice showed a delayed increase of  $\beta$ -cell mass in response to HFD. These data suggest that PAX4 variants may impair beta cell function by affecting compensatory beta cell mass expansion and reduced glucose-induced insulin secretion in response to a high-fat diet which provides a mechanistic insight linking the ethnic-specific PAX4 variant and East Asian T2D phenotype. Based on the aforementioned results, the pax4 variant diabetes is considered one of the endotypes of type 2 diabetes specific to East Asians.

**PL2****Hepatic fibrosis, the silent threat of the metabolic syndrome****Scott Friedman**

Icahn School of Medicine at Mount Sinai, USA

Metabolic dysfunction-associated steatotic (fatty) liver disease (MASLD), previously termed NAFLD, is a worldwide epidemic that can lead to hepatic inflammation, fibrosis, cirrhosis and hepatocellular carcinoma (HCC). The disease is typically a component of the metabolic syndrome that accompanies obesity, and is often overlooked because the liver manifestations are clinically silent until late-stage disease is present (ie., cirrhosis). Moreover, Asian populations, including Koreans, have a higher fraction of patients who are lean, yet their illness has the same prognosis or worse than those who are obese. Nonetheless, ongoing injury can lead to hepatic inflammation and ballooning of hepatocytes as classic features. Over time, fibrosis develops following activation of hepatic stellate cells, the liver's main fibrogenic cell type. The disease is usually more advanced in patients with type 2 diabetes mellitus (T2DM), indicating that all diabetic patients should be screened for liver disease. Although there has been substantial progress in clarifying pathways of injury and fibrosis, there no approved therapies yet, but current research seeks to uncover the pathways driving hepatic inflammation and fibrosis, in hopes of identifying new therapeutic targets. Emerging molecular methods, especially single cell sequencing technologies, are revolutionizing our ability to clarify mechanisms underlying MASLD-associated fibrosis and HCC.

**PL3****Endotypes of type 2 diabetes in East Asians****Kyong Soo Park**

Seoul National University, Korea

Type 2 diabetes (T2D) in East Asians shows a different clinical and metabolic phenotype compared to other ethnic populations. T2D patients in East Asia have a lesser degree of obesity/insulin resistance and lower beta cell function compared to Europeans. A prospective cohort study tracing beta cell function and insulin sensitivity revealed that normal glucose tolerant subjects who progressed to diabetes had a 25% lower insulin secretory function and 20% lower insulin sensitivity compared to those who remained normal glucose tolerant 10 years before the onset of diabetes. When dividing the normal glucose-tolerant subjects into four groups based on insulin sensitivity and insulin secretion capability, approximately 60% of the individuals belonged to the group with reduced insulin secretion. Genetic studies of T2D revealed many East Asian-specific variants which might be associated with beta cell dysfunction or reduced beta cell mass. Among nonsynonymous variants, the PAX4 Arg192His variant is exclusive to East Asian individuals and increases the risk of T2D with genome-wide significance. PAX4 Arg192His is associated with an earlier onset at diagnosis and lower C-peptide levels. Furthermore, normal glucose-tolerant subjects who are PAX4 Arg192His carriers showed a lower and more rapid decline of disposition index compared to subjects with the PAX4 wild type in the Ansung Ansan prospective diabetes cohort. PAX4 H/H mutant mice developed glucose intolerance earlier, at four weeks of HFD, compared to PAX4 wild-type mice. Pax4 H/H mutant mice showed decreased glucose-induced insulin secretion compared to the wild type after 4 weeks

### S1-1

#### Artificial intelligence for causal inference: trends and future

Sungbin Lim

Korea University, Korea

Unlike the rapid improvements in the performance of predictive models driven by deep learning, the task of causal inference has been recognized as a challenging problem. Recently, scaling laws have allowed pre-trained Large Language Models (LLMs) into the field of causal reasoning. This talk will introduce recent advances and the future of causal inference using LLMs.

### S1-2

#### AI in diabetes: prediction and control for glucose management

Sung-Min Park

POSTECH, Korea

Artificial Intelligence technologies have transformed the future of medical practice. While the most visible progress of AI powered medical technologies has been made for the medical imaging, glucose management with intensive insulin therapy apparently seems to follow that big step. Continuous Glucose Monitoring (CGM) has been a true initiator for the advancement toward fully automated insulin therapy, and integrating AI technology as a part of glucose management has been identified as a key factor to fulfill this mission. The current research trend in this area includes data-driven blood glucose (BG) prediction model development and control algorithm development for the next generation artificial pancreas (AP) system. In the first part of the talk, we will discuss the glucose prediction model development in details. Then we will cover the control algorithm development for AP.

### S1-3

#### Latest trends related to digital therapeutics in diabetes

Sang Youl Rhee

Kyung Hee University, Korea

The digital therapeutics landscape for diabetes mellitus is rapidly evolving, with innovative trends focusing on personalized and adaptive care. AI-driven predictive models are increasingly utilized for real-time glucose level forecasting and tailored insulin dosage recommendations. Moreover, comprehensive platforms integrating continuous glucose monitoring, dietary, and physical activity data are emerging to provide a holistic approach to disease management. The rise of telemedicine further broadens patient access to expert care, regardless of geographical constraints. However, issues regarding data security and digital health equity remain, demanding careful consideration and research.

### S1-4

#### Application of digital twin technology to the treatment of diabetes

Joonyub Lee

The Catholic University of Korea, Korea

Diabetes is a prevalent yet often inadequately managed chronic disease. Achieving proper glycemic control in diabetic patients is challenging due to the intricate interplay of various factors, including diet, exercise, and medication. Advancement in digital technology provides physicians to access to comprehensive life-log data presenting the possibility of developing a new paradigm of diabetic care. The concept of a "digital twin" involves creating a virtual counterpart to simulate and evaluate a particular environment, subsequently offering feedback to the actual entity. Recently, our group has initiated a research project to develop digital twin technology for patients with insulin-dependent diabetes mellitus (IDDM). In this ongoing study, we enrolled 36 IDDM patients from Seoul St. Mary's Hospital and Yeungnam University Hospital in South Korea. Each patient was provided with EOPatch (EOflow) insulin pumps, Free Style Libre 2 (Abott) continuous glucose monitors, Dofit pro band (Mediplus Solution) activity tracker, and a

food tag AI (KT). Along with the EMR data, four types of continuous life-log variables were obtained through the Korea Health Partners' patient-physician communication app. This data was then processed using a recurrent neural network employing the Long Short-Term Memory algorithm. In this presentation, I will share some of the preliminary results of our research, which predicted IDDM patients' glucose levels with reasonable accuracy. Additionally, we'll explore how we simulated individual life-log variables to observe potential fluctuations in glucose levels in these patients.

### S2-1

#### RNA processing: novel mechanism modulating islet beta cell secretion

Lori Sussel

University of Colorado, USA

There is emerging evidence implicating RNA-binding protein (RBPs) and altered splicing activity in the pathogenesis of diabetes. RBPs bind to target RNAs to direct a host of functions, including the regulation of alternative splicing. Recent studies have identified dysregulation RBPs and ensuing aberrant mRNA splicing in diseased human  $\beta$  cells compared to healthy controls. These alterations could occur as a consequence of cellular stress or could directly contribute to  $\beta$  cell health. To address this question, we explored the functional role of RBFOX2, a conserved splicing factor that is dysregulated in T1D and T2D human islets and in mouse models of diabetes. We demonstrate that conditional loss of *Rbfox2* from pancreatic  $\beta$  cells in mice leads to impaired blood glucose regulation without a significant change in  $\beta$  cell mass, suggesting  $\beta$  cell function is disrupted. Further phenotypic analysis of these mice highlights specific defects in insulin secretion in response to a glucose challenge. Molecular analysis determined that RBFOX2 directly the splicing isoforms of insulin secretion pathway genes to modulate the secretion of insulin in healthy and diabetic conditions.

### S2-2

#### Down-regulation of PERK in human islets for diabetes treatment

Hye Seung Jung

Seoul National University, Korea

PERK (pancreatic endoplasmic reticulum kinase) has a critical implication on pancreatic beta cells, in terms of proliferation and differentiation during development, while insulin trafficking and cell survival during adults. We investigated metabolic effects of partial down-regulation of PERK using either low-dose PERK inhibitors or heterozygotic deletion of *Perk* under diabetic conditions. These studies showed that attenuation of PERK enhanced insulin synthesis and insulin secretion in vivo and in vitro, in pancreatic islets including those from human. Various mechanisms like ER chaperone, calcium dynamics, and autophagic flux were involved in the effects. Therefore, PERK inhibitors have a potential as a new therapeutic approach for diabetes.

### S2-3

#### ER stress and its associated signaling modulate incretin receptor signaling

Jaemin Lee

DGIST, Korea

Pancreatic  $\beta$ -cell dysfunction and eventual loss are key steps in the progression of type 2 diabetes (T2D). Endoplasmic reticulum (ER) stress responses, especially those mediated by the PERK-ATF4 pathway, have been implicated in promoting these  $\beta$ -cell pathologies. However, the exact molecular events surrounding the role of the PERK-ATF4 pathway in  $\beta$ -cell dysfunction remain unknown. Here, we report our discovery that ATF4 promotes the expression of PDE4D, which disrupts  $\beta$ -cell function via a downregulation of cAMP signaling. We found that  $\beta$ -cell-specific transgenic expression of ATF4 led to early  $\beta$ -cell dysfunction and loss, a phenotype that resembles accelerated T2D. Expression of ATF4, rather than CHOP, promoted PDE4D expression, reduced cAMP signaling, and attenuated responses to incretins and elevated glucose. Furthermore, we found that  $\beta$ -cells of leptin

receptor-deficient diabetic (db/db) mice had elevated nuclear localization of ATF4 and PDE4D expression, accompanied by impaired  $\beta$ -cell function. Accordingly, pharmacological inhibition of the ATF4 pathway attenuated PDE4D expression in the islets and promoted incretin-simulated glucose tolerance and insulin secretion in db/db mice. Finally, we found that inhibiting PDE4 activity with selective pharmacological inhibitors improved  $\beta$ -cell function in both db/db mice and  $\beta$ -cell-specific ATF4 transgenic mice. In summary, our results indicate that ER stress causes  $\beta$ -cell failure via ATF4-mediated PDE4D production, suggesting the ATF4-PDE4D pathway could be a therapeutic target for protecting  $\beta$ -cell function during the progression of T2D.

## S2-4

### Ciliary control of islet function

Jing Hughes

Washington University, USA

Cilia are ancient organelles with sensory and signaling functions critical for tissue development and homeostasis. In the pancreatic islets of Langerhans, endocrine alpha and beta cells each possess a primary cilium, but their structure and function are not well characterized. The Hughes Lab studies the biology of primary cilia in islet cells in their native cellular context, focusing on the discovery of ciliary protein components, dynamic behaviors, and signaling pathways that are important for glucose-regulated hormone secretion. In this talk, I will highlight recent work showing the 3D ultrastructure of human islet cilia including single protein identification using immuno-electron microscopy, mechanisms of ciliary glucose sensing and metabolic signaling, and genetic models linking cilia loss of function to diabetes development. These findings provide evidence that the primary cilium dynamically controls islet endocrine function and represents a new target for diabetes.

## S3-1

### The use of new technology as a simple screening tool for the detection of diabetic retinopathy

Ji Won Chun

The Catholic University of Korea, Korea

Artificial intelligence (AI)-based diagnostic technology using medical images can be used to increase examination accessibility and support clinical decision-making for screening and diagnosis. To determine a machine learning algorithm for diabetes complications, a literature review of studies using medical image-based AI technology was conducted using the National Library of Medicine PubMed, and the Excerpta Medica databases. Lists of studies using diabetes diagnostic images and AI as keywords were combined. In total, 227 appropriate studies were selected. Diabetic retinopathy studies using the AI model were the most frequent (85.0%, 193/227 cases), followed by diabetic foot (7.9%, 18/227 cases) and diabetic neuropathy (2.7%, 6/227 cases). The studies used open datasets (42.3%, 96/227 cases) or directly constructed data from funduscopy or optical coherence tomography (57.7%, 131/227 cases). Major limitations in AI-based detection of diabetes complications using medical images were the lack of datasets (36.1%, 82/227 cases) and severity misclassification (26.4%, 60/227 cases). Although it remains difficult to use and fully trust AI-based imaging analysis technology clinically, it reduces clinicians' time and labor, and the expectations from its decision-support roles are high. Various data collection and synthesis data technology developments according to the disease severity are required to solve data imbalance.

## S3-2

### Association between biomarkers of diabetic kidney disease with hepatic steatosis and fibrosis

Jaehyun Bae

Catholic Kwandong University, Korea

As organs that are important in systemic homeostasis, the liver and kidneys influence each other. In particular, metabolic (dysfunction) associated fat-

ty liver disease (MAFLD) and diabetic kidney disease (DKD) share various pathophysiological factors, and epidemiological evidence suggests that these two diseases are associated.

The conventional biomarkers of DKD including albuminuria and the estimated glomerular filtration rate are reported to be associated with the risk or severity of MAFLD. Recently, novel DKD biomarkers reflecting renal tubular injury have been introduced to complement conventional DKD markers. Although insufficient, studies have begun to report on the association between these novel biomarkers and MAFLD, and future research can be expected.

We will look at previous studies that showed an association between MAFLD and DKD, and also reviewed the significance of DKD biomarkers as predictive risk factors for MAFLD.

## S3-3

### The recent update of cardiac MRI in diabetic patients

Sung Ho Hwang

Korea University, Korea

#### Diabetes-associated cardiomyopathy (DAC)

- Diabetes predisposes to coronary artery disease and various myocardial diseases.
- DAC includes a broad spectrum of myocardial disease: myocardial fibrosis, cellular changes, metabolic disturbances, and remodeling in diabetes

#### Cardiac Magnetic resonance imaging (MRI)

- MRI is a non-invasive imaging technique that combines strong magnetic fields, radio waves, and computer technology to produce detailed images.
- Cardiac MRI offers insights into the shape, function, and tissue status of the left ventricle and epicardial fat.
- In cardiac MRI, we usually stratify the myocardium tissue characteristics from normal, borderline, and irreversible fibrosis using extracellular volume fraction and late gadolinium enhancement techniques.

#### Diabetic Medications Effective for Heart Failure

- Sodium-glucose cotransporter-2 inhibitors (SGLT2i) are a groundbreaking class of medications that not only effectively manage diabetes by promoting glucose excretion through urine but also exhibit benefits in improving cardiac function.
- Recently, a new medication has been shown to reduce hospitalization for heart failure and cardiovascular death in diabetic patients with DAC.
- The clinical trials demonstrated that SGLT2i improved myocardial status determined with cardiac MRI (4,5).

#### Summary

- Diabetes is intrinsically tied to a broad spectrum of myocardial diseases, determined with cardiac MRI.
- The introduction of medications like SGLT2i highlights a promising direction in the co-management of diabetes and cardiac health.
- Cardiac MRI may be useful in assessing their efficacy and guiding treatment strategies.

## S3-4

### Imaging of skeletal muscle quantity and quality in relation to fatty liver disease and type 2 diabetes

Bo Kyung Koo

Seoul National University, Korea

Sarcopenia is a syndrome characterized by the loss of skeletal muscle mass and strength, which can elevate the risk of physical disability, chronic conditions like fatty liver disease, diabetes mellitus and cardiovascular diseases, and long-term mortality.

The lecture offers updated definitions of sarcopenia and provides recommendations for assessing muscle quantity and quality.

### S4-1

#### Clinical characteristics and treatment strategy of young-onset type 2 diabetes

Ye Seul Yang

Seoul National University, Korea

The prevalence of young-onset type 2 diabetes mellitus (T2DM), which typically develops before the age of 40, is increasing worldwide. Young-onset T2DM has a common pathophysiology of glucose dysregulation like late-onset T2DM. However, it has a greater association with obesity and a more rapid decline in  $\beta$ -cell function than late-onset T2DM. Accumulating evidence suggests that young-onset T2DM has a more rapid disease progression, leading to early and frequent microvascular and macrovascular complications, as well as premature death. Inadequate management and low treatment adherence are also important issues in young-onset T2DM, making early detection and intensive management of Young-onset T2DM paramount. In this talk, I will review the clinical characteristics of young-onset T2DM and treatment strategies based on them.

### S4-2

#### Education strategies using new technology of diabetes care

Kang Hee Sim

Samsung Medical Center, Korea

Diabetes Self-Management Education (DSME) and support should be interactive and collaborative to improve knowledge, attitudes, self-efficacy, healthy behaviors, as well as clinical outcomes. Diabetes technology is a term used to describe the hardware, devices and Diabetes management software that people with diabetes use to manage blood glucose level, stave off diabetes complications, reduce the burden of living with diabetes and to improve Quality of life. Technology can offer increased opportunity to improve health outcomes while also offering conveniences for people with diabetes. The availability of several different technologies, including the Internet, web-based education and communities, text messaging, email, automatic telephone reminders and telehealth/telephone education provide an effective and time-efficient means of providing DSME. Therefore, in this lecture, I would like to introduce an educational strategy using the new technology of diabetes care.

### S4-3

#### Application of special diet in young patients with diabetes

Yun Mi Chung

Kyung Hee University Medical Center, Korea

Recently, the prevalence rate of young diabetic patients is increasing every year, which has become a social problem. This is closely related to the increase in the obese population, and irregular lifestyle and inappropriate eating habits act as important causes.

In the case of developing type 2 diabetes at a young age, blood sugar control is more difficult than in the case of developing it in old age, and pancreatic function is damaged quickly. In addition, it is reported that the long period of exposure to hyperglycemia increases the risk of complications, resulting in a decrease in the quality of life. Therefore, active management is very important, but low management compliance is a problem in young diabetic patients.

Young diabetic patients have a lot of interest in fad foods or fad diets, and accordingly, they often adopt the wrong diet due to inaccurate information. In addition, there are many cases where regular and varied food intake is difficult due to school or work life. Therefore, rather than a stereotyped meal strategy, a new meal strategy that fits the lifestyle and values of the younger generation will be needed.

Therefore, in this lecture, considering the characteristics and circumstances of young diabetic patients, we would like to present concerns and directions for special diet that can be effectively applied to them.

### S4-4

#### Exercise recommendations for young patients with diabetes

Seung Jae Jeong

Samsung Medical Center, Korea

The number of young diabetics is increasing due to obesity and westernized eating habits. Young people are likely to neglect diabetes due to the few outward symptoms. However, diabetes is classified as a chronic disease that is difficult to cure, so it is necessary to detect it early and actively manage weight loss. In particular, excessive drinking and overeating cause insulin resistance, causing high blood sugar and high blood pressure, and increasing the risk of abdominal obesity and fatty liver. Due to these eating habits and lifestyle habits, diabetes from a relatively young age increases the risk of diabetes complications. In addition, in the case of young patients, complications of major organs can occur less than 20 years after the onset of complications because the rate of complications is fast. The risk of premature death increases as well. The most important thing to improve insulin resistance is exercise. Not only aerobic exercise but also muscular exercise is important. Body fat loss is also emphasized in the 2023 ADA guideline. More than 150 minutes of aerobic exercise per week and more than twice a week of muscle exercise are essential. For young diabetics, regular exercise for a healthy old age is a must, not an option.

### S4-5

#### Psychosocial evaluation and care tips for young patients with diabetes

Junyoung Kim

Hallym University Dongtan Sacred Heart Hospital, Korea

Young adulthood is a period in life during which individuals set the direction for their future. During this phase, activities such as career pursuits, marriage, childbirth and parenting take place. Development during young adulthood is not gained by physical or cognitive abilities, but is shaped by social relationships, and intimacy is formed through this process. However, if developmental tasks are not accomplished due to factors such as illness or economic problems during this period, the problem of isolation arises. In this lecture, we will discuss educational tips and social support systems that can be beneficial during this phase of young adulthood.

### S5-1

#### Characterization and subgrouping T2DM

Yongin Cho

Inha University, Korea

Advances in medicine, human biology, data science, and technology have provided new insights into the phenomenon known as 'type 2 diabetes.' This allows for the precise matching of prevention strategies and treatments to individuals at risk of or diagnosed with diabetes. To implement precision treatment for patients with diabetes, precision diagnosis must precede. Precision diagnosis enables the successful application of precision treatment approaches, utilizing methods to classify patients.

Studies related to the characterization and subgroups of patients with type 2 diabetes using cluster analysis are actively discussed. Categories based on cluster analysis at diagnosis can provide insights into disease progression, risk of complications, and treatment response. However, it has several barriers to implementation. More research is needed in type 1 diabetes and type 2 diabetes in order to define subtypes and decide the best interventional and therapeutic approaches.

### S5-2

#### Applying precision medicine for the treatment of T2DM

Robert Wagner

Heinrich Heine University Düsseldorf, Germany

Diabetes is characterized by elevated glucose levels, with type 2 diabetes encompassing various pathologies leading to this elevation. These pathologies can result in different metabolic outcomes and complications.

Recent subphenotyping of adult-onset diabetes identified subtypes based on insulin deficiency and resistance, each with distinct complication risks. Recognizing that glycemic elevation is progressive and type 2 diagnosis can be delayed, we clustered individuals at risk for type 2 diabetes using various metabolic and genetic variables. This identified six metabolic groups: three with low diabetes risk (clusters 1, 2, and 4) and three with high risk (clusters 3, 5, and 6). Notably, cluster 5 had the highest diabetes risk due to significant insulin resistance, while cluster 6, despite a lower diabetes risk, had the highest risk for nephropathy and overall mortality. This might be attributed to prolonged hyperinsulinemia, severe insulin resistance, and unfavorable fat distribution in cluster 6. Understanding the diverse pathologies of type 2 diabetes is essential from the prediabetic stage. Further studies are crucial to determine if targeted prevention can mitigate severe diabetes complications.

### S5-3

#### Precision treatment of T2DM

Daehee Hwang

Seoul National University, Korea

As huge amounts of global data (genomic, epigenomic, transcriptomic, proteomic, and metabolomic) generated from a broad spectrum of specimens collected from human patients have been accumulated in public repositories, together with electronic health records and drug treatment information, biology is now becoming an informational science. Accordingly, there have been significant needs for bioinformatic methods that can effectively extract useful information from these data. In this talk, I will present two different precision medicine approaches using multi-omics data and clinical big data, respectively.

### S5-4

#### Genetic risk and precision medicine

Soo Heon Kwak

Seoul National University, Korea

Precision medicine involves tailoring medical treatment to the individual characteristics, needs, and preferences of each patient. In the realm of diabetes, this strategy encompasses considering a person's genetic, environmental, and lifestyle factors to develop personalized management plans. Conversely, polygenic risk refers to the cumulative risk of developing a disease, such as diabetes, based on the presence of multiple genetic variants across the genome. Understanding the polygenic nature of diabetes assists in identifying various genetic factors that contribute to its onset, progression, and the development of complications. Recent studies indicate that polygenic risk scores are instrumental in distinguishing between type 1 diabetes, monogenic diabetes, and type 2 diabetes. Moreover, these scores can predict incident type 2 diabetes in women with a history of gestational diabetes and can be used to forecast diabetic complications. When polygenic risk scores are combined with other risk factors, such as age, BMI, and family history, risk stratification is enhanced, pinpointing individuals who may benefit most from intensive prevention or early intervention strategies. Challenges in utilizing polygenic scores in the clinic encompass ethnicity specificity, data privacy, and generating evidence in the clinical setting. Through this session, we aim to explore opportunities as well as challenges in utilizing genetic risk for precision medicine.

### S6-1

#### Melanocortin regulation of autonomic nervous system

Jong-Woo Sohn

KAIST, Korea

Melanocortin-4 receptors (MC4Rs) expressed by the central nervous system are essential regulators of energy homeostasis, and Mc4r mutation is the most common cause of human monogenic obesity. Notably, patients with obesity carrying Mc4r mutations are protected against obesity-induced hypertension, and MC4R agonists elevate blood pressure (BP). Although increased sympathetic tone by MC4Rs is suggested to underlie this phenotype, the detailed mechanisms remain unclear. In this talk, I will discuss our

recent findings regarding how MC4Rs regulate the sympathetic preganglionic neurons and find that MC4Rs activate these neurons via the protein kinase A-dependent activation of the transient receptor potential vanilloid 1 (TRPV1) channel. Importantly, we demonstrated that the inhibition of TRPV1 prevents MC4R-induced elevation of BP but does not affect MC4R-induced anorexia. We further showed that TRPV1 is responsible for MC4R-dependent activation of the sympathetic preganglionic neurons by high-fat diet. Together, our results provide insight into how MC4Rs regulate sympathetic function.

### S6-2

#### The GDF15-GFRAL axis controls systemic homeostasis in wasting syndrome

Minho Shong

KAIST, Korea

Cachexia, also known as wasting syndrome, is a complex condition associated with illnesses such as cancer, chronic kidney disease, heart failure, COPD, and HIV/AIDS. This disorder is characterized by a significant loss of lean body mass, including skeletal muscle and fat, and cannot be corrected by conventional nutritional support. Cachexia profoundly impacts quality of life, treatment tolerance (particularly in the case of cancer), and overall prognosis. Numerous studies have identified cachexia as a robust predictor of mortality, independent of the primary disease.

GDF15 serves as a diagnostic biomarker for cachexia, exhibiting elevated levels in cachectic patients. This increase in GDF15 correlates with the severity of the disease and poor prognosis. Recently, it was demonstrated that GDF15 plays a role in cachexia, thereby marking it as a potential therapeutic target.

GFRAL, a recently discovered receptor with localized expression in the hindbrain known for mediating GDF15 actions, has emerged as a promising therapeutic target for cachexia. Recent research using monoclonal antibodies to target GFRAL successfully reversed cachexia symptoms in mice, suggesting the GDF15-GFRAL pathway as a potential therapeutic approach.

In this study, we utilized RNA-targeting therapeutics to address cancer cachexia in mouse models of pancreatic and colon cancer by downregulating GFRAL expression in the brainstem, which led to a reversal of cachexia symptoms. Two preclinical models were employed: peritoneal carcinomatosis and orthotopic models. Both models, known for high GDF15 secretion, showed a correlation between increasing GDF15 levels and cancer progression. We observed activation of GFRAL neurons in mice with peritoneal cavity tumor metastasis, suggesting a potential association between increased GDF15 and GFRAL activation in the brainstem. Increased sympathetic activity was also observed, suggesting a potential link between the GDF15-GFRAL axis and activation of sympathetic pathways in the spinal cord. These findings underscore the potential of GFRAL RNA-targeted therapeutics in treating cancer cachexia.

### S6-3

#### Prevention of diabetes by metabolic adaptation of glucose and lipid utilization via activation of wakefulness and olfactory system

Toshiyasu Sasaoka

University of Toyama, Japan

Present study shows novel approach to metabolic adaptation of glucose and lipid utilization via brain-organ interaction for therapeutic intervention of diabetes. Firstly, hypothalamic orexin plays a key role in regulation of wakefulness, physical activity, and autonomic nervous system. Intracerebroventricular (ICV) injection of orexin at low concentration decreased blood glucose levels, whereas it increased the levels at high concentration in mice. The biphasic daily change of glucose metabolism was mediated by regulation of hepatic glucose production via autonomic nervous system. Orexin-knockout mice fed high-fat diet (HFD) demonstrated marked obesity and NASH progression in the liver. Feeding with long-term HFD caused hepatocellular carcinoma (HCC) in the mice. ICV injection of orexin and pharmacogenetic activation of orexin neuron prevented ER stress in the progression of NASH. Daily administration of orexin decreased hepatic ER stress and inflammation in HFD-fed orexin-knockout mice. Thus, orexin bidirectionally regulates systemic glucose homeostasis and prevents NASH and HCC with obesity. Secondly, it was unknown whether the olfactory

system is involved in metabolic adaptations, whereas recognition of food odor mediates food anticipation response for subsequent digestion. Food-odor stimulation during fasting increased serum free fatty acids by lipolysis of adipose tissue via the brain olfactory memory. In addition, the food odor before refeeding also stimulated whole body lipid utilization mediated by increased intestinal lipid absorption and hepatic lipid turnover in the tissue-specific manner. The effect of food odor was mediated by the bidirectional regulation of hypothalamic AgRP/POMC and sympathetic nervous systems. Importantly, food odor stimulation with intermittent fasting prevented glucose impairment and insulin resistance in obese mice fed-HFD. Thus, olfactory regulation plays a crucial role in the adaptation of metabolic homeostasis in environments with both energy deficit and surplus. Taken together, utilization of brain function via activation of orexin and olfactory system could be novel intervention approach for prevention and treatment of diabetes and its complication.

### S6-4

#### Gastrointestinal microbiome homeostasis in health, disease, and aging

Jihyun Kim

Yonsei University, Korea

Powered by high-speed high-throughput next-generation genomic technologies, life science and biotechnology are being transformed. In our laboratory, we apply genomic and metagenomic tools to study model microbes and microbial communities. The microbiome, comprised of the microbiota, their collective genomes called the metagenome, and the macromolecules and metabolites they produce, is an integral part of our body and the ecosystem. Microorganisms have shaped our planet's biosphere and mediate biogeochemical cycling and energy flow in nature. Systems understanding of host physiology can be possible only if the microbial counterparts that reside in are fully appreciated and both are considered as a unit, i.e. holobiont. Recent analyses of metagenome-assembled genomes and meta-omics data, as well as more traditional community data, revealed that a myriad of microbial members, mutualistic, commensal, or pathogenic, play pivotal roles in host health, disease, and aging. Host-microbiota relationships in the human gastrointestinal tract, as well as the dynamics of microbial communities, will be presented as examples. In the talk, efforts to develop probiotics or more preferably pharmabiotics for the prevention or treatment of various diseases including gastrointestinal cancers and aging will also be presented. Synthetic biology concepts and toolkits enable us to modulate the microbiome to maintain or regain homeostasis (eubiosis and rebiosis, respectively), and even to transform it to become preventive or curative.

### S7-1

#### Big data and machine learning applications in diabetes care

Kazuya Fujihara

Niigata University, Japan

Although there are a number of diabetic cardiovascular disease clinical studies being conducted around the world, clinical studies face a large cost, enormous effort and cooperation of subjects. In order to resolve such issues it is essential to use new and alternative research sources such as big data. Big data has the following characteristics that can complement above issues: be available existing data set, no need a large cost, be available data accumulated over a long period, expecting to increase in events as time passed. While the use of claims data for epidemiologic research has increased, validation studies are limited regarding the use of those data. The first part of the presentation will introduce real-world data studies, focusing on Japanese receipt data.

Machine learning, which can learn patterns and decision rules from data, has been used in clinical practice. Applications of machine learning for the early detection of diabetic retinopathy, for which clear-cut diagnostic gold standards exist, have been evaluated. However, little is known about the usefulness of machine learning for decisions in treatment strategies. The second part of the presentation will discuss mainly the role of the utilization of big data for complication of diabetes and role of the utilization of machine learning for diabetes treatment.

### S7-2

#### Prediction of type 2 diabetes using genome-wide polygenic risk score and metabolic profiles: a machine learning analysis of population-based 10-year prospective cohort study

Junghye Lee

Seoul National University, Korea

In this study, we aimed to predict the risk of type 2 diabetes (T2D) in the Asian population by combining clinical and genetic factors. Previous research in this area has predominantly focused on Western populations. We utilized data from 1,425 participants in the Korean Genome and Epidemiology Study (KoGES) Ansan-Ansung cohort. To construct our predictive models, we integrated genome-wide polygenic risk scores (gPRS) and serum metabolite data. Our gPRS analysis drew on genotypic and clinical information from two KoGES sub-cohorts: the KoGES health examinee (n=58,701) and KoGES cardiovascular disease association (n=8,105) groups. We identified 239,062 genetic variants through linkage disequilibrium analysis to create the gPRS, while the Boruta algorithm helped select relevant metabolites. We evaluated our models using bootstrapped cross-validation and compared logistic regression to random forest (RF)-based machine learning approaches. Over an 8.3±2.8-year follow-up period, 331 participants (23.2%) developed T2D. The RF-based models yielded area-under-the-curve (AUC) values of 0.844, 0.876, and 0.883 for three scenarios: using only demographic and clinical factors, incorporating gPRS, and including both gPRS and metabolites, respectively. The addition of these genetic and metabolic parameters improved classification accuracy by 11.7% and 4.2%, respectively. While gPRS showed a significant association with homeostatic model assessment of beta-cell function (HOMA-B) values, most metabolites were notably associated with HOMA-IR values. By combining gPRS and metabolite data, our models effectively enhanced T2D risk prediction, capturing distinct T2D development mechanisms. The RF-based model, integrating clinical factors, gPRS, and metabolites, outperformed the logistic regression-based approach in predicting T2D risk.

### S7-3

#### An artificial intelligence-based prediction model for diabetic kidney disease progression

Nan Hee Kim

Korea University, Korea

Diabetic kidney disease is a major complication of diabetes and is steadily increasing in Korea. The unmet need in this field is early diagnosis to identify rapid progressors and implement more intensive treatments to prevent its progression. Recently, several AI studies have been conducted to enhance prediction models. However, the majority of these studies are centered on the development of ESRD. In this presentation, I will introduce these background studies and my recent work, which develops AI model to predict the occurrence of CKD stages 4 or 5 in individuals with diabetes

### S7-4

#### Electronic medical record-based machine learning approach to predict the risk of cardiovascular disease

Tae Joon Jun

Asan Medical Center, Korea

The advancement of artificial intelligence technologies, including deep learning, has brought significant progress to risk prediction research in the field of healthcare. However, while much research has been conducted using imaging and signal data, there has been relatively limited focus on prediction studies utilizing Electronic Medical Records (EMR). In this lecture, we introduce several case studies of risk prediction for cardiovascular diseases using EMRs from Asan Medical Center and public EMR datasets. Furthermore, we emphasize the importance of multi-modal prediction research in the medical field with EMRs at its core.

**S8-1****The diabetes educator's role in CGM world**

Jung Hwa Lee

Kyung Hee University Hospital at Gangdong, Korea

Continuous Glucose Monitoring (CGM) technology has revolutionized diabetes management, providing real-time glucose data and empowering individuals with diabetes to make informed decisions regarding their treatment. In this rapidly evolving landscape, diabetes educators play a crucial role in supporting patients who use CGM devices. Their expertise and guidance are instrumental in maximizing the potential of CGM technology and improving overall diabetes management outcomes. Their expertise in patient education, data analysis, problem-solving, therapy adjustments, behavioral support, and ongoing monitoring significantly contribute to improved diabetes management outcomes. By harnessing the power of CGM technology and providing personalized guidance, diabetes educators empower patients to take control of their diabetes, achieve optimal glycemic control, and enhance their quality of life. Their vital role ensures that individuals with diabetes receive the necessary support and resources to thrive in the CGM world.

**S8-2****Role of diabetes educators in lowering barriers to insulin pump therapy**

Su Ji Lee

Kangbuk Samsung Hospital, Korea

An insulin pump is a device that injects insulin in insignificant amounts by inserting a cannula into subcutaneous tissue. Using insulin pumps can reduce the number of injections and enable a more flexible lifestyle and level of activity. It can also finely control the dose and reduce the incidence of complications. For these reasons, the role of educators has become more important amidst the growing demand for insulin pumps in the treatment of diabetes. First, when examining the barriers to insulin pump treatment can be categorized into economic/policy, physical, psychosocial, and environmental factors from the patient's perspective. On the other hand, from the hospital's standpoint, the barriers include financial/policy, psychosocial, human factors, and environmental aspects. Looking at the role of insulin pump treatment educators in lowering barriers to insulin pump treatment, they can be divided into counselors, experts, educators, selectors, and managers. A counselor's responsibility is to plan the patient's overall medical care, and proper and thorough counseling should be conducted using exact information prior to starting insulin pump therapy. The role of an expert is to supply education to patients, based on their professional knowledge acquisition, more than anyone else. The educator's role is to provide education to the patient using standardized educational materials, while the selector's role is to prioritize and allocate educational time and content based on the patient's level of understanding. Finally, the manager's role is to supply comprehensive care to ensure that patients learn how to use insulin pumps correctly and consistently. As a result, the outcomes of diabetes management and quality of life can be improved. It is essential for educators responsible for insulin pump treatment to have a thorough understanding of their roles and responsibilities and to make every effort to reduce barriers to insulin pump treatment.

**S8-3****Using smart pen and digital apps for diabetes management**

Miae Yoon

Korea University Anam Hospital, Korea

After the first discovery of insulin in 1921, insulin pens were introduced in 1985 as an alternative to vials and syringes. Insulin pens allowed the patients to adjust the correct dose, enhance adherence and feel less pain at the injection site. However, despite of these benefits, patients receiving insulin treatment have difficulty determining their insulin dose depending on the amount of carbohydrates they take, food composition, and physical activity. In addition, a decrease adherence, such as missing insulin injection time or incorrect dose, is a factor that hinders the arrival of target blood sugar.

In 2007, the development of smart insulin pens that can store date, time, and insulin amounts began to solve these insulin pen challenges. These devices continue to evolve, allowing individualized target glucose, insulin sen-

sitivity factors (ISF), and insulin duration (DIA) to be programmed into the patient's smartphone applications. Based on these settings and patient's blood sugar information received from CGM, bolus dose and calibration dose are calculated and provided, and the concept of "Insulin On Board (IOB)" is automatically applied because the previously injected insulin time and dose are recorded.

Smart insulin pens, combined with CGM, improved adherence and blood glucose control. The risk of hyperglycemia and hypoglycemia could be lowered through the application of bolus alarms and active IOB concepts. In addition, children can share data on insulin injections to multiple guardians. The precise doses can be injected (ex. 0.1unit), and the adherence in elderly patients can be evaluated.

However, there are challenges to be solved, such as higher costs compared to insulin pens, additional training for device use, and lack of educational materials and guidelines for clinicians on interpreting data and determining treatment directions.

**S9-1****Mechanisms of NASH-induced HCC**

Utpal Pajvani

Columbia University, USA

Hepatocellular carcinoma (HCC) is the third leading cause of cancer deaths in the world. Because of its heterogeneity, personalized mechanisms are likely critical to choosing optimal treatment in HCC. Our group and others have observed that Notch activity - a developmental signaling pathway, re-activated in liver disease - defines a subset of HCC with immature features and worse prognosis. Studies in animal models suggest that endogenous Notch activation in hepatocytes is associated with repressed  $\beta$ -catenin signaling and hepatic metabolic functions, in lieu of increased interactions with extracellular matrix in NASH. Similarly, constitutive hepatocyte Notch activation is sufficient to induce  $\beta$ -catenin-inactive HCC in mice with NASH. Notch and  $\beta$ -catenin show a pattern of mutual exclusivity in carcinogen-induced HCC. We are now studying mechanisms of Notch-induced tumorigenesis, and whether we can leverage the above associations to develop novel diagnostic tools for personalized approaches for HCC.

**S9-2****G13 axis in the network of liver and muscle energy metabolism**

Sang Geon Kim

Dongguk University, Korea

Skeletal muscle is a key determinant of the systemic energy homeostasis. In the muscles, mitochondria are the major organelle for oxidative fuel consumption, ATP production, and body heat generation. Thus, increases in mitochondrial mass, electron transfer uncoupling, and heat generation are critical processes necessary for the disease treatment. Since the regulatory pathways and molecules responsible for this step are not fully understood, the discovery of molecules and relevant signaling nodes would be an attractive strategy to find therapeutic approaches. This research investigated new physiological roles of the molecules that regulate mitochondrial biogenesis, thermogenesis in skeletal muscle, muscle type switch and muscle mass increase, and the consequent body weight decrease, which include  $G\alpha 13$  and the downstream axis. In association with  $G\alpha 13$  signalling axis, we found USP21, which belongs to a family of deubiquitinases that mediate the removal and processing of ubiquitinated proteins, as a regulator of DNA-PKcs and ACLY. Our findings may expand the knowledge on oxidative myofiber type conversion, muscle mass control and thermogenic physiology involved in energy expenditure, providing an opportunity to develop strategies to treat patients suffering from diabetes, muscle problems and the associated metabolic diseases.

**S9-3****Sex disparity in progression of nonalcoholic fatty liver disease**

Youngmi Jung

Pusan National University, Korea

Nonalcoholic fatty liver disease (NAFLD) is the most serious health concern

worldwide and progresses into nonalcoholic steatohepatitis (NASH). However, there is no effective therapy for NAFLD/NASH. The main obstacle to control NAFLD/NASH is sex disparity showing a higher prevalence and severity of NAFLD/NASH in men than in women. However, it is unknown how sex affects NAFLD pathophysiology. Formyl peptide receptor 2 (FPR2), a G protein-coupled receptor, modulates inflammatory responses in several organs; however, its role in the liver remains unclear. Here we show that FPR2 is a key molecule that explains gender disparities in NAFLD. We fed wild-type and FPR2-knockout male and female mice a chow or a choline-deficient, L-amino acid-defined, high-fat diet (CDAHFD) for 36 weeks. Estradiol-supplemented male mice and ovariectomized female mice were also treated with CDAHFD for 12 weeks. The effect of FPR2 was examined in primary hepatocytes exposed to lipotoxicity. NAFLD/NASH-like liver injury was induced in both genders during CDAHFD feeding, but compared with females, male mice had more severe hepatic damage, including excessive fibrosis and inflammation. FPR2 was more highly expressed in hepatocytes in healthy livers from females than from males, and FPR2 deletion exacerbated liver damage including severe fibrosis and inflammation in CDAHFD-fed female mice. Estradiol induced FPR2 expression, which protected hepatocytes and the livers of male mice from damage. Liver injuries also worsened in ovariectomized female mice compared with sham-operated mice during CDAHFD feeding. Our results demonstrate that FPR2 mediates sex-specific responses to nonalcoholic injury, suggesting FPR2 as a novel therapeutic target for NAFLD/NASH.

### S9-4

#### Machine learning-driven discovery of a novel diagnostic index for NASH

Dongryeol Ryu

GIST, Korea

Nonalcoholic fatty liver disease (NAFLD), which includes nonalcoholic steatohepatitis (NASH) and nonalcoholic fatty liver (NAFL), is extremely common and poses a serious threat to global health. As a result of the need for a liver biopsy to establish the diagnosis, NASH, an irreversible stage in the progression of NAFLD, is typically underdiagnosed. Hepatokines, a subgroup of liver-secreted peptides, may be linked to the onset and progression of NAFLD, according to recent research. Hepatokines as biomarkers for NASH diagnosis, which might be less invasive, easier, and safer than a liver biopsy, have, however, received little attention from research. Screening patients with nonalcoholic steatohepatitis (NASH) from those with nonalcoholic fatty liver (NAFL) is still a challenge. Here, we used a machine learning method to predict potential biomarkers effective for diagnosing NASH. To find biomarkers for NASH, we gathered and processed RNA sequencing data and used the random forest algorithm (RF), a machine learning technique. The Genotype-Tissue Expression (GTEx) histology data, which was assessed by two blinded pathologists, was used to validate the RF-predicted biomarker. Furthermore, utilizing plasma samples from NASH patients who underwent gastric bypass surgery to address obesity and its associated illnesses, the diagnostic capability of four RF-featured hepatokines was verified. Finally, the *ioa*NASH value was calculated using just two hepatokine concentrations after evaluating the performance of four hepatokines. The *ioa*NASH score, which can be obtained with a straightforward blood test and only requires the concentration of two peptides, has the potential to be a ground-breaking diagnostic index for NASH.

### S10-1

#### Monogenic diabetes

Toni I. Pollin

University of Maryland, USA

Monogenic forms of diabetes, defined as having an etiology completely or largely explained by a single genetic variant in any given individual, comprise approximately 1/250 cases of diabetes mellitus. These include syndromic forms, non-syndromic forms historically and commonly known as maturity-onset diabetes of the young (MODY), and neonatal diabetes. Distinguishing monogenic diabetes from type 1 (T1D) and type 2 diabetes (T2D) often demonstrably improves glucose control and quality of life by enabling replacement of invasive insulin treatment and/or ineffective oral treatment with less invasive and more efficacious etiology-based oral treatment (e.g., sulfonyleureas for *HNF1A*-MODY and *HNF4A*-MODY caused by variants in genes encoding pancreatic beta cell nuclear transcription

factors) or even no treatment (for *GCK*-MODY/hyperglycemia caused by variants in the gene encoding glucokinase) for patients and their affected family members. However, most cases are misdiagnosed due to lack of awareness, clinical overlap with other diabetes types, expense of genetic testing, genetic heterogeneity, and challenges in assessing the pathogenicity of rare variants. With the advent of next generation sequencing techniques, testing is becoming increasingly feasible and cost-effective; however, challenges remain in interpreting, reporting, and incorporating genetic information into diabetes care. The clinical and genetic aspects of monogenic diabetes and several local, national, and international efforts to improve access of individuals with monogenic diabetes to molecular diagnosis and individualized management will be described: the Personalized Diabetes Medicine Program/ Diabetes Genetics Service at the University of Maryland School of Medicine, U.S. Monogenic Diabetes Registry at The University of Chicago, DiabetesGenes Resource at the University of Exeter (UK), American Diabetes Association/European Association for the Study of Diabetes Precision Medicine in Diabetes Initiative (PMDI), the ClinGen Monogenic Diabetes Variant Curation and Gene Curation Expert Panels (MDEP), and the Rare and Atypical Diabetes Network (RADIANT).

### S10-2

#### Clinical overview and implications of immune checkpoint inhibitor-induced diabetes mellitus

Yu Mi Kang

Harvard University, USA

The discovery of immune checkpoint molecules playing a pivotal role in antitumor immunity evasion has brought about a transformative shift in cancer therapy. Immune checkpoint inhibitors (ICIs) have demonstrated remarkable effectiveness in treating various malignancies and thus, their indications are rapidly expanding. Nevertheless, ICIs are significantly associated with immune-related adverse events (irAEs), particularly endocrine disorders. Among these, new-onset insulin-dependent diabetes mellitus (DM) occurs in approximately 0.2% to 1.0% of patients and more frequently observed as ICIs are more widely introduced. However, the incidence, progression, and underlying mechanisms of ICI-associated DM (ICI-DM) remain poorly understood. This session aims to present clinical scenarios and implications of ICI-DM, including practical recommendations for the accurate assessment, clinical management, and follow-up of affected patients.

### S10-3

#### Characteristics and clinical course of diabetes of the exocrine pancreas

Seung Jin Han

Ajou University, Korea

Diabetes of the exocrine pancreas (DEP) results from the structural or functional loss of insulin secretion in the context of exocrine pancreatic dysfunction. It has been described by alternate terminology, including pancreatic, pancreatogenic, and type 3c diabetes. The causes of DEP include pancreatitis, cystic fibrosis, or pancreatic malignancy DEP tends to be less frequently considered in practice because of its etiologic heterogeneity and unique pathophysiology and is commonly misdiagnosed as type 2 diabetes. A recent study demonstrated the prevalence of DEP has nearly tripled over the past decades in New Zealand. DEP is likely to become a more important condition with the increase in chronic pancreatitis, pancreatic surgery, and longer survival of patients with cystic fibrosis. DEP affects the hormone release capacity of all cell subtypes within islets of Langerhans, such as  $\beta$ ,  $\alpha$ , and pancreatic polypeptide cells. While insulin deficiency due to loss of  $\beta$ -cell mass is the main cause, the combination with other hormonal deficiencies of DEP contribute to its unique features, which differ from those of type 1 and type 2 diabetes. There are few studies on the clinical course of DEP. In Korean nationwide population-based cohort study, DEP is more likely to require insulin therapy than type 2 diabetes. Hypoglycemia, micro- and macrovascular complications, and all-cause mortality events are higher in DEP compared with type 2 diabetes. Physicians should keep in mind tailored management, including the best time for insulin therapy and a regular monitoring strategy to reduce diabetic complications and mortality while managing patients with DEP.

**S10-4****Post-transplantation diabetes, current status and new treatment**

Chul-Woo Yang

The Catholic University of Korea, Korea

Post-transplantation diabetes mellitus (PTDM) is closely associated with high cardiovascular accident, and poor graft and patients' survival. There are multiple risk factors of PTDM and calcineurin inhibitors (CNIs) are most popular immunosuppressant and major diabetogenic drug.

We tested two drugs (mTOR inhibitors and CTLA4Ig) for replacing CNIs in PTDM. Using experimental model of CNIs-induced DM, we found that CTLA4Ig was not diabetogenic, and conversion to CTLA4Ig reduced CNIs-induced pancreatic islet injury (Transplantation 2018; 102: e137). On the other hand, mTOR inhibitor was diabetogenic and aggravated CNIs-induced pancreatic islet dysfunction (Am J Transplant 2009; 9: 2024).

With regards to new anti-diabetic drugs, we found that an inhibitor of sodium glucose co-transporter type 2 (SGLT-2) is effective in controlling CNIs-induced hyperglycemia and has direct protective effect on CNIs-induced renal injury (Am J Transplant 2017; 17(10):2601-2616). Furthermore, addition of DPP4 inhibitor to SGLT2 inhibitor compensated for a lack of protective effect of SGLT2 inhibitor on INS-1 cells. This finding provides the rationale for the combined treatment of SGLT2 inhibitor and DPP4 inhibitor in CNI-induced DM and nephrotoxicity (Am J Transplant. 2022; 22:1537-1549).

In addition, we investigated whether patient-specific induced pluripotent stem cells (iPSCs) could help predict DM development. First, we performed whole transcriptome and functional enrichment analyses of KT patient-derived iPSCs, and found that insulin resistance, type 2 DM, and transforming growth factor beta signaling pathways are associated with DM group. We also found that the genetic background was associated with development of iPSCs into pancreatic progenitor cells. Thus, genetic analysis can be used to predict the risk of DM before KT.

**S11-1****Dietary assessment and monitoring in telenutrition**

Jung Eun Lee

Seoul National University, Korea

Academy of Nutrition and Dietetics defined Telenutrition as "The interactive use by an RDN of electronic information and telecommunications technologies to implement the Nutrition Care Process with patients or clients at a remote location, within the provisions of the RDN's state license as applicable". The use of electronic devices in the nutrition field has grown rapidly in line with digital technology developments. In particular, mobile tools have the potential to enhance flexibility and efficiency to improve dietary and health-related behaviors and to enable efficient communication between caregivers and their care recipients. Mobile devices hold promise for tracking and assessing individual's diet and collecting large chronological data on dietary information. As diet-tracking devices grow more available commercially, telenutrition becomes an efficient approach for promoting dietary behavior change.

Both dietary assessment and dietary behavior monitoring are important steps of telenutrition. Dietary assessment is the process of collecting and analyzing information about dietary behavior. It enables care givers and recipients to estimate intakes of foods and nutrients. Dietary behavior monitoring is the process of tracking changes in dietary intake over time. It can be used to provide feedback and support, and to track the progress of care recipients towards dietary goals.

We have developed a diet-tracking app and conducted clinical trials. This talk will present previous study results and potential directions for telenutrition research.

Given the widespread use of digital devices and growing interest in the efficacy of digital health for lifestyle modification in metabolic disease prevention and control, it is important to understand and implement telenutrition in metabolic disease care. Further prospective and intervention studies are warranted.

**S11-2****The use of telenutrition medical nutrition therapy for diabetes in the US**

Lisa Andrews

Sound Bites Nutrition, USA

The use of telehealth for medical nutrition therapy services (also known as "telenutrition") in the US has been in use for less than 10 years but has become a necessity since the COVID-19 pandemic. A 2021 survey conducted by the Academy of Nutrition and Dietetics found that 37% of RDs provided medical nutrition therapy services via telehealth prior to the pandemic, and 78% of RDs reported using telehealth at the time of the survey. Telenutrition offers convenience for Registered Dietitian providers as well as their recipients but can have some disadvantages and barriers to regular face-to-face meetings in traditional medical office or clinic settings. Lack of client interest, as well as poor internet access, may make telenutrition difficult or impossible for some. Limited reimbursement for telenutrition and coding errors may be barriers to dietetics professionals. This presentation will review the use of synchronous (real-time) telehealth of medical nutrition therapy for individuals with diabetes in the US. Research regarding the benefits and barriers of telenutrition use in addition to insurance coverage of telenutrition will be discussed. Finally, payment and eligibility for telenutrition, as well as the institutional and environmental limitations, will also be reviewed.

Reference: Telehealth During the COVID-19 Pandemic: A Cross-Sectional Survey of Registered Dietitian Nutritionists - PubMed (nih.gov)

**S11-3****Non-face-to-face nutrition intervention for chronic disease treatment in clinic**

Shin Ok Park

Noom Korea, Korea

In recent years after the COVID-19 pandemic, the development of digital technology has accelerated and enabled more accurate nutrition assessment, more steady monitoring, and more efficient nutritional counseling than before based on data measured by various biometrics. In 2022, the Ministry of Health and Welfare decided to certify five apps and allowed to be used for chronic disease health care. This was to secure the rapidly increasing quality of non-face-to-face health care applications, since discussions about non-face-to-face medical treatment have, in fact, become more active, and experiments on effective non-face-to-face counseling have been increasing. With this development, we found several opportunities for healthcare especially through various applications in nutrition care for chronic diseases.

Korea Health Industry Development Institute, SNU R&DB Foundation and Noom Korea conducted two consecutive studies to examine the effectiveness of using the app in chronic diseases and to find out the results in the real world. The objective of the first research was to investigate the impact of human coaching-based mobile health applications on primary care clinics. The second study was designed to be more sophisticated, establishing a website to share feedback with medical staff and coaches based on focus group interviews, and examined the long-term effects on the health measurements of patients in chronic diseases.

In this session, based on the results of these two studies, we would review the components of application contributing to non-face-to-face nutrition care processes in primary care clinics and discuss what the strengths and limits of this model are. In addition, we would like to share the insights through the cases in which the clinical nutrition management process was applied.

**S12-1****More intensive LDL cholesterol reduction: statin and ezetimibe combination**

Jung-Sun Kim

Yonsei University, Korea

The effect of moderate-intensity statin with ezetimibe combination therapy versus high-intensity statin monotherapy among patients with diabetes mellitus (DM) and atherosclerotic cardiovascular disease (ASCVD) was not fully evaluated. We performed a pre-specified, stratified subgroup analysis of the DM cohort in the RACING trial. The primary outcome was a 3-year

composite of cardiovascular death, major cardiovascular events, or non-fatal stroke.

Among total patients, 1398 (37.0%) had DM at baseline. The incidence of primary outcomes was 10.0% and 11.3% among patients with DM randomized to ezetimibe combination therapy versus high-intensity statin monotherapy (hazard ratio=0.89; 95% confidence interval=0.64-1.22; P=0.460). Intolerance-related discontinuation or dose reduction of the study drug was observed in 5.2% and 8.7% of patients in each group, respectively (P=0.014). Low-density lipoprotein (LDL) cholesterol levels <70 mg/dL at 1, 2, and 3 years were observed in 81.0%, 83.1%, and 79.9% of patients in the ezetimibe combination therapy group, and 64.1%, 70.2%, and 66.8% of patients in the high-intensity statin monotherapy group (all P<0.001). In the total population, no significant interactions were found between DM status and therapy regarding primary outcome, intolerance-related discontinuation or dose reduction, and the proportion of patients with LDL cholesterol levels <70 mg/dL.

In conclusion, ezetimibe combination therapy effects observed in the RACING trial population are preserved among patients with DM. This study supports moderate-intensity statin with ezetimibe combination therapy as a suitable alternative to high-intensity statins if the latter cannot be tolerated, or further reduction in LDL cholesterol is required among patients with DM and ASCVD.

### S12-2

#### Triglyceride - REDUCE-IT (DM subgroup), STRENGTH trial, PROMINENT trial

Michael Miller

University of Pennsylvania, USA

Randomized clinical trials have recently been undertaken in patients with hypertriglyceridemia (HTG) patients to determine the extent to which effective reductions in triglycerides might translate into improved cardiovascular disease (CVD) outcomes.

Of the 3 randomized, double-blind, placebo-controlled trials conducted, REDUCE-IT (Reduction of Cardiovascular Events with Icosapent Ethyl-Intervention Trial), STRENGTH (Study to Assess Statin Residual Risk with Epanova in High Cardiovascular Risk Patients with Hypertriglyceridemia) and PROMINENT (Pemafibrate to Reduce Cardiovascular Outcomes by Reducing Triglycerides in Patients with Diabetes), only REDUCE-IT that used Icosapent Ethyl, a highly purified formulation of EPA improved CVD outcomes, even in the DM subgroup. In contrast, neither the combination of EPA and DHA carboxylic acids used in STRENGTH, nor the fibric acid derivative, pemafibrate, reduced CVD events despite significant reductions (~25-35%) in TG levels in patients with DM. These divergent results in patients with HTG, a group at particularly high risk of CVD, especially when coupled with other risk factors, indicates that TG lowering in of itself is insufficient to offset CVD risk. This lecture will review the epidemiology and atherogenicity of TG-rich lipoproteins, the evidence in support of suppression of inherent atherogenic properties associated with HTG that were the principal drivers for the benefit observed in the REDUCE-IT trial.

### S12-3

#### Antiplatelet agents in diabetes: where are we now?

Ramzi A. Ajjan

University of Leeds, UK

Cardiovascular disease (CVD) remains the main cause of mortality and morbidity in diabetes. One of the key mechanisms for the high CVD risk in this condition is the presence of a thrombotic environment. This in turn is related to platelet hyper-reactivity and raised activity of the coagulation system coupled with hypofibrinolysis.

The current presentation is focused on providing an update on the use of antiplatelet agents in diabetes to minimize the risk of CVD.

The latest evidence on the use of aspirin in primary vascular prevention is reviewed together with the role of this agent in long-term secondary prevention therapy. Also, the different P2Y<sub>12</sub> inhibitors are discussed including their role in monotherapy and short, as well as long-term, dual antiplatelet therapy. This will include the review of the latest international guidelines in this area. None anti-platelet agents to reduce thrombosis risk are also briefly highlighted.

The overall aim of this presentation is to provide the audience with a pragmatic, yet evidence-based, approach for managing thrombosis risk in di-

abetes, aiming to improve vascular outcome in this high-risk population.

### S12-4

#### Recent advance in hypertension management

Sungha Park

Yonsei University, Korea

Based on the latest evidence, 2022 update of the KSH hypertension guideline and the 2023 ESH hypertension guideline have been published. The latest guidelines emphasize 1) proper measurement of BP using validated devices 2) Use of out of office BP for diagnosis and management of hypertension 3) Early and intensive BP lowering, especially for younger and high risk hypertension 4) Improvement of medication adherence by prescribing single pill combination treatment if possible 5) Identification and treatment of resistant hypertension. In this talk, we will review importance issues from the latest clinical trials and guidelines.

### S13-1

#### Non-bioenergetic ether lipid synthesis by mitochondrial GPD2 promotes tumor progression

Sunghyoun Park

Seoul National University, Korea

Despite growing evidence for mitochondria's involvement in cancer, the roles of specific metabolic components outside the respiratory complex have been little explored. We conducted metabolomic studies on mitochondrial DNA (mtDNA)-deficient ( $\rho 0$ ) cancer cells with lower proliferation rates to clarify the undefined roles of mitochondria in cancer growth. Despite extensive metabolic downregulation,  $\rho 0$  cells exhibited high glycerol-3-phosphate (G3P) level, due to low activity of mitochondrial glycerol-3-phosphate dehydrogenase (GPD2). Knockout (KO) of GPD2 resulted in cell growth suppression as well as inhibition of tumor progression in vivo. Surprisingly, this was unrelated to the conventional bioenergetic function of GPD2. Instead, multi-omics results suggested major changes in ether lipid metabolism, for which GPD2 provides dihydroxyacetone phosphate (DHAP) in ether lipid biosynthesis. GPD2 KO cells exhibited significantly lower ether lipid level, and their slower growth was rescued by supplementation of a DHAP precursor or ether lipids. Mechanistically, ether lipid metabolism was associated with Akt pathway, and the downregulation of Akt/mTORC1 pathway due to GPD2 KO was rescued by DHAP supplementation. Overall, the GPD2-ether lipid-Akt axis is newly described for the control of cancer growth. DHAP supply, a non-bioenergetic process, may constitute an important role of mitochondria in cancer.

### S13-2

#### Glutamine metabolism in tumor immune microenvironment

Keun-Gyu Park

Kyungpook National University, Korea

Despite its outstanding clinical success, immune checkpoint blockade remains ineffective in many patients. The mechanisms of resistance to immunotherapy are poorly understood, but several lines of evidence suggest that the immunosuppressive tumor microenvironment plays an important role. Therefore, the understanding of the complexity and diversity of the immune context of the tumor microenvironment and its influence on response to therapy is urgently required. In this workshop, I will introduce our two studies demonstrating that glutamine metabolism has a pivotal role in anti-tumor response of CD8 T cells and polarization of tumor associated macrophages (TAMs), which are major players in tumor immune microenvironment. Firstly, our previous study reported that limiting glutamine metabolism in cancer cells bolsters the effectiveness of anti-PD-L1 antibody. Inhibition of glutamine utilization increased PD-L1 levels in cancer cells, thereby inactivating co-cultured T-cells. Under glutamine-limited conditions, reduced cellular GSH levels caused upregulation of PD-L1 expression by impairing SERCA activity. Consequently, in tumors grown in immune-competent mice, inhibition of glutamine metabolism decreased the antitumor activity of T-cells. In combination with anti-PD-L1, however, glutamine depletion strongly promoted the antitumor efficacy of T-cells in

vitro and in vivo due to simultaneous increases in Fas/CD95 levels. Secondly, our ongoing study presents compelling evidence that glutamine-derived aspartate in TAMs stimulates the production of spermidine through the polyamine synthesis pathway, thereby enhancing the translation efficiency of HIF-1 $\alpha$  via eIF5A hypusination. Consequently, the augmented translation of HIF-1 $\alpha$  drives TAMs to sustain heightened glycolysis, establishing a distinct metabolic phenotype separate from that of M2 macrophages. Finally, we observed elevated levels of eIF5A hypusination in tumor stromal lesions compared to adjacent non-tumor stromal tissue in tumor specimens from 205 HCC patients. Collectively, our studies highlight the potential of targeting glutamine metabolism in tumor immune microenvironment will offer a promising avenue for cancer treatment.

### S13-3

#### Targeting hyperglycemia and insulin signaling for cancer therapy

Jungwhan Kim

The University of Oklahoma, USA

Squamous cell carcinoma (SCC) is an epithelial cancer that can develop in various anatomical sites including the lung, esophagus, skin, bladder, and cervix and is responsible for more than 1 million deaths every year worldwide. Despite the distinct microenvironmental influence of the tissues, which develop squamous cancers, the majority of squamous cancers share common genomic as well as oncogenic signatures. SCC patients have benefited very little from the application of targeted therapeutic options. As a result, decades-old platinum-based chemotherapy or radiation regimens with limited efficacy and specificity remain the first-line treatment options. Therefore, identification and elucidation of targetable vulnerabilities in SCC is urgently needed to improve therapeutic outcomes in SCC patients. Our efforts to identify targetable pathways crucial for SCC growth and survival led to the discovery of exceptional overexpression of glucose transporter 1 (GLUT1, encoded by the *SLC2A1* gene) and exceptional glucose reliance for tumor growth and survival. Mechanistically, our recently published study demonstrated that squamous lineage transcription factors, p63 and SOX2 jointly transactivate an intronic enhancer cluster in the *SLC2A1* gene and this hyperactive GLUT1-mediated glucose influx provides a carbon source to enhance the anti-oxidative capacity and tumorigenicity of SCC. This previously unrecognized metabolic signature phenotypically embedded in the squamous lineage cancer provides rationale to target GLUT1-mediated glucose influx. We evaluate the efficacy of ketogenic diet (dietary glucose restriction) as well as the SGLT2 inhibitor canagliflozin, an FDA approved drug for the treatment of type 2 diabetes (pharmacological glucose restriction), which effectively lowers the host blood glucose levels by blocking SGLT2-mediated renal glucose reabsorption. Reduction of blood glucose lowers blood insulin levels, which effectively suppresses PI3K/AKT signaling in SCC cells. Repurposing FDA-approved canagliflozin can be rapidly translatable as an effective therapeutic strategy for squamous cancer patients.

### S13-4

#### Paradigm shift in cancer catabolism: from glucose-centric to fatty acid-centric

Soo-Youl Kim

New Cancer Cure-Bio Co., Korea

We have proposed "*Kim effect*" to explain a new paradigm of cancer energy metabolism which is composed of our 3 major new findings. First, cancer cell does not depend on glycolysis for ATP production. Second, cancer mitochondria is not damaged but functional and active. Oxidative phosphorylation is active in cancer cell, which plays a key role of ATP production in mitochondria. Third, cancer cell depends on fatty acid oxidation for ATP production using fatty acids supplied not from microenvironment but from blood. All three new findings are totally contradicted to the explanation of energy metabolism using Warburg effect. Especially the third discovery is very important but there is a clear difference between "*metabolic reprogramming theory*" and "*Kim effect*". The metabolic reprogramming theory also suggests that cancer cell can use fatty acid oxidation for ATP generation under the limited condition such as microenvironment. However, we found that the fatty acids for fatty acid oxidation in cancer cell are systemically supplied from blood vessel by diet. This big difference has to be named as "*Kim effect*" (Semin Cancer Biol. 2022 Nov;86(Pt 2):347-357). Until now, majority of oncologists accepts knowledge of that glucose deprivation-induced cell death is recognized as the result of decreased ATP production based on the "*Warburg effect*", which proposes that glycolysis is the major metabolic pathway for ATP production. However, our experimental data showed that ATP depletion resulting from glucose deprivation is not the cause of cancer cell death, but the result of cancer cell death caused by failure of ROS regulation. Indeed, glucose deprivation-induced cell death is independent from ATP depletion-induced cell death. These serial happenings suggests that, in cancer energy metabolism, glucose-centric paradigm is ended, and fatty acid-centric paradigm has just begun.

vation-induced cell death is recognized as the result of decreased ATP production based on the "*Warburg effect*", which proposes that glycolysis is the major metabolic pathway for ATP production. However, our experimental data showed that ATP depletion resulting from glucose deprivation is not the cause of cancer cell death, but the result of cancer cell death caused by failure of ROS regulation. Indeed, glucose deprivation-induced cell death is independent from ATP depletion-induced cell death. These serial happenings suggests that, in cancer energy metabolism, glucose-centric paradigm is ended, and fatty acid-centric paradigm has just begun.

### S14-1

#### Overview of residual risks after adapting current prevention modalities

Frederik Persson

Steno Diabetes Center Copenhagen, Denmark

The last three decades in diabetes research have resulted in an increase in strategies to prevent diabetes complications and guidelines have been updated accordingly.

This positive development translates into improved prognosis for populations at risk, most notably so for persons with type 2 diabetes at risk for cardiovascular disease, while other groups so far have not seen great improvements in outcome.

There remains however, a need to improve implementation and individualization of the new treatments.

This lecture will give an overview of impact of recent guideline updates on residual risk and will look to the future for ongoing and planned studies to discuss where the area is heading.

### S14-2

#### The present and future of the management of type 2 heart failure

Kyung-Hee Kim

Incheon Sejong Hospital, Korea

Type 2 Heart Failure (HF) represents a major public health challenge due to its escalating prevalence and substantial mortality and morbidity rates. With our aging population and the rising epidemic of obesity and diabetes, the incidence of this clinical syndrome is expected to continue to increase. This presentation will provide an overview of the current strategies and emerging therapies in the management of Type 2 HF, highlighting the novel approaches that hold promise for the future.

Currently, the management of Type 2 HF primarily focuses on alleviating symptoms, improving quality of life, and preventing hospital admissions through lifestyle modifications, pharmacotherapy, device therapy, and coordinated care models. Pharmacotherapies including beta-blockers, ACE inhibitors, and mineralocorticoid receptor antagonists have been cornerstones in Type 2 HF treatment, with recent additions like SGLT2 inhibitors showing significant benefits.

Emerging therapies aim at addressing the underlying pathophysiological mechanisms of Type 2 HF. Recent advancements in gene and cell therapies, novel biomarkers for precise patient stratification, and innovative medical devices are expected to revolutionize the management of Type 2 HF. The integration of telemedicine and digital health tools has further enhanced patient monitoring, risk prediction, and timely intervention, thereby improving patient outcomes.

Furthermore, the presentation will discuss the significance of personalized medicine and the need for developing targeted therapies considering the heterogeneous nature of Type 2 HF. Multi-disciplinary approaches combining novel pharmacological agents, device therapies, and care coordination strategies are imperative for effective management. The future holds substantial promise with several clinical trials underway evaluating the efficacy and safety of emerging therapies.

In conclusion, the landscape of Type 2 HF management is undergoing significant transformations with the advent of novel therapies and technologies. Continuous research and development efforts are crucial to further refine these approaches, ultimately aiming at improving the prognosis and quality of life for patients with Type 2 HF.

### S14-3

#### What to do next to prevent diabetic retinopathy?

Yoon Jeon Kim

University of Ulsan, Korea

In this talk, we will discuss the treatment of diabetic retinopathy and its related pathogenesis. There are challenges in understanding the pathogenesis of diabetic retinopathy in humans, particularly in its early stages. While animal models have limitations in replicating human pathology, it is increasingly recognized that diabetic retinopathy affects the neurovascular complex in the retina early in the disease, potentially before microangiopathy is clinically evident. Therefore, there is the need for clinical endpoints to evaluate treatments targeting this complex. Various molecules, including Tauroursodeoxycholic acid and Glibenclamide, have shown neuroprotective effects in diabetic retinopathy models. Additionally, drugs like fenofibrate and calcium dobesilate have shown benefits in clinical trials. Recently, there are novel approaches, such as Rho kinase inhibitors and intraocular delivery of neuroprotective compounds. Also, current treatments, including anti-VEGF and corticosteroid therapy, are explored, along with the importance of functional phenotyping and biomarkers for predicting patient responses to therapy.

### S14-4

#### Paradigm shift in clinical treatment for diabetic kidney disease

Mi Kyung Kim

Keimyung University, Korea

Diabetic kidney disease (DKD) is one of the microvascular complications. About 20-40% of adult people with diabetes have DKD; it typically develops after a diabetes duration of 10 years in type 1 diabetes but may be present at diagnosis of type 2 diabetes. It is a leading cause of end-stage kidney disease worldwide. In addition, it increases cardiovascular risk and health costs. Screening using urine albumin and an estimated glomerular filtration rate is recommended for detecting DKD.

Many clinical studies show intensive glucose control therapies can reduce microvascular complications, including DKD. A consensus report by the American Diabetes Association and Kidney Disease: Improving Global Outcomes recommend a holistic approach for improving outcomes in patients with DKD, including lifestyle, glycemic control, blood pressure management, and lipid management. The guideline recommends an inhibitor of the renin-angiotensin system to prevent DKD, but it is not enough to prevent DKD. Recently, a lot of clinical trials advancing clinical care of DKD. Some anti-diabetic drugs and nonsteroidal mineralocorticoid receptor antagonists have shown that they could prevent or delay the progression of DKD. Therefore, this session will discuss how to change the paradigm in clinical treatment for DKD based on clinical trials and guidelines.

### S15-1

#### Facilitator for diabetes prevention

Seokyoung Park

Kyung Hee University, Korea

According to DIABETES FACT SHEET IN KOREA 2022, the prevalence of diabetes in Korean adults aged 30 years or older is 16.7% as of 2020, and 4 out of 10 adults aged of 30 years or older have prediabetes. These results indicate the need for management of the high-risk group of diabetes.

Risk factors for type 2 diabetes include overweight or obesity, abdominal obesity, diabetes history, impaired fasting glucose or impaired glucose tolerance history, high blood pressure, hyperlipidemia, and cardiovascular disease, and prior management of these risk factors is needed to prevent diabetes.

Based on the results of previous studies on lifestyle intervention therapy, the Korean Diabetes Association recommends educating individual lifestyle correction to prevent diabetes, and recommends that adults in pre-diabetes conduct individual dietary therapy to prevent diabetes.

Nutrition is an important part of the lifestyle intervention for diabetes prevention, and the role of clinical nutritionists in providing education is very important to lead to changes in the subject's actual dietary habits.

In Korea, a Korea Diabetes Prevention Study (KDPS) has been conducted on overweight/obese pre-diabetic adults. In the KDPS study, intensive nutrition therapy by clinical nutritionists and lifestyle interventions based on health lifestyle changes by health coordinators were conducted, with the

goal of losing and maintaining more than 5% of the initial weight. In this session, I will discuss practical cases from KDPS research and the role of clinical dietitians in diabetes prevention.

### S15-2

#### Coaching for diabetes management

Min Kyong Kim

Seoul Asan Medical Center, Korea

Diabetes is one of the most common chronic diseases that causes numerous deaths worldwide and puts a heavy burden on the healthcare system. The prevalence rate is as high as 14.5% over the age of 30 and 29% over the age of 65 in Korea, and the prevalence of diabetes among hospitalized patients is 20-40% in the United States, and the hospitalization rate of diabetic patients is 3 times that of non-diabetic. In 2020, the prevalence of diabetes in inpatients at Seoul Asan Medical Center was also high at 23.1%. Health coaching is a new technique used to treat and manage chronic diseases and is a patient-centered approach that focuses on patient decisions and actual behaviors. Coaching interventions are very effective in helping patients form healthy lifestyles because they are patient-centered and focus on practical behaviors rather than traditional counseling or health education. Let's take some time to talk about coaching that can help people who are struggling to manage diabetes.

In hospitalized patients, hyperglycemia increased the overall mortality rate by more than 10 times compared with normal patients, the length of hospital stay was more than 2 times, and the probability of intensive care unit transfer and infection was more than 3 ~ 4 times. Hyperglycemia increases the likelihood of postoperative complications such as infectious diseases, cardiovascular disease, electrolyte abnormalities, and acute renal failure. In addition, the patient's condition is diverse, and the medication for diabetes treatment is complex, so the choice of medication requires the help of a specialist for blood sugar management. Therefore, Seoul Asan Medical Center operated an inpatient blood glucose management team, and I would like to introduce and share it.

### S15-3

#### Supporter for problem solving

Donghee Yang

Ilsan Paik Hospital, Korea

Despite the remarkable advances in diabetes management technology, the importance of diabetes education to effectively utilize it is still emphasized. Individualized diabetes education can help people to begin effective self-management and encourage behavior change through repeated education. The goal of continuing education is to prevent and manage diabetes-related complications and improve quality of life. However, even the most experienced diabetic patients may find their self-management at risk when faced with crises or stress due to sudden changes in their environment, and how they face and resolve current problems depends on their problem-solving skills. This article explores the role that diabetes educators can play as problem-solving support.

### S15-4

#### Partner for physical activity

Dongcheol Kim

Inha University Hospital, Korea

Physical activity is very important for people with diabetes. Physical activity means any movement of the body and it helps a lot in improving health and quality of life. There are various ways to get started with the physical activity.

First of all, you should find something to like. Most people find exercise uninteresting and a waste of time, so they spend most of their time lying down and using their smartphones. Therefore, they should find something more fun than lying down after having a meal. Second, you should start with easy movements. This is because too difficult activities and physical activities that are not suitable for age make you give up quickly. So, the simpler the movement, the better it is at first. Third, you should set goals and plans. It is

good for you to decide on physical activities that are realistic and possible in everyday life. Finally, when doing physical activities, the most important thing is to have a partner who can be with you. Your partner can remove all excuses, so you can encourage more physical activities. Also, the diabetes is very essential to manage blood sugar and the body. It is desirable for people with diabetes to engage in physical activity for a long time and to increase the intensity of physical activity. In addition, physical activity has a positive effect on blood sugar management after breakfast, lunch and dinner. Therefore, for people with diabetes, physical activity is essential for blood sugar management and health management.

### KS1-1

#### Human muscle aging at single-cell and single-nucleus resolution

Hongbo Zhang

Sun Yat-sen University, China

Skeletal muscle ageing increases the incidence of age-associated frailty and sarcopenia in the elderly worldwide, leading to increased morbidity and mortality. However, our understanding of the cellular and molecular mechanisms of muscle ageing is still far from complete. We generate a single-cell and single-nucleus transcriptomic atlas of skeletal muscle ageing sampling intercostal muscle from 17 donors across the adult human lifespan, accompanied by myofiber typing using imaging. This atlas reveals ageing mechanisms acting across different cell compartments of the muscle, including muscle stem cells (MuSCs), myofibers and the muscle microenvironment. Firstly, we uncover two subpopulation-dependent mechanisms driving MuSC ageing, namely a decrease in ribosome assembly and an increase in cytokine CCL2 expression. Secondly, we identify two pairs of convergent myonuclei states in slow- and fast-twitch myofibers which are involved in stress and repair response. These states demonstrate different ageing dynamics between slow- and fast-twitch myofibers. Thirdly, we describe a novel neuromuscular junction accessory myonuclei population that dramatically increases with age, possibly compensating age-related muscle denervation. Fourthly, we find that loss of fast-twitch myofiber with age is counteracted by its regeneration, as well as by increased expression of fast-type markers within slow-twitch myofiber nuclei. Finally, we reveal that multiple cell types in the ageing muscle microenvironment produce cytokines and chemokines to attract immune cells. Additionally, we provide an integrated human-mouse muscle ageing atlas and highlight an increase in inflammatory pathways, and a decrease in growth and innervation pathways as conserved ageing hallmarks across species. In summary, we uncover major ageing changes in different compartments of the skeletal muscle, and present a comprehensive human skeletal muscle ageing resource for the community.

### KS1-2

#### Discovery and development of molecular imaging-biomarker for metabolic disease

Hongyoon Choi

Seoul National University, Korea

Metabolic disorders are complex and multifaceted, with intricate pathophysiology. Traditional approaches for diagnosing and monitoring these conditions often involve the analysis of biomarkers extracted from blood or other biofluids. Molecular imaging has the potential to provide additional insights by offering organ and tissue-specific information about metabolic processes. For instance, FDG PET has been used to assess brown adipose tissue activity throughout the body, which can be linked to metabolic abnormalities. Molecular imaging can also help identify pathophysiology-related cells such as pancreatic neuroendocrine cells. However, the clinical application of these imaging methods remains limited.

Recent advances in molecular analysis, including single-cell and spatial transcriptomics, offer alternative strategies for discovering and translating novel molecular imaging techniques. These approaches allow for comprehensive molecular characterization at the cellular level, opening up new possibilities for the identification of optimal imaging targets for specific molecular pathways or cell types associated with metabolic disorders. In this talk, I will discuss how integrating molecular imaging with spatial omics data can contribute to the discovery of valuable biomarkers and therapeutic targets for metabolic disorders. By combining imaging and spatial biology data, we can uncover underlying molecular mechanisms, as well as evaluate drug distribution and effects in a data-driven manner. I will

present future strategies for the identification and clinical translation of targeted molecular imaging approaches for metabolic disorders, taking advantage of the insights provided by spatial omics technologies.

### KS1-3

#### Super-resolved mitochondrial proteome map by proximity labeling

Hyun-Woo Rhee

Seoul National University, Korea

The intracristal space (ICS) is a distinct subdomain of the mitochondrial intermembrane space (IMS) where oxidative phosphorylation occurs. This region supposedly controls the dynamic demands regulating mitochondrial respiration; however, its other molecular components remain largely unknown. To remedy this, we developed isotope-coded proximity labeling tool that enabled differential mass analysis of post-translocated modifications. Using this unique proximity labelling approach dubbed "iSpot-ID", we discovered that TMEM177 is exclusively localized to the ICS and that the protein offers an ICS targeting modality for studying the unique characteristics of ICS, such as the local pH, redox states, and temperature in the space. Furthermore, we obtained a proteome specifically localized to the ICS using iSpot-ID with TMEM177-APEX2, which included a high portion of mitochondrial matrix-targeting proteins and several known IMS-localised proteases as well as subunits of the OXPHOS complex. This protein accumulation was enriched by inhibiting the import of mitochondrial matrix proteins or by inducing other stress conditions; the protein was consequently degraded by proteases in the ICS. Our data revealed that the ICS is important for mitochondrial quality control under dynamic cellular states.

### JS1-1

#### New therapeutic targets for alleviating diastolic dysfunction in diabetic cardiomyopathy

John Ussher

University of Alberta, Canada

Diastolic dysfunction is frequently present in people with type 2 diabetes (T2D), but often remains undiagnosed as routine cardiovascular screening is usually not considered in people during the early stages of T2D. This diastolic dysfunction is a key feature of diabetic cardiomyopathy (DbCM), which is the presence of ventricular dysfunction in the absence of coronary artery disease and/or hypertension. The myocardium in diabetes is characterized by several disturbances in energy metabolism that may represent potential targets for pharmacotherapy. One of the most prominent changes in DbCM is a robust impairment in myocardial glucose oxidation (GOx), and interventions that correct this metabolic defect have been shown to alleviate diastolic dysfunction. For example, the glucagon-like peptide-1 receptor (GLP-1R) agonists, which promote glucose-lowering in diabetic subjects secondary to increases in insulin secretion, improve diastolic function in T2D concomitant with an increase in myocardial GOx. Furthermore, treatment with the GLP-1R agonist, liraglutide, fails to improve diastolic dysfunction in mice with a cardiac-specific deletion of pyruvate dehydrogenase, the rate-limiting enzyme of GOx. More recently, increases in myocardial ketone oxidation have been reported in heart failure, which have been proposed as an adaptive response to account for reductions in myocardial fatty acid oxidation. As diabetes increases the risk for heart failure, it is essential to elucidate potential changes in myocardial ketone oxidation in DbCM. In contrast to observations in the failing heart, working hearts from mice with experimental DbCM exhibited decreases in ketone oxidation. Nonetheless, pharmacological inhibition of succinyl CoA:3-ketoacid CoA transferase, the rate-limiting enzyme of ketone oxidation, also alleviated diastolic dysfunction and decreased cardiomyocyte hypertrophy in mice with T2D. As diastolic dysfunction and DbCM may be a precursor to HFpEF, which is enriched in the diabetic population, it would seem prudent to determine whether long-term optimization of cardiac energetics in T2D impacts HFpEF prevalence.

### JS1-2

#### A $\beta$ efflux impairment and inflammation linked to cerebrovascular accumulation of amyloid-forming amylin secreted from pancreas

Florin Despa

The University of Kentucky, USA

Impairment of vascular pathways of cerebral  $\beta$ -amyloid (A $\beta$ ) elimination contributes to Alzheimer disease (AD). Vascular damage is commonly associated with diabetes. Here we show in human tissues and AD-model rats that bloodborne islet amyloid polypeptide (amylin) secreted from the pancreas perturbs cerebral A $\beta$  clearance. Blood amylin concentrations are higher in AD than in cognitively unaffected persons. Amyloid-forming amylin accumulates in circulating monocytes and co-deposits with A $\beta$  within the brain microvasculature, possibly involving inflammation. In rats, pancreatic expression of amyloid-forming human amylin indeed induces cerebrovascular inflammation and amylin-A $\beta$  co-deposits. LRP1-mediated A $\beta$  transport across the blood-brain barrier and A $\beta$  clearance through interstitial fluid drainage along vascular walls are impaired, as indicated by A $\beta$  deposition in perivascular spaces. At the molecular level, cerebrovascular amylin deposits alter immune and hypoxia-related brain gene expression. These converging data from humans and laboratory animals suggest that altering bloodborne amylin could potentially reduce cerebrovascular amylin deposits and A $\beta$  pathology.

### JS1-3

#### Role of flow-sensitive HEG1 in endothelial function and protection against atherosclerosis

Hanjoong Jo

Emory University, USA

Atherosclerosis preferentially occurs in arterial regions of disturbed blood flow, while stable flow (s-flow) protects against atherosclerosis by incompletely-understood mechanisms. We recently identified HEG1 from a single-cell RNA-sequencing study as an s-flow-induced endothelial gene, which we validated *in vivo* and *in vitro*. I will discuss how HEG1 mediates

s-flow-induced endothelial responses, including monocyte adhesion and permeability. I will also discuss how HEG1 regulates key flow-dependent signaling pathways leading to upregulation of KLF2/4. I will also discuss how endothelial-targeted HEG1 knockout (HEG1<sup>HECKO</sup>) mice exacerbate atherosclerotic plaque development. I will also show a negative correlation of HEG1 expression in human coronary arteries as advanced atherosclerotic lesions occur. Our findings indicate that HEG1 is a novel mediator of atheroprotective endothelial responses to flow and potential therapeutic target.

### JS2-1

#### Obesity and diabetes as two intersecting risk factors for pancreatic cancer

Mark A. Gromski

Indiana University, USA

Pancreatic cancer (ductal adenocarcinoma [PDAC]) remains one of the deadliest cancers around the globe. PDAC is projected to be responsible for more deaths over time, and some predict it will be the second leading cause of cancer related deaths by 2030. Population based studies have identified both obesity and diabetes as independent risk factors for the development of PDAC.

This presentation aims to describe the epidemiological data describing the link between these risk factors and pancreas cancer. The mechanisms of each risk factor and their connection with PDAC will be expounded upon. Finally, ongoing research and gaps in knowledge will be highlighted upon.

### JS2-2

#### Rapid deterioration of new-onset diabetes and risk of pancreatic cancer

Minyoung Lee

Yonsei University, Korea

Newly diagnosed diabetes increases the risk of pancreatic cancer. Most previous studies have assessed the presence or absence of diabetes without considering the severity of diabetes mellitus at the time of diagnosis or changes in its severity. Therefore, we aimed to analyze the risk of pancreatic cancer according to the severity of diabetes at diagnosis and changes in its severity.

We included 283,445 individuals with or without diabetes provided by the Korean National Health Insurance System between 2002 and 2019. Individuals with diabetes were categorized into three groups, no medication, oral medication, and insulin, based on their medication prescription history.

During the 2,143,680 person-years of follow-up, 1,455 incident pancreatic cancer cases were identified. Individuals prescribed with a higher intensity of antidiabetic medication were at a higher risk of incident pancreatic cancer than those a lower intensity of antidiabetic medication or without diabetes at cohort entry. Individuals with an increased intensity of antidiabetic treatment after 6 months from the initial diagnosis had a higher risk of pancreatic cancer than those with an unchanged or decreased intensity of antidiabetic treatment.

Severe new-onset diabetes mellitus and its rapid aggravation were associated with a greater risk of pancreatic cancer. Thus, these data suggest that the initial severity and progression course of new-onset diabetes mellitus should be the clinical factors determining referral to a pancreatic cancer specialist.

### JS2-3

#### Changes in metabolic syndrome status are associated with altered risk of pancreatic cancer: a nationwide cohort study

Jung Yong Hong

Sungkyunkwan University, Korea

Pancreatic cancer is the third leading cause of cancer-related deaths in the United States, with a 5-year survival rate of 8-9%. The incidence, mortality, and disease burden of pancreatic cancer are rapidly increasing worldwide. Thus, identifying modifiable risk factors for pancreatic cancer may reduce

the growing socio-economic burden of pancreatic cancer.

Metabolic syndrome is a complex of metabolic abnormalities, including elevated waist circumference, elevated triglyceride levels, elevated blood pressure, elevated fasting glucose levels, and reduced high-density lipoprotein cholesterol (HDL-C) levels. Notably, metabolic syndrome is modifiable and may change over time. So, we aimed to investigate whether the risk of pancreatic cancer differs depending on changes or persistence in metabolic syndrome.

In this lecture, we will discuss about the association between metabolic syndrome and pancreatic cancer risk, and further discuss about the altered risk of pancreatic cancer associated with changes in metabolic syndrome status.

## JS2-4

### Experimental models for the connection between pancreatic cancer and diabetes

Sang Hoon Lee

Konkuk University, Korea

Pancreatic cancer remains one of the most lethal malignancies worldwide, and the lack of early detection strategies for high-risk patients contributed to its poor prognosis. Much clinical evidence suggest that diabetes mellitus (DM) is a significant risk factor for pancreatic cancer and can be both a cause and consequence of pancreatic cancer. The underlying mechanism between pancreatic cancer and DM is complex due to the presence of a bidirectional connection. The ability to distinguish pancreatic cancer-related DM from type 2 DM is essential for recognizing that the new onset of DM may indicate a developing pancreatic cancer and can lead to develop the novel biomarker for earlier pancreatic cancer detection. Although the pathogenesis of pancreatic cancer-related DM has not been fully elucidated, experimental results indicated that this paraneoplastic phenomenon is mediated by beta-cell dysfunction and insulin resistance caused by tumor-derived 'exosomes'. Exosomes are part of a family of membrane-derived particles that are collectively known as extracellular vehicles (EVs). They facilitate intercellular communication via their cargo which consists of a mixture of bioactive molecules such as nucleic acids (mRNA, miRNA, DNA), lipids and proteins. Here I summarized the recent work on role of exosomes and its mediators in the development of pancreatic cancer-related DM. In the future, these promising developments in this field could enable timely diagnosis and improved clinical outcomes for pancreatic cancer patients.

## JS3-1

### Evaluation and management of patients with diabetes and heart failure: a Korean Diabetes Association and Korean Society of Heart Failure consensus statement

Junghyun Noh

Inje University, Korea

Diabetes mellitus is a major risk factor for the development of heart failure. Furthermore, the prognosis of heart failure is worse in patients with diabetes mellitus than in those without it. Therefore, early diagnosis and proper management of heart failure in patients with diabetes mellitus are important. Recent clinical trials have demonstrated the potential for diabetes mellitus therapies to modulate the risk of heart failure outcomes. Based on evidence from clinical trials, Korean Diabetes Association and Korean Society of Heart Failure have launched the consensus statement for 'Evaluation and Management of Patients with Diabetes and Heart Failure'. This statement provides the current criteria for diagnosis and screening tools for heart failure and the currently recommended pharmacological therapies for heart failure. The effects of anti-diabetic medications on heart failure are also highlighted.

## JS3-2

### In-hospital glycemic variability and all-cause mortality among patients hospitalized for acute heart failure

Jaewon Oh

Yonsei University, Korea

**Background:** High glycemic variability (GV) is a poor prognostic marker in cardiovascular diseases. We aimed to investigate the association of GV with all-cause mortality in patients with acute heart failure (HF).

**Methods:** The Korean Acute Heart Failure registry enrolled patients hospitalized for acute HF from 2011 to 2014.

Blood glucose levels were measured at the time of admission, during hospitalization, and at discharge. We included those who had 3 or more blood glucose measurements in this study. Patients were divided into two groups based on the coefficient of variation (CoV) as an indicator of GV. Among survivors of the index hospitalization, we investigated all-cause mortality at 1 year after discharge.

**Results:** The study analyzed 2,617 patients (median age, 72 years; median left-ventricular ejection fraction, 36%; 53% male). During the median follow-up period of 11 months, 583 patients died. Kaplan-Meier curve analysis revealed that high GV (CoV>21%) was associated with lower cumulative survival (log-rank P<0.001). Multivariate Cox proportional analysis showed that high GV was associated with an increased risk of 1-year (HR 1.56, 95% CI 1.26-1.92) mortality. High GV significantly increased the risk of 1-year mortality in non-diabetic patients (HR 1.93, 95% CI 1.47-2.54) but not in diabetic patients (HR 1.19, 95% CI 0.86-1.65, P for interaction=0.021).

**Conclusions:** High in-hospital GV before discharge was associated with all-cause mortality within 1 year, especially in non-diabetic patients with acute HF.

## JS3-3

### Intersection of heart failure and NAFLD

Marat Fudim

Duke Clinical Research Institute, USA

Heart failure (HF) and liver disease are among the most common causes of morbidity and mortality worldwide. The bidirectional relationship between HF and liver disease can occur in 2 forms: liver complications of HF (eg, congestive hepatopathy) and cardiac complications of liver disease with resultant HF (eg, cirrhotic cardiomyopathy). The prevalence of this bidirectional relationship can reach up to 65%. Although the relationship between HF and liver disease is generally well recognized, the association between HF with preserved ejection fraction (HFpEF), in particular, and liver disease has not been well studied or defined. I will highlight the relationship between HFpEF and nonalcoholic fatty liver disease (NAFLD), and propose that some phenotypes of HFpEF are cardiac manifestations of NAFLD rather than 2 independent disease forms. I will also discuss challenges related to diagnosing NAFLD-related HFpEF phenotypes and diagnosing either entity in the presence of the other. I will propose several treatments for NAFLD-related phenotypes on the basis of plausible mechanism of actions.

## JS3-4

### Obesity and heart failure

Masaaki Konishi

Yokohama City University, Japan

As the population ages, the number of heart failure patients in Japan and other Asian continues to increase. Overcoming the "heart failure pandemic" will become an important international issue. The major causes of heart failure, ischemic heart disease and atherosclerosis, are further upstreamed by lifestyle-related diseases such as obesity, and obesity is known as an independent risk factor for the development of heart failure. Therefore, weight loss is generally recommended for obese patients. On the other hand, once a patient has a chronic disease such as heart failure or cancer, being obese is conversely a favorable prognostic factor, known as the obesity paradox. Effects of skeletal muscle and adipose tissue on the body and heart, as exemplified by cachexia, frailty, and sarcopenia in the context of chronic disease and chronic inflammation, are key to elucidating the pathological basis for the "heart failure-obesity paradox". In this lecture, we show our results of observational studies in which body weight, weight change, anthropometric measures, body composition, and epicardial fat

were analyzed, and update our knowledge by introducing recent results of clinical trials. The results of these studies provide an important basis that can be used not only for treatment selection, such as nutritional therapy (weight loss and nutritional supplementation) and exercise therapy, but also for prevention of frail and malnutrition in the increasing number of elderly heart failure patients, care prevention, and even palliative care, which are all important issues to be addressed in daily clinical practice.

### JS4-1

#### Recent updates in diabetes guidelines by the KDA: overview of cardiovascular and renal management with SGLT-2 inhibitors and GLP-1RAs

Jong Han Choi

Konkuk University, Korea

Cardiovascular and kidney diseases have been major comorbidities and causes of death in people with diabetes, traditionally at the forefront of concerns in diabetes management. Historically, the management of diabetes has emphasized not only strict glycemic control but also proactive screening for cardiovascular risk factors, assiduous management of blood pressure and lipid profiles, smoking cessation, and anti-thrombotic treatments. Gradual advancements are being made in the management of cardiovascular and renal diseases, and these are incorporated into the recent clinical guidelines. It is noteworthy, however, that these interventions traditionally functioned in isolation from glycemic management strategies. From the mid-2010s, novel antidiabetic agents, namely sodium-glucose cotransporter-2 (SGLT-2) inhibitors and glucagon-like peptide-1 receptor analogs (GLP-1RAs), unveiled their distinctive capacity to attenuate cardiovascular morbidity and associated mortality, a phenomenon observed to be discrete from their glycemic modulation effects. Consequently, this paradigmatic shift has redefined the clinical decision-making process regarding pharmacological interventions for glycemic control in people with atherosclerotic cardiovascular disease (ASCVD) or indicators of high risk, heart failure, or chronic kidney disease. In this presentation, I will introduce the recent updates to the clinical guidelines from the Korean Diabetes Association, focusing on the management of cardiovascular and renal diseases in people with diabetes, and pharmacotherapy guidelines centered around SGLT-2 inhibitors and GLP-1RAs.

### JS4-2

#### Effects of glucose-lowering drugs on cardiovascular outcomes in patients with type 2 diabetes

Brian Tomlinson

Macau University of Science and Technology, Macau SAR, China

The introduction of the sodium-glucose cotransporter-2 inhibitors (SGLT-2is) and the glucagon-like peptide-1 (GLP-1) receptor agonists (GLP-1 RAs) has had a major impact on cardiovascular outcomes in patients with type 2 diabetes (T2D). Drugs in these two classes have additional benefits apart from their glucose lowering effects and some of the drugs have additional indications beyond the use in patients with T2D. The inhibition of renal glucose reabsorption with SGLT-2is reduces fasting and postprandial plasma glucose levels with improvements in both insulin secretion and insulin sensitivity, and in addition reduces blood pressure, ameliorates glucotoxicity and produces haemodynamic changes that result in improved cardiovascular and renal outcomes in patients with T2D. The effects on heart failure and renal disease have been extended to patients without T2D with some of the drugs in this group. Several different mechanisms are involved in these benefits including reduction in body weight, a diuretic effect, reduction in blood pressure and change in myocardial metabolism to the more efficient use of ketones rather than glucose.

The GLP-1 RAs are particularly effective in reducing body weight and the combined agonist at GLP-1 and glucose-dependent insulinotropic polypeptide (GIP), tirzepatide, appears to be even more effective in weight reduction than the GLP-1 RAs. Reductions in body weight with these peptides are associated with reductions in blood pressure and inflammatory markers and improvements in the lipid profile. Some of the GLP-1 RAs have shown reductions in cardiovascular events which might be attributed to the improvement in the various cardiovascular risk factors associated with body weight. Non-alcoholic fatty liver disease (NAFLD) and non-alcoholic steatohepatitis (NASH), which frequently accompany the metabolic syndrome and T2D, may also be improved with these drugs when there

is substantial body weight reduction. Furthermore, both these groups of drugs are well tolerated with few serious adverse effects.

### JS4-3

#### GLP 1 based therapy including its effect on cardiovascular risk and lipid profiles

Chang Hee Jung

University of Ulsan, Korea

Type 2 diabetes mellitus (T2DM) is frequently found in patients with atherosclerotic cardiovascular disease (ASCVD) or those at the highest risk of developing cardiovascular disease (CVD). Conversely, ASCVD is prevalent among individuals with T2DM. Recognizing this interconnectedness is crucial when formulating strategies to reduce cardiovascular risk. Thanks to the wealth of data from multiple dedicated cardiovascular outcome trials (CVOTs) involving glucose-lowering medications in patients with diabetes and ASCVD or high CV risk, we now have substantial information to guide the preferred use of specific glucose-lowering medications for CV risk reduction, independently of their glucose management effects.

The advantages of glucagon-like peptide-1 receptor agonists (GLP-1 RAs) stem from their multifaceted effects. These include glucose-dependent insulin secretion, suppression of glucagon release, and appetite reduction. Additionally, GLP-1 RAs exert favorable effects on various organ systems housing GLP-1 receptors, particularly the cardiovascular system. The cardiovascular effects of GLP-1 RAs have garnered significant attention, given the escalating burden of CVD in the global diabetic population, despite stringent glycemic control and advanced therapeutic interventions for CVD. In this presentation, I will provide a brief overview of the diverse effects of GLP-1-based therapies on cardiovascular risk and lipid profiles. I hope this session will shed light on how various GLP-1-based therapies can offer benefits in mitigating the cardiovascular risk associated with T2DM.

### JS4-4

#### Precision medicine for atherosclerotic cardiovascular disease risk stratification and therapy in Familial Hypercholesterolemia

Raul D. Santos

University of Sao Paulo, Brazil

Familial hypercholesterolemia (FH) is an autosomal dominant disease characterized by hypercholesterolemia from birth and early onset of atherosclerotic cardiovascular disease (ASCVD). Recent meta-analyses indicate that the FH phenotype is more frequent than previously thought (1 in 310 people). FH is associated with 3-fold risk of ASCVD in comparison with normolipidemic people. Data from the EAS-FHSC registry with 61,612 FH patients (42,167 adults, 53.6% women) from 56 countries and median age of 46.2 years indicate that CHD is present already in 21.5% and 12.4% respectively of men and women. ASCVD risk is determined not only by higher cholesterol levels but also by other risk factors, polygenes and presence of coronary subclinical atherosclerosis. Most patients with FH are neither diagnosed nor treated with 40.5% of patients on the FHSC registry not receiving lipid lowering therapies. Of importance only 35.2%, 13.6%, 2.7% and 1.2% attained LDL-C values respectively <130 mg/dL, <100 mg/dL, <70 mg/dL and <55 mg/dL. Therefore, there is need for combination therapies in FH since diagnosis to better achieve cholesterol lowering recommendations. To reduce the hiatus on diagnosis and treatment the International Atherosclerosis Society has recently published an action statement that summarized the best literature evidence about diagnosis, natural history, universal cholesterol measurement and cascade screening, risk stratification and therapy of FH. There are implementation science recommendations that should be customized to each reality to reduce the burden of FH.

## CS1-1

**Sex differences of visceral fat area and visceral-to-subcutaneous fat ratio for the risk of incident type 2 diabetes mellitus**

Eun Hee Kim

University of Ulsan, Korea

**Background:** This study aimed to determine the optimal cut-off values of visceral fat area (VFA) and visceral-to-subcutaneous fat ratio (VSR) for predicting incident type 2 diabetes mellitus (T2DM).

**Methods:** A total of 10,882 individuals (6,835 men; 4,047 women) free of T2DM at baseline aged between 30 and 79 years who underwent abdominal computed tomography scan between 2012 and 2013 as a part of routine health check-ups were included and followed. VFA, subcutaneous fat area, and VSR on L3 vertebral level were measured at baseline.

**Results:** During a median follow-up of 4.8 years, 730 (8.1% for men; 4.3% for women) incident cases of T2DM were identified. Receiver operating characteristic curve analysis showed that the optimal cut-off values of VFA and VSR for predicting incident T2DM were 130.03 cm<sup>2</sup> and 1.08 in men, respectively, and 85.7 cm<sup>2</sup> and 0.48 in women, respectively. Regardless of sex, higher VFA and VSR were significantly associated with a higher risk of incident T2DM. Compared with the lowest quartiles of VFA and VSR, the highest quartiles had adjusted odds ratios of 2.62 (95% confidence interval [CI], 1.73 to 3.97) and 1.55 (95% CI, 1.14 to 2.11) in men, respectively, and 32.49 (95% CI, 7.42 to 142.02) and 11.07 (95% CI, 3.89 to 31.50) in women, respectively.

**Conclusion:** Higher VFA and VSR at baseline were independent risk factors for the development of T2DM. Sex-specific reference values for visceral fat obesity (VFA ≥130 cm<sup>2</sup> or VSR ≥1.0 in men; VFA ≥85 cm<sup>2</sup> or VSR ≥0.5 in women) are proposed for the prediction of incident T2DM.

## CS1-2

**Efficacy and safety of self-titration algorithms of insulin glargine 300 units/ml in individuals with uncontrolled type 2 diabetes mellitus (the Korean titration study): a randomized controlled trial**

Jae Hyun Bae

Korea University, Korea

International guidelines provide recommendations for initiating and adjusting basal insulin therapy in the management of type 2 diabetes. However, there is no widely accepted insulin titration method for this condition. We conducted a 12-week, single-center, pragmatic, randomized, open-label, treat-to-target trial involving Korean individuals with uncontrolled type 2 diabetes to compare the efficacy and safety of two insulin titration algorithms, INSIGHT and EDITION, using insulin glargine U-300 (Gla-300). We included adults aged ≥19 years with type 2 diabetes, either using noninsulin antihyperglycemic agents with HbA1c levels between >7% and ≤10% while on basal insulin or insulin naïve with HbA1c levels between >7% and ≤11%. Participants were randomly assigned to the INSIGHT algorithm (adjusting insulin by 1 unit/day) or the EDITION algorithm (adjusting by 3 units/week) to achieve a target fasting self-monitoring blood glucose (SMBG) of 4.4 to 5.6 mmol/L. The primary outcome was the proportion of participants achieving a fasting SMBG ≤5.6 mmol/L without nocturnal hypoglycemia at week 12. Of 129 participants (mean age 64.1±9.5 years; 51.2% women), 65 were in the INSIGHT group and 64 in the EDITION group. Both groups had similar primary outcome achievements (24.6% vs. 23.4%, *P*=0.876). While both groups had similar reductions in fasting plasma glucose and HbA1c, the INSIGHT group had a greater reduction in 7-point SMBG. The INSIGHT group required a higher increase in total daily insulin dose than the EDITION group (between-group difference: 5.8±2.7 units/day, *P*=0.033). Nevertheless, only the EDITION group had a significant increase in body weight (0.6±2.4 kg, *P*=0.038). Hypoglycemia rates were similar, and patient satisfaction was higher in the INSIGHT group (*P*=0.014). In summary, our study has demonstrated that the INSIGHT algorithm for self-titrating Gla-300 appears effective and safe in managing uncontrolled type 2 diabetes in Korean individuals compared to the EDITION algorithm.

## CS1-3

**Reproductive life span and severe hypoglycemia risk in postmenopausal women with type 2 diabetes mellitus**

Soyeon Kang

The Catholic University of Korea, Korea

Estrogen promotes glucose homeostasis, enhances insulin sensitivity, and maintains counterregulatory responses in recurrent hypoglycemia in women of reproductive age. Postmenopausal women with type 2 diabetes mellitus (T2DM) might be more vulnerable to severe hypoglycemia (SH) events. However, the relationship between reproductive factors and SH occurrence in T2DM remains unelucidated.

This study included data on 181,263 women with postmenopausal T2DM who participated in a national health screen-ing program from January 1 to December 31, 2009, obtained using the Korean National Health Insurance System database. Outcome data were obtained until December 31, 2018. Associations between reproductive factors and SH incidence were assessed using Cox proportional hazards models.

During the mean follow-up of 7.9 years, 11,279 (6.22%) postmenopausal women with T2DM experienced SH episodes. A longer reproductive life span (RLS) (≥40 years) was associated with a lower SH risk compared to a shorter RLS (<30 years) (adjusted hazard ratio [HR], 0.74; 95% confidence interval [CI], 0.69 to 0.80; *P* for trend <0.001) after multivariable adjustment. SH risk decreased with every 5-year increment of RLS (with <30 years as a reference [adjusted HR, 0.91; 95% CI, 0.86 to 0.95; *P*=0.0001 for 30-34 years], [adjusted HR, 0.80; 95% CI, 0.76 to 0.84; *P*<0.001 for 35-39 years], [adjusted HR, 0.74; 95% CI, 0.68 to 0.81; *P*<0.001 for ≥40 years]). The use of hormone replacement therapy (HRT) was associated with a lower SH risk than HRT nonuse.

In conclusion, extended exposure to endogenous ovarian hormone during lifetime may decrease the number of SH events in women with T2DM after menopause.

## CS1-4

**Serum retinol-binding protein levels are associated with nonalcoholic fatty liver disease in Chinese patients with type 2 diabetes mellitus: a real-world study**

Man-Rong Xu

Shanghai Jiao Tong University, China

**Background:** The association of serum retinol-binding protein (RBP) levels with nonalcoholic fatty liver disease (NAFLD) remains controversial. Furthermore, few studies have investigated their relationship in type 2 diabetes mellitus (T2DM) patients. Therefore, the aim of the present study was to explore the association between serum RBP levels and NAFLD in Chinese inpatients with T2DM.

**Methods:** This cross-sectional, real-world study included 2,263 Chinese T2DM inpatients. NAFLD was diagnosed by abdominal ultrasonography. The subjects were divided into four groups based on RBP quartiles, and clinical characteristics were compared among the four groups. The associations of both RBP levels and quartiles with the presence of NAFLD were also analyzed.

**Results:** After adjustment for sex, age, and diabetes duration, there was a significant increase in the prevalence of NAFLD from the lowest to the highest RBP quartiles (30.4%, 40.0%, 42.4%, and 44.7% for the first, second, third, and fourth quartiles, respectively, *P*<0.001 for trend). Fully adjusted multiple logistic regression analysis revealed that both increased RBP levels (odds ratio, 1.155; 95% confidence interval, 1.012 to 1.318; *P*=0.033) and quartiles (*P*=0.014 for trend) were independently associated with the presence of NAFLD in T2DM patients.

**Conclusion:** Increased serum RBP levels were independently associated with the presence of NAFLD in Chinese T2DM inpatients. Serum RBP levels may be used as one of the indicators to assess the risk of NAFLD in T2DM patients.

### CS1-5

#### Glucose profiles assessed by intermittently scanned continuous glucose monitoring system during the perioperative period of metabolic surgery

Kyuhoo Kim

The Catholic University of Korea, Korea

**Background:** Continuous glucose monitoring (CGM) has been widely used in the management of diabetes. However, the usefulness and detailed data during perioperative status were not well studied. In this study, we described the immediate changes of glucose profiles after metabolic surgery using intermittently scanned CGM (isCGM) in individuals with type 2 diabetes mellitus (T2DM).

**Methods:** This was a prospective, single-center, single-arm study including 20 participants with T2DM. The isCGM (FreeStyle Libre CGM) implantation was performed within 2 weeks before surgery. We compared CGM metrics of 3 days before surgery and 3 days after surgery, and performed the correlation analyses with clinical variables.

**Results:** The mean glucose significantly decreased after surgery ( $147.0 \pm 40.4$  to  $95.5 \pm 17.1$  mg/dL,  $P < 0.001$ ). Time in range (TIR; 70 to 180 mg/dL) did not significantly change after surgery in total. However, it was significantly increased in a subgroup of individuals with glycosylated hemoglobin (HbA1c)  $\geq 8.0\%$ . Time above range ( $>250$  or  $180$  mg/dL) was significantly decreased in total. In contrast, time below range ( $<70$  or  $54$  mg/dL) was significantly increased in total and especially in a subgroup of individuals with HbA1c  $< 8.0\%$  after surgery. The coefficient of variation significantly decreased after surgery. Higher baseline HbA1c was correlated with greater improvement in TIR ( $\rho = 0.607$ ,  $P = 0.005$ ).

**Conclusion:** The isCGM identified improvement of mean glucose and glycemic variability, and increase of hypoglycemia after metabolic surgery, but TIR was not significantly changed after surgery. We detected an increase of TIR only in individuals with HbA1c  $\geq 8.0\%$ .

### CS2-1

#### From ACCORD to GRADE: lessons and more steps forward

Rodica Pop-Busui

University of Michigan, USA

In the history of diabetes management, there have been multiple shifts in the paradigm of type 2 diabetes therapy. The UKPDS demonstrated that intensive glycemic control in early diabetic patients reduces the risk of complications. On the other hand, the ACCORD study revealed possible risks associated with intensive glycemic control in advanced diabetic patients. Recent Cardiovascular Outcome Trials (CVOT) results are challenging the paradigm of glycemic control.

By organizer

### CS2-2

#### UKPDS vs recent CVOTs: does glycemic control still matter

Ramzi A. Ajjan

University of Leeds, UK

Diabetes is characterized by elevated blood glucose levels and this population is at a high risk of cardiovascular complications. Hyperglycaemia is clearly responsible for microvascular complications in diabetes but the role in macrovascular disease is more complex.

The current presentation will review the data on the relationship between high glucose levels and macrovascular disease, including the concept of the metabolic memory. Discussions will also take place on the role of decreasing glucose levels as a mean of preventing cardiovascular complications in diabetes, including atherosclerotic disease and heart failure. The potential adverse effects of hypoglycaemia on cardiovascular risk are also discussed while also highlighting differential effects of various glucose lowering agents.

The overall aim of is to provide the audience with the latest evidence on the relationship between glycaemia and macrovascular disease while also guiding the health care professional on the glycaemic management of individuals with diabetes, which minimizes the risk of atherosclerotic vascular disease and heart failure.

### CS2-3

#### REMATCH: beyond ACCORD and GRADE

Sin Gon Kim

Korea University, Korea

For many decades, glycemic control was a well-established primary purpose in diabetes care, supported by the results from the DCCT and the UKPDS. However, the ACCORD trial showed that when intensive glycemic control was compared with standard care, the magnitude of the harms - complexity of treatment, hypoglycemia, weight gain, and costs - outweighed the benefits. The GRADE trial was a study to assess the effectiveness of various add-on therapies to metformin in patients with recent onset T2DM but was not designed to answer whether the intensive glycemic control is good or not, and SGLT2i were not included in the trial.

The best way to improve the management of T2DM is to conduct trials that can answer the questions important to patients. Comprehensive management of patients includes not only macrovascular complications but also microvascular complications such as kidney disease, neuropathy, amputation and blindness. Large long-term randomized controlled trials measuring these outcomes, not solely based on glycemic parameters, are needed to test different approaches and drugs for the management of T2DM.

Therefore, initiated by the Korean Diabetes Association, we designed the K-ACCORD trial to recruit 6,000 participants, titled REMATCH (A Registry based randomized controlled trial: Multiple combination Strategies of intensive Glycemic Control to reduce cardiorenal outcomes in type 2 diabetes with risk factors of cardiovascular disease). In this lecture, I will introduce the REMATCH trial and emphasize the value of the trial for us and our patients.

### CS3-1

#### Clinical usefulness of digital therapeutics on diabetes management

Dugyun Choi

Soonchunhyang University, Korea

Diabetes is a chronic disease, and in the already-arrived super-aged society, its prevalence is expected to increase even more in the future. Diabetes is a primary causative disease for major causes of death, such as cardiovascular diseases, and major diseases that degrade the quality of life, like end-stage renal disease and diabetic retinopathy. If diabetes is not properly managed, it will pose a significant burden not only to individuals but also to society as a whole in the future.

The recent dazzling advancements in information and science technology have also been realized in the field of diabetes. In particular, the developments of portable digital devices are expected to greatly assist in blood sugar management for diabetic patients, improving individual quality of life and also benefiting national health and healthcare management. Furthermore, the correct national policy direction for digital health is also essential from the perspective of international competition in future industries." In this KDA committee session of health insurance and legislation, I will discuss the current status and feature of digital therapeutics being applied to diabetic patients and its actual application in the clinical fields.

### CS3-2

#### Digital health policy direction from the corporate side

Junhwan Kim

Kakao Healthcare, Korea

Since COVID-19, digital transformation has accelerated and digital health has spread rapidly.

Digital health technologies and various sensors have also been adopted in diabetes management.

This session will discuss how enterprises are viewing digital health at a time when a variety of medical devices and digital health technologies continue to emerge.

**RS1-1****Discovery of a new NASH clinical candidate**

Jin Hee Ahn

GIST, Korea

Nonalcoholic fatty liver disease (NAFLD) is currently the leading cause of chronic liver disease worldwide. Nonalcoholic Steatohepatitis (NASH), an advanced form of NAFLD, can progress to liver fibrosis, cirrhosis, and hepatocellular carcinoma. Based on recent findings by our team that liver 5HT2A knockout mice suppressed steatosis and reduced fibrosis-related gene expression, we developed a peripheral 5HT2A antagonist, compound GM-106 for NASH. It shows good in vitro activity, stability, and in vivo pharmacokinetics (PK) in rat and dogs. GM-106 also shows good in vivo efficacy in a diet-induced obesity (DIO) mice model and in a choline-deficient, L-amino acid-defined, high-fat diet (CDAHFD) mice model, effectively improving histologic features of NASH and fibrosis. According to the tissue distribution study using [<sup>14</sup>C]-labeled GM-106, the compound was determined to be a peripheral 5HT2A antagonist. Collectively, first-in-class compound GM-106 shows promise as a therapeutic agent for the treatment of NAFLD and NASH and is currently undergoing a Phase 1 clinical trial.

**RS1-2****Rho-kinase is a molecular target for fatty liver diseases**

Young-Bum Kim

Harvard University, USA

Nonalcoholic fatty liver disease (NAFLD) is a major public health problem and the most common form of chronic liver disease, affecting 25% of the global population. The emerging data point to the significance of Rho-kinase (Rho-associated coiled-coil-containing kinase; ROCK) action in the development of fatty liver diseases. In particular, chemical inhibitors of ROCK isoforms in hepatocytes or hepatic stellate cells prevent the progression of liver diseases such as NAFLD and fibrosis. Moreover, mice lacking hepatic ROCK1 are protected against obesity-induced fatty liver diseases by suppressing hepatic de novo lipogenesis. This talk will focus on the physiological functions of hepatic ROCK isoforms and interrogate the molecular mechanisms underlying their impacts on fatty liver diseases. The emergence of ROCK isoforms as a key regulator of hepatic lipid metabolism may lead to new treatment approaches for obesity-related fatty liver disorders.

**RS1-3****ILDONG's new drug development program for metabolic diseases**

Sung Goo Choi

Ildong Pharmaceutical, Korea

Ildong Pharmaceutical has invested a lot of effort and capital in new drug research over the past six years. Metabolic diseases are among the five major therapeutic groups Ildong Pharmaceutical is pursuing. As a result of our intense R&D efforts, we have secured four significant pipelines. They are a type 2 diabetes candidate targeting GPR40 (IDG16177, Xelaglifam), a type 2 diabetes and obesity drug targeting GLP1 (ID110521156), a NASH drug targeting FXR receptor (ID119031166), and a liver cirrhosis drug targeting ATX enzyme inhibition (ID119050134).

IDG16177 demonstrated a superior glucose-lowering effect compared to fasigliam in different rat models. The mechanism of action involves the activation of both beta-arrestin2 and Gq-dependent pathways via the GPR40 G-protein receptor. The compound also demonstrated potential for synergistic/additive effect when combined with SGLT-2 inhibitors, which does have a meaning considering combination therapy is very common in diabetes treatment. Because of Glucose-dependent insulin secretion, the compound is free of hypoglycemic risk. The safety margin for Drug Induced Liver Injury (DILI) is significantly wider than fasigliam's, meaning IDG16177 needs a much lower dose. There were no particular findings in safety studies as well. Phase 1 is ongoing in Germany, starting in July 2021. In 2023, Parexel has completed Phase 1, single ascending dose (SAD) and multiple ascending dose (MAD) phases. And the part 2 study in T2DM patients is undergoing.

ID110521156 is a glucagon-like peptide (GLP)-1 receptor agonist to treat type 2 diabetes, an orally bioavailable, potent, and selective, small molecu-

lar GLP-1R agonist. Glucose lowering efficacy was demonstrated in diabetic monkeys by oral administration and completed in vitro/in vivo effectiveness, pharmacokinetic studies, and GLP safety studies. MFDS approved the IND application in September 2023. Ildong and Seoul National University Hospital plan to dose to the first subject in December 2023. Our efforts to develop innovative new medicines for metabolic diseases with high unmet needs will continue.

**RS1-4****The searching process for biomarkers predicting diabetes and complications**

Ho Chan Cho

Keimyung University, Korea

Type 2 diabetes mellitus (T2DM) is a progressive metabolic disease with several complications and the prevalence of prediabetes gradually increased recently and is known to be a major health problem in Korean population. Therefore, the biomarkers predicting diabetes and complications may be very important to prevent or treat diabetes or diabetic complications. Therefore, we aimed to identify cytokines and exosomal miRNA profiles as novel biomarkers predicting progression from prediabetes to diabetes or diabetic complications such as diabetic neuropathy or retinopathy. In Korea, the prevalence of prediabetes among adults aged 19 years or older and aged 65 years was 39.3% and 50.0%, according to diabetes fact sheet 2020. In addition to diabetes, the prevalence of prediabetes gradually increased recently and is known to be a major health problem in Korean population. Therefore, the detection and treatment of prediabetes can delay the onset of diabetes and presents an important diabetes prevention strategy. Biomarkers predicting progression from prediabetes to diabetes at an early stage is useful to stop the progression of prediabetes to diabetes. The most widely used markers such as blood glucose, hemoglobin A1c (HbA1c) and glycoalbumin present glucose status of sampling time, but there may be some limitations like inaccurate results in special conditions and we can't predict the progression of prediabetes to diabetes with these biomarkers. Recently, urine microalbumin is widely used biomarker predicting diabetic nephropathy. However, there is no definite biomarker predicting diabetic retinopathy or neuropathy. Therefore, we aimed to identify potential biomarkers predicting diabetic retinopathy or neuropathy with investigating cytokines and exosomal miRNA profiles. These new biomarkers may be useful tool predicting progression of prediabetes to diabetes or diabetic complications.

**RS2-1****Islet xenotransplantation: unlocking the new possibility in diabetes care**

Byung Joon Kim

Gachon University, Korea

Islet transplantation is a promising treatment option for patients with type 1 diabetes who suffer from labile glycemic control and frequent hypoglycemic unawareness. However, the limited availability of human donors has hindered its widespread use. Porcine islets have long been considered a viable replacement for human pancreatic islets. Although clinical trials of encapsulated porcine islets have shown long-term clinical improvements, the use of naked porcine islets combined with immunosuppression has reported limited short-term clinical benefits. This discrepancy may be due to the lack of prior preclinical experiments showing efficacy in pig-to-non-human primate (NHP) transplantation settings. To address this, the International Xenotransplantation Association has mandated the need for efficacy and safety data from NHP studies, as outlined in 2009 and updated in 2016 consensus statements. Our research group has successfully met the rigorous preclinical criteria in NHPs, making us the only group to do so. Based on our preclinical results, we submitted an investigational new drug (IND) application for the first human clinical trial to the Korean Ministry of Food and Drug Safety (MFDS) in 2020. After extensive discussion and revisions, the clinical trial protocol was approved in December 2022. In this article, we present an overview of the clinical protocols and the process we went through to get the proposal approved. I hope that our experiences will be helpful for other scientists seeking to expedite similar human clinical trials of porcine islet xenotransplantation worldwide.

### RS2-2

#### Endoplasmic reticulum stress causes beta cell failure in monogenic and polygenic diabetes

Miriam Cnop

Universite Libre de Bruxelles, Belgium

Diabetes is a heterogeneous disorder, with diverse routes leading to pancreatic beta cell failure. Genetic and lifestyle factors play essential roles in polygenic diabetes. We identified endoplasmic reticulum (ER) stress as an important cellular response contributing to fatty acid-induced beta cell failure in type 2 diabetes. Saturated fatty acids impair ER-to-Golgi protein trafficking and induce signaling in the PERK branch of the ER stress response, thereby triggering beta cell demise.

Monogenic forms of diabetes are simpler systems, where a single loss-of-function mutation reveals a gene that is essential for beta cell development, function and/or survival. More than a dozen monogenic forms of diabetes have been described that are caused by mutations in genes of the ER and the ER stress response. Five pertain to the PERK branch, providing strong human genetic evidence for the importance of PERK signaling in maintaining beta cell integrity. In these diseases, dysregulated eIF2a phosphorylation and mRNA translation lead to beta cell demise. Three monogenic forms of diabetes are caused by perturbations in the ER-to-Golgi protein trafficking pathway. The differentiation of patients' induced pluripotent stem cells into beta cells provides an exciting disease-relevant model to study molecular mechanisms of beta cell failure and test beta cell protective therapies.

### RS2-3

#### Heterogeneity of islet cells during embryogenesis and differentiation

Takeshi Miyatsuka

Kitasato University, Japan

Glucagon-expressing pancreatic  $\alpha$  cells have attracted much attention for their plasticity to transdifferentiate into insulin-producing  $\beta$  cells; however, it remains unclear precisely when, and from where, alpha cells emerge and what regulates alpha-cell fate. We therefore explored the spatial and transcriptional heterogeneity of alpha-cell differentiation by a novel time-resolved reporter system, "Gcg-Timer," in which newly generated  $\alpha$  (early  $\alpha$ ) cells can be sorted by FACS separately from more differentiated  $\alpha$  cells.

Fluorescence imaging and flow cytometry demonstrated that green fluorescence-dominant cells were observed in Gcg-Timer mice at the embryonic and neonatal stages, but not after 1 week of age, suggesting that alpha-cell neogenesis occurs during embryogenesis and early neonatal stages under physiological condition. Transcriptome analysis of Gcg-Timer embryos revealed that the mRNAs related to angiogenesis were enriched in newly generated alpha cells. Histological analysis revealed that some newborn alpha cells arise close to the pancreatic ducts, whereas the others arise away from the ducts and adjacent to the blood vessels. Notably, when the glucagon signal was suppressed by genetic ablation or by chemicals, such as glucagon receptor antagonist, green-dominant cells emerged again in adult mice.

Cell therapies through  $\alpha$ -to- $\beta$  reprogramming has been one of our targets for generating surrogate  $\beta$  cells. We recently demonstrated that STAT3 suppression and  $\beta$ -cell ablation significantly enhanced the number of insulin-expressing cells derived from Pdx1-expressing  $\alpha$  cells. Furthermore, the suppression of glucagon signaling additively promoted  $\alpha$ -to- $\beta$  reprogramming induced by ectopically expressed Pdx1. Thus, recent advances in  $\alpha$ -cell biology uncovered the heterogeneity and plasticity of pancreatic  $\alpha$  cells. Further studies would be needed to efficiently and safely regulate  $\alpha$ -cell plasticity, which may lead to the establishment of cell therapies for curing diabetes.

### RS2-4

#### Role of mTORC1 in the regulation of pancreatic beta cell mass

Shun-ichiro Asahara

Kobe University, Japan

Pancreatic  $\beta$ -cell mass is regulated by a variety of factors, each of which is thought to regulate pancreatic  $\beta$ -cell mass in a complex manner. In particular, mTORC1, which is activated by insulin and amino acid signals, contributes significantly to the regulation of cell volume. mTORC1 activation

has been found to be enhanced in pancreatic beta cells from type 2 diabetes patients. We have previously reported that mTORC1 activation in mouse pancreatic  $\beta$ -cells transiently increases pancreatic  $\beta$ -cell mass and lowers blood glucose levels by enhancing insulin secretion, but induces increased apoptosis of pancreatic  $\beta$ -cells in old age via impaired autophagy and ER stress induction.

Recently, it has been revealed that dedifferentiation is important in the regulation of pancreatic  $\beta$ -cell mass, and it has attracted attention as one of the mechanisms in the pathogenesis of diabetes mellitus. We investigated whether dedifferentiation also occurs in islets of pancreatic  $\beta$ -cell-specific TSC2 knockout mice. We observed the appearance of amylase-positive cells and Ptf1a-positive cells, with characteristics of acinar cells in the islets, although the expression of markers of dedifferentiation was not elevated. Lineage-tracing revealed that these cells were derived from pancreatic  $\beta$ -cells, suggesting that increased mTORC1 activity induces the differentiation of pancreatic  $\beta$ -cells into acinar cells.

In this talk, I would like to outline how mTORC1 activation in pancreatic  $\beta$ -cells affects the regulation of pancreatic  $\beta$ -cell mass.

### RS3-1

#### Regulation of GPR92-mediated intercellular communication in islets

Dayoung Oh

UT Southwestern Medical Center, USA

The molecular mechanisms underlying obesity-induced increase in  $\beta$  cell mass, and the resulting  $\beta$  cell dysfunction need to be elucidated further. Our study revealed that GPR92, expressed in islet macrophages, is modulated by dietary interventions in metabolic tissues. Therefore, we aimed to define the role of GPR92 in islet inflammation by using high fat diet (HFD)-induced obese mouse model. GPR92 knockout mice exhibited glucose intolerance and reduced insulin level, despite the enlarged pancreatic islets, and increased islet macrophage content and inflammation level (compared to those in wild type mice). These results indicate that the lack of GPR92 in islet macrophages can cause  $\beta$  cell dysfunction, leading to disrupted glucose homeostasis. Alternatively, GPR92 agonist, farnesyl pyrophosphate stimulation results in the inhibition of HFD-induced islet inflammation and increased insulin secretion in WT mice, but not in GPR92 KO mice. Thus, our study suggests that GPR92 can be a potential target to alleviate  $\beta$  cell dysfunction via the inhibition of islet inflammation associated with the progression of diabetes.

### RS3-2

#### Hepatic glutamate-mediated steatosis and inflammation

Won-Il Jeong

KAIST, Korea

Diverse harmful effects such as chronic alcohol consumption and high calorie diet intake induce the development of steatotic liver disease (SLD), which is one of the most widespread liver diseases worldwide. Chronic alcohol consumption induces hepatic cysteine deficiency by generating reactive oxygen species (ROS) and subsequent glutathione depletion by impaired transsulfuration pathway. To compensate for glutathione shortage, hepatocytes turn on an alternative defense pathway, such as the xCT transporter. The antiporter xCT mediates the uptake of cystine coupled to the efflux of glutamate, leading to the production of an endocannabinoid 2-arachidonoylglycerol (2-AG) by activating metabotropic glutamate receptor 5 (mGluR5) in hepatic stellate cells (HSCs), which in turn stimulates CB<sub>1</sub>R-mediated *de novo* lipogenesis in neighboring hepatocytes. We conclude that a bidirectional signaling operates at a metabolic synapse between hepatocytes and HSCs through xCT-mediated glutamate-mGluR5 signaling to produce 2-AG, which induces CB<sub>1</sub>R-mediated alcoholic steatosis. Consistently, in obesity-mediated hypoxic stress, interferon (IFN)- $\gamma$  production by natural killer (NK) cells increases in white adipose tissue. However, the effects of obesity on NK cell IFN- $\gamma$  production remain obscure. Here, we show that hypoxia promotes xCT-mediated glutamate excretion and C-X-C motif chemokine ligand 12 (CXCL12) expression in white adipocytes, resulting in CXCR4<sup>+</sup> NK cell recruitment. Interestingly, this spatial proximity between adipocytes and NK cells induces IFN- $\gamma$  production in NK cells by stimulating mGluR5. IFN- $\gamma$  then triggers inflammatory activation of macrophages and augments xCT and CXCL12 expression in adipocytes, leading to the elevation of free fatty acids (FFAs) in

blood by lipolysis. Consequently, increased FFAs stimulate the production of pro-inflammatory cytokines in hepatic macrophages through the activation of toll-like receptor 4/NADPH oxidase 2, subsequently enhancing the development of non-alcoholic fatty liver disease. Together, bidirectional pathways between hepatocytes and HSCs and between adipocytes and NK cells could be important therapeutic targets in alcohol-associated and obesity-related liver disease.

### RS3-3

#### Intestinal FXR agonism modulates inter-organ crosstalk between intestine and adipose tissue to maintain glucose homeostasis

Sungsoon Fang

Yonsei University, Korea

The Farnesoid X receptor (FXR) is a bile acid receptor found in the intestine and liver. It is known to play a crucial role in maintaining glucose homeostasis and ameliorating various metabolic dysfunctions when activated through various means, including bariatric surgery (BS). Among these, intestinal-specific FXR signaling is notably recognized for its ability to alleviate diet-induced weight gain and inflammation. In this study, we administered a gut-specific FXR agonist (27c), previously reported to be effective in treating non-alcoholic fatty liver disease (NAFLD), to ob/ob mice via oral administration. We utilized single-cell RNA sequencing (scRNA-seq) to observe changes in the ileum and epididymal adipose tissue (eWAT). Our results demonstrated improved glucose homeostasis and a consistent reduction in the inflammatory response in both the ileum and eWAT. Furthermore, in the ileum, we observed an increase in the expression of Reg3g, known to be upregulated after BS. In eWAT, the expression of Cd44 decreased, and our investigation into the impact of reduced Cd44 expression involved intraperitoneal injection of Cd44 antibody into ob/ob mice, revealing improved glucose homeostasis. These findings suggest that the activation of gut-specific FXR signaling impacts the mitigation of metabolic dysfunction through the regulation of Reg3g and Cd44 expression.

### RS3-4

#### Selective hepatic insulin resistance is not selective; serotonergic regulation of hepatic insulin signaling

Hail Kim

KAIST, Korea

Insulin signaling is known to induce lipogenesis and suppress gluconeogenesis in the liver. During insulin resistance, hepatic lipogenesis is expected to decrease and gluconeogenesis to increase. However, hepatic lipogenesis does not decrease during insulin resistance, although hepatic gluconeogenesis increases as expected. The mechanism of this selective hepatic insulin resistance remains to be elucidated.

Serotonin (5-HT) has been shown to induce lipogenesis in the liver. However, the mechanism how 5-HT signaling engages insulin signaling has not been studied. In the present study, we investigated molecular mechanism how 5-HT regulates lipogenesis in the liver and its contribution to insulin signaling. 5-HT activates AKT phosphorylation through PI3K and intracellular calcium flux resulting in the activation of SREBP-1c. When the hepatic insulin signaling was inhibited by LIRKO or S-961 (insulin receptor antagonist), 5-HT induced AKT phosphorylation but insulin could not. In addition, 5-HT also phosphorylates CREB through HTR2B which was mediated by PKG, not by PKA and 5-HT injection could not induce CREB activation in L2BKO mice.

Taken together, 5-HT can increase hepatic lipogenesis when insulin signaling is weakened. This compensatory recovery of lipogenesis by 5-HT makes the insulin signaling appear to be selectively intact during insulin resistance.

### RS4-1

#### Diabetic vascular complications factsheet in Korea

Jin Hwa Kim

Chosun University, Korea

The global prevalence of diabetes, especially type 2 diabetes (T2DM), has reached epidemic proportions in the last few decades. The International Diabetes Federation reported in November 2019 that the number of adult diabetic patients reached 436 million worldwide, 90% of whom had type 2 diabetes.

Type 2 diabetes is a complex, chronic illness requiring continuous medical care with multifactorial risk-reduction strategies beyond glycemic control. T2DM has different complications, among which the most important are the vascular complications. Among individuals with T2DM, over two-thirds of deaths are caused by the cardiovascular complications. These complications include atherosclerosis, coronary artery disease, nephropathy, stroke, thromboembolism, peripheral vascular disease.

T2DM causes a variety of macrovascular complications through different pathogenetic pathways that include hyperglycaemia and insulin resistance. The central pathological mechanism in the development of the macrovascular complications is atherosclerosis, which leads to narrowing of arterial walls. Cardiovascular events constitute the greatest component of health care expenditures in patients with T2DM. Among the major macrovascular complications of T2DM is stroke. Of the several mechanistic stroke subtypes, individuals with T2DM are especially susceptible to the consequences of cerebral small vessel disease. Hyperglycaemia confers greater risk of stroke occurrence. This increased risk is often seen in individuals with T2DM and is associated with poorer clinical outcomes (including higher mortality), especially following ischaemic stroke.

In this presentation, I will discuss diabetic vascular complication factsheet in Korea. It will be help clinicians to manage patients with diabetes.

### RS4-2

#### Blood Flow-Induced Reprogramming of Endothelial cells (FIRE) in atherosclerosis

Hanjoong Jo

Emory University, USA

Atherosclerosis is the major underlying cause of myocardial infarction and stroke. It occurs preferentially in arterial regions exposed to disturbed flow (d-flow) by mechanisms involving broad changes in the expression of coding and non-coding genes. Using the partial carotid ligation model of atherosclerosis in mice and gene array and "bulk" RNA sequencing studies, we revealed the roles of flow-sensitive genes and microRNAs in endothelial dysfunction and atherosclerosis. Furthermore, these results showed that targeting mechanosensitive genes and "athero-miRs" provide a new treatment paradigm in atherosclerosis. Recently, we carried out single-cell (sc)RNAseq and scATACseq studies using the partial carotid ligation model of atherosclerosis. The single-cell study results and additional validation studies revealed that d-flow reprograms endothelial cells to proatherogenic phenotypes, including EndMT and endothelial-to-immune cell-like transition. The scRNAseq study revealed several novel flow-sensitive genes and pathways, further characterized to define how flow regulates endothelial reprogramming and atherosclerosis. We carried out additional comprehensive scRNAseq studies using the mouse partial carotid ligation model of atherosclerosis in a time-, d-flow-, hypercholesterolemia-, and the combined d-flow/hypercholesterolemia-dependent manner. The results demonstrate how each of arterial cells, ECs, SMCs, monocytes/macrophages, T cells, dendritic cells transdifferentiate and reprogram from healthy/normal cell types to plaque cell types. We also identified how each cell reprograms via specific transcriptome changes. I will discuss how those flow-sensitive genes and pathways that change as atherosclerosis develops could be explored as novel anti-atherogenic therapeutics.

### RS4-3

#### Novel concepts in the pathogenesis of diabetic vasculopathy

Junyeop Lee

University of Ulsan, Korea

All cells in our body have their given lifespan. Pericytes, which cover endothelial cells and stabilize the blood vessels, may also undergo dynamic replacements. Dysfunction and loss of pericytes are involved in the patho-

genesis of several diabetic vasculopathies. In this study, we evaluated how fast the pericytes disappear and how they fill their place again in diabetes. We have monitored a series of changes in retinal pericytes using the intravitreal imaging of PDGFR $\beta$ -creERT2:tdTomato mice. The number of PDGFR $\beta$ +pericytes was reduced over time, which was faster in diabetes than non-diabetic condition. About half of the retinal pericytes were lost within a month after diabetes induction. The PDGFR $\beta$ -/TAGLN+ cells remained and occupied where the PDGFR $\beta$ + pericytes were lost, which prevents the development of diabetic retinopathy. This presentation will discuss the underlying mechanisms of how pericytes show dynamic changes focusing on the role of endothelial Pdgfb and Angpt2. In summary, pericytes undergo dynamic replacements and are rapidly lost in diabetes, but other types of cells replace them, which is essential for maintaining normal blood vessels. Endothelial Pdgfb and Angpt2 are involved in the pericyte dynamics. The lack of pericyte replacement leads to the development of vascular diseases. We propose new concepts in the pathogenesis of diabetic vasculopathy, and thus enhancing proper pericyte recovery as a novel option for preventing and fundamental treatments of diabetic vasculopathy.

### RS5-1

#### Fatty liver & diabetes statics in Korea 2009-2017

Eugene Han

Keimyung University, Korea

Fatty liver disease is one of the most common metabolic liver disorders, with an estimated prevalence of ~30% in developed countries, and its incidence is expected to rise rapidly in the future as the rate of obesity increases, population age, and sedentary lifestyles prevail. The close association between fatty liver disease and type 2 diabetes (T2D) probably originates from the central role of the liver in glucose and lipid metabolism, independent of other risk factors such as hypertension, dyslipidemia, and chronic systematic inflammation. In this respect, verifying the current status of fatty liver disease and its association with T2D has important clinical relevance and public health implications. In this talk, I summarize the recent data from our study group investigation, the prevalence of fatty liver disease in both the general Korean population and individuals with T2D.

### RS5-2

#### Building a clinical care pathway for diabetes and NAFLD

Terry Cheuk-Fung Yip

The Chinese University of Hong Kong, China

Paralleled by the increasing global prevalence of type 2 diabetes (T2D) and obesity, non-alcoholic fatty liver disease (NAFLD), recently renamed metabolic-associated fatty liver disease (MAFLD)/metabolic dysfunction-associated steatotic liver disease (MASLD), is currently affecting over 30% of the Asian adult population. While most patients with NAFLD have simple steatosis, some can develop non-alcoholic steatohepatitis, which can lead to progressive liver disease and cirrhosis. T2D is an important risk factor for developing NAFLD, non-alcoholic steatohepatitis, and clinically significant fibrosis. Hence, the field of Hepatology is devoted to identifying patients with advanced liver disease among patients with T2D. Recently, the American Gastroenterology Association proposed a clinical care pathway for the risk stratification and management of patients with NAFLD. They suggested screening all patients with T2D. Serum-based non-invasive test for fibrosis by FIB-4 was proposed as the first screening step. FIB-4 <1.3 has a high negative predictive value to exclude patients with a low risk of advanced fibrosis. Patients with high FIB-4 of >2.67 are at high risk for advanced fibrosis, while those in the grey zone should receive a specialized test to examine their risk of advanced fibrosis. Despite the clearly-defined 2-tier process by multidisciplinary experts, some issues remain. To allow clinicians to care for a rapidly growing population of patients, automation of fibrosis score calculation may be necessary. A recent randomized study suggested that automated fibrosis score calculation and electronic reminder messages can increase the referral of patients with type 2 diabetes and abnormal fibrosis scores in non-hepatology settings. On the other hand, previous studies suggested that FIB-4 is less accurate among patients with T2D due to different patient populations and clinical characteristics. Specialized tests such as FibroMeter or transient elastography may be needed as the first screening step in certain patient subgroups.

### RS5-3

#### Drug screening strategies using the zebrafish model for NAFLD

Ji Hee Yu

Korea University, Korea

Nonalcoholic fatty liver disease (NAFLD) is the most prevalent liver disease worldwide. NAFLD is a hepatic manifestation of metabolic syndrome, and its incidence has risen worldwide with the increased global prevalence of obesity. NAFLD can gradually deteriorate from simple liver steatosis, inflammation, and fibrosis to liver cirrhosis and/or hepatocellular carcinoma. Weight loss with diet or bariatric surgery effectively treats NAFLD, but drugs specifically approved for NAFLD are not available. Over the last decade, rodent studies have yielded an impressive list of molecules associated with NAFLD and non-alcoholic steatohepatitis (NASH) pathogenesis. However, the identification of currently unknown metabolic factors using mammalian model organisms is inefficient and expensive compared with studies using fish models. Zebrafish have now emerged as a powerful pre-clinical model for human disease, as their disease characteristics, etiology and progression, and molecular mechanisms are clinically relevant and highly conserved. The zebrafish has become a prominent vertebrate model for disease and has already contributed to several examples of successful phenotype-based drug discovery. Recent studies have begun to establish the capabilities of zebrafish for disease modelling, drug screening, target identification, pharmacology, and toxicology. These easily manipulated organisms have been used to great advantage to evaluate the therapeutic effectiveness of various chemical compounds for the treatment of NAFLD. Here, we discuss how zebrafish is an important model for drug evaluation and discovery for NAFLD. The use of small fish in identifying novel potential therapeutic agents for the treatment of NAFLD is also addressed.

### RS5-4

#### Maladaptive regeneration - the reawakening of developmental pathways in the obese liver

Utpal Pajvani

Columbia University, USA

With the rapid expansion of the obesity epidemic, nonalcoholic fatty liver disease (NAFLD) is now the most common chronic liver disease, with almost 25% global prevalence. NAFLD ranges in severity from simple steatosis, a benign 'pre-disease' state, to the liver injury and inflammation that characterize nonalcoholic steatohepatitis (NASH), which in turn predisposes individuals to liver fibrosis. Fibrosis is the major determinant of clinical outcomes in patients with NASH, and it is associated with increased risks of cirrhosis and hepatocellular carcinoma. NASH has no approved therapies, and liver fibrosis shows poor response to existing pharmacotherapy, in part due to an incomplete understanding of underlying pathophysiology. Patient and mouse data have shown that NASH is associated with activation of developmental pathways: Notch, Hedgehog and Hippo-YAP-TAZ. Although these evolutionarily conserved fundamental signals are known to determine liver morphogenesis during development, new data have shown a coordinated and causal role for these pathways in the liver injury response, which becomes maladaptive during obesity-associated chronic liver disease. In this lecture, we discuss the etiology of this reactivation of developmental pathways and review the cell-autonomous and cell-non-autonomous mechanisms by which developmental pathways influence disease progression. Finally, we discuss the potential prognostic and therapeutic implications of these data for NASH and liver fibrosis.

### RS6-1

#### Methods for constructing polygenic risk scores

Wonil Chung

Soongsil University, Korea

Predicting individual traits and diseases from genetic variants is critical to fulfilling the promise of personalized medicine. The genetic variants from genome-wide association studies (GWAS), including variants well below GWAS significance, can be accumulated into highly significant predictions across a wide range of complex traits and diseases. The recent arrival of large-sample public biobanks enables highly accurate polygenic prediction based on genetic variants across the whole genome. Various statistical methodologies and diverse computational tools have been introduced and developed for computing polygenic risk scores (PRS) more accurately.

However, many researchers utilize PRS tools without a thorough understanding of the underlying model and how to specify the parameters for optimal performance. It is advantageous to study the statistical models implemented in the computation tools for PRS estimation and the formula of parameters to be specified. I will give a talk about a variety of recent statistical methodologies and computational tools for PRS computation.

## RS6-2

### Polygenic risk scores for diabetes and related complications

Jae-Seung Yun

The Catholic University of Korea, Korea

Most common chronic diseases are polygenic, involving thousands of variants, and are characterized by their modest individual effects. Polygenic Risk Scores (PRS) are calculated from the cumulative genetic risk contribution of known variants and provide estimates of an individual's susceptibility to a specific disease based on their genetic makeup. The power of PRS has increased due to larger GWAS sample sizes and advanced computational algorithms, surpassing classical genetic risk scores. PRS can be used to construct polygenic risk scores that identify clinically meaningful genetic subtypes for diseases and predict responses to treatment. To date, PRS has been implemented in numerous cardiovascular diseases, diabetes, neuropsychiatric disorders, and ophthalmic conditions, with individuals at the extreme ends of PRS distribution showing significantly elevated disease risk. Clinical applications of PRS for diabetes complications and treatment response are highly anticipated. In the ACCORD study, PRS was employed to differentiate subtypes with treatment response efficacy, while the ADVANCE study used a multi-PRS, combining 10 PRS, including albuminuria, to predict the risk of cardiovascular mortality. In this discussion, we aim to review research findings related to PRS associated with diabetes and its complications.

## RS6-3

### Risk prediction with polygenic risk score and updates from commercial genome-wide scans

Sungho Won

Seoul National University, Korea

Predicting disease risks is a crucial component of personalized medicine, encompassing early disease detection, prevention, and targeted interventions. The Polygenic Risk Score (PRS) has emerged as the standard metric for quantifying genetic susceptibility in risk prediction. PRS is calculated using single-nucleotide polymorphisms (SNPs), identified for their genetic risk factors through genome-wide association studies (GWAS). The score is a weighted sum of these SNPs, with the weights determined by their effect sizes as derived from GWAS findings.

PRS has proven useful in risk assessment for a variety of common diseases, including cancer, coronary artery disease, obesity, and diabetes, as well as for non-disease traits like clinical biomarkers. Such applications have shown that PRS can identify high-risk subgroups for these diseases and offer insights into modifiable risk factors that influence health outcomes. Recently, commercial internet-based companies have begun offering genome-wide scans that employ PRS to predict the risk of common diseases. These risk estimates are continually updated as new genetic discoveries are made. In this presentation, I will review the accuracy of risk prediction methods employed by commercial companies and discuss the clinical implications of their results.

## RS6-4

### Issues in identifying monogenic diabetes

Toni I. Pollin

University of Maryland, USA

Monogenic diabetes (including so-called maturity-onset diabetes of the young [MODY], neonatal diabetes, and syndromic forms) comprises approximately 1/250 diabetes mellitus cases. Distinguishing monogenic diabetes from type 1 (T1D) and type 2 diabetes (T2D) often demonstrably improves glucose control and quality of life by enabling replacement of in-

vasive insulin treatment and/or ineffective oral treatment with less invasive and more efficacious etiology-based oral treatment (e.g., sulfonylureas for *HNF1A*-MODY and *HNF4A*-MODY caused by variants in genes encoding pancreatic beta cell nuclear transcription factors) or even no treatment (for *GCK*-MODY/hyperglycemia caused by variants in the gene encoding glucokinase) for patients and their affected family members. Next generation sequencing is improving the feasibility and cost-effectiveness of genetic testing including for monogenic diabetes. However, issues remain in identifying individuals with monogenic diabetes due limited awareness, clinical overlap with other diabetes types, genetic heterogeneity, and challenges in assessing the pathogenicity of rare variants. To address this last challenge, pooling of both case-level data and interdisciplinary expertise is needed along with standardized processes and centralized documentation. The international 65+ member ClinGen Monogenic Diabetes Expert Panels (MDEP VCEP), funded by the U.S. National Institute of Child Health and Human Development (NICHD) of the NIH, was convened in 2017 and later expanded to include a Gene Curation Expert Panel (GCEP). To date, MDEP has developed gene-specific criteria and deposited over 400 U.S. Food and Drug Administration (FDA)-approved pathogenicity curations of *HNF1A*, *HNF4A*, and *GCK* variants into the ClinVar and ClinGen databases and 17 gene-disease validity curations into ClinGen. Expansion of both scope and number of genes and variants is currently in progress. These resources are improving the standardization, completeness, accuracy and applicability of genetic testing for monogenic diabetes. MDEP is also promoting worldwide collaborations to maximize the identification, molecular diagnosis, and access to individualized management for people with monogenic diabetes.

## RS7-1

### Empowering diabetes management: leveraging patient-driven lifestyle modification with isCGM and the SEOUL Algorithm

Hun Jee Choe

Hallym University, Korea

We recently investigated the impact of patient-driven lifestyle modification on patients with type 2 diabetes using intermittently scanned continuous glucose monitoring (isCGM). Although CGM has been a significant advancement in diabetes management, its use is hindered by the burden of overloading information for physicians and the cumulative CGM metrics becoming outdated by the time the patient visits the outpatient clinic. Our aim was to shift the paradigm from physician-driven to a data-based, patient-driven lifestyle modification, enabling patients to personalize nutrition therapy based on individual postprandial glycemic response.

This study was the first multicenter, 12-week open-label randomized controlled trial with 126 participants randomized to the intervention or control group. The intervention group received isCGM and structured education using the "Self-Evaluation Of Unhealthy foods by Looking at postprandial glucose (SEOUL)" algorithm, while the control group received standard care with blood glucose monitoring.

Our findings suggest that the patient-driven lifestyle modification using isCGM was effective in safely lowering HbA1c levels in patients with type 2 diabetes. Additionally, we observed significant improvements in self-management of diabetes and a decrease in fasting blood glucose and body weight reduction in the intervention group compared to the control group. This approach can lead to improved glycemic control, making it an essential addition to the tools available for managing T2D.

The SEOUL algorithm is a simple, intuitive, and patient-centered approach that enables patients with type2 diabetes to personalize nutrition therapy based on individual postprandial glycemic response. In this lecture, I will introduce the SEOUL algorithm and explain how it can be applied in patients with T2D using isCGM who have not attained optimal glycemic control.

## RS7-2

### T2DM with MDI and premixed insulin: results from the FreEdoM-2 trial

Sang-Man Jin

Sungkyunkwan University, Korea

Numerous randomized controlled trials (RCTs) in people with type 1 diabetes (T1D) have consistently proven the advantages of personal continuous glucose monitoring (CGM), in terms of either lowering HbA1c levels or minimizing hypoglycemia. The benefit was consistent regardless of the

baseline HbA1c, with almost no exception if adequate education was provided during the study period.

Although an RCT conducted in individuals with type 2 diabetes (T2D) receiving multiple daily injections (MDI) reported similar benefit of personal CGM, both the intervention and control group checked minimum four times a day of fingerstick BGM in the study. Although the benefit of stand-alone CGM is well-established in individuals with T1D and even in individuals with T2D who do not use prandial insulin, RCTs which explored the benefit of stand-alone CGM in individuals with T2D who use MDI failed to demonstrate consistent results. For example, Haak et al. assessed the efficacy of stand-alone intermittently scanned CGM (isCGM) to replace BGM, but found no HbA1c reduction. Although another RCT by Yaron M et al. showed a greater reduction of HbA1c with stand-alone isCGM as a secondary outcome, the primary endpoint of the study, patient satisfaction, was not met during the trial. At least in part, these inconsistent results may be attributable to the difference in the quality of education for interpretation of CGM. In fact, we recently showed that a structured education program on adjustment of insulin dosage and timing according to the graphical patterns of CGM was a requisite for sustained benefit of real-time CGM in people with T1D on MDI. In this talk, I will present the research context and results of the FreEdom-2 trial, which was designed to determine whether structured education program on adjustment of insulin dosage and timing is required for the benefit of CGM also in individuals with T2D.

### RS7-3

#### **Automated Insulin Delivery (AID): the first RCT evidence in Koreans**

Jun Sung Moon

Yeungnam University, Korea

While automated insulin delivery (AID) systems are evolving to support safe and effective glycaemic control, the use of hybrid closed-loop (HCL) AIDs is limited in Korea. The EOPatch pump is the first tubeless patch pump developed by EOFLOW (Republic of Korea) and we evaluated the efficacy and safety of EOPatch X, a HCL AID based on TypeZero's inControl closed-loop algorithms, compared with a sensor-augmented tubeless patch pump called EOPatch M. In this multi-centre, randomised, open-label, parallel, pivotal clinical trial, adults aged 19-69 years with type 1 diabetes were randomised 1:1 to receive treatment with EOPatch X (HCL AID, intervention group) or EOPatch M (sensor-augmented pump, control group) for 12 weeks. The primary outcome was the percentage of time that blood glucose levels were between 70 and 180 mg/dL (time in range (TIR)), as measured by continuous glucose monitoring.

Today, I will present the key findings of this novel study and discuss the clinical implications for the use of HCL AID in Korea.

### RS7-4

#### **Individualized nutrition using CGM and Artificial Intelligence**

Sun Joon Moon

Sungkyunkwan University, Korea

Since the introduction of continuous glucose monitoring (CGM), the landscape of diabetes care has undergone significant transformation. Particularly in nutrition therapy, CGM has proven to be a potent tool for influencing patient eating behaviors. This lecture will delve into the clinical evidence regarding how CGM usage can impact glycemic control in patients. Moreover, evidence suggests that solely relying on carbohydrates does not suffice to predict post-prandial glycemic response (PPGR) as revealed by CGM. As a result, we have developed machine learning algorithms that more accurately predict PPGR in individuals with diabetes, which will also be a focal point of discussion.

**SS1-1****Early treatment of T2DM patients considering cardiorenal function**

Sung Hoon Yu

Hanyang University, Korea

The prevalence of obesity in South Korea has increased significantly over the past decade.

This increase is directly linked to the rising incidence of type 2 diabetes mellitus (T2DM), especially in younger people. They often have poor glycemic control at the time of diagnosis and are at higher risk of complications. While cardiovascular disease has traditionally been recognized as the leading cause of death in diabetes, the trend is changing. Heart failure (HF) and chronic kidney disease (CKD) are now emerging as the most common conditions among people with type 2 diabetes.

In addition, T2DM treatment guidelines have evolved to a more patient-centered approach that takes into account comorbidities and complications. Combination therapy with SGLT-2 inhibitors and DPP-4 inhibitors has the potential to provide cardiovascular and renal protection through complementary pathways in patients with T2DM.

In conclusion, early and comprehensive management of T2DM, with a particular focus on cardiac and renal function, should be prioritized. This approach is critical to mitigate complications, improve patient outcomes, and ultimately reduce healthcare costs.

**SS1-2****What's new in drug treatment of diabetes**

Mi Kyung Kim

Keimyung University, Korea

In South Korea, in the early 2000s, monotherapy accounted for over 50% of diabetes treatment prescriptions. However, the trend shifted over time towards using two or more medications in combination. Since 2010, drugs involving combination therapy exceeded 60%, and in 2016, combination therapy was seen in over 70% of cases, with three-drug combination therapy occurring in over a quarter of patients.

Due to the relatively low control rate of diabetes compared to other chronic conditions, combination therapy in the early stages of diabetes is emphasized. Among the numerous diabetes medications, the combination prescription of DPP-4 Inhibitors and SGLT-2 Inhibitors complement each other regarding their mechanisms. SGLT-2 Inhibitors increase urinary glucose excretion, reducing glucose toxicity and plasma volume. They also activate beta-cells in the pancreas and decrease insulin resistance. In contrast, DPP-4 increases insulin secretion through the incretin hormone effect and also helps reduce oxidative stress in the kidneys and blood vessels. DPP-4 Inhibitors, unlike SGLT-2 Inhibitors, decrease the secretion of glucagon and glucose, allowing the two drugs to complement each other. Based on recent clinical trials, this session will review the efficacy of the combination treatment of DPP-4 inhibitor and SGLT-2 inhibitor.

**SS2-1****Expanding the option of SGLT2 inhibitor and DPP4 inhibitor**

Dughyun Choi

Soonchunhyang University, Korea

Sodium-glucose cotransporter-2 inhibitors (SGLT2is) and dipeptidyl peptidase-4 inhibitors (DPP4is) are anti-hyperglycemic drugs, each with a distinct mechanism of action for controlling hyperglycemia. Using both classes of drugs together promises beneficial results for patients with type 2 diabetes. SGLT2is have unique mechanism that regulates blood sugar by excreting sugar through urine. This not only shows positive results for cardiovascular diseases but also helps prevent the worsening of heart failure and chronic kidney disease. Moreover, this drug offers a relative advantage in weight control for diabetic patients, as emphasized in international guidelines. DPP4is work by exhibiting an incretin effect. They are drugs with minimized side effects, such as hypoglycemia and discomfort during administration, and they aid insulin secretion by preserving pancreatic function. In this sponsored session, I will discuss how the combination of SGLT2i, dapagliflozin, and DPP4i, sitagliptin, can assist in controlling blood sugar levels and managing complications in patients with type 2 diabetes.

**SS2-2****The effects of TZD and combination therapy with DPP4i**

Da Young Lee

Korea University, Korea

Diabetes mellitus remains a significant global health concern, necessitating innovative approaches to enhance glycemic control and reduce associated complications. Currently, there is potential for various combinations targeting a wide range of pathophysiological factors among different classes of antihyperglycemic agents.

Thiazolidinediones (TZD) have garnered recognition for their capacity to enhance insulin sensitivity in the liver, adipose tissue, and skeletal muscle. Conversely, Dipeptidyl Peptidase-4 Inhibitors (DPP4i) exert their effects by augmenting the incretin pathway. Consequently, the combination of TZD and DPP4i is anticipated to possess synergistic potential in diabetes management.

I would like to present findings from several clinical trials that underscore the remarkable advantages of TZD and DPP4i combination therapy. In the group receiving the initial combination of metformin, sitagliptin, and lobeglitazone, significant improvements were observed in insulin sensitivity,  $\beta$ -cell function, and albuminuria in comparison to conventional stepwise therapy based on metformin and glimepiride. In a Phase 3 study comparing metformin + sitagliptin + lobeglitazone versus metformin + sitagliptin + placebo, the results indicate that the lobeglitazone group exhibited enhanced insulin sensitivity, preserved  $\beta$ -cell function, optimized lipid profiles, and superior glycemic control.

In conclusion, TZD and DPP4i combination therapy offer a comprehensive approach to diabetes management, holding promise for more effective and holistic strategies in the future.

**SS3-1****Holistic approach of T2D management - Cardiorenal outcome of Forxiga**

Jae-Han Jeon

Kyungpook National University, Korea

Dapagliflozin is a sodium-glucose cotransporter 2 (SGLT2) inhibitor that has gained significant attention in recent years for its potential cardiorenal benefits. This abstract provides a concise overview of the cardiorenal outcomes associated with dapagliflozin based on current research and clinical trials. Numerous clinical studies have demonstrated the efficacy of dapagliflozin in improving cardiovascular and renal outcomes in patients with type 2 diabetes mellitus and high cardiovascular risk. These trials have shown a significant reduction in major adverse cardiovascular events, heart failure hospitalizations, and renal decline among dapagliflozin-treated patients when compared to placebo or other antidiabetic agents. Additionally, dapagliflozin has been shown to reduce blood pressure and body weight, factors that are closely related to cardiovascular health. Its mechanism of action, which involves promoting glycosuria and natriuresis, contributes to its favorable effects on the cardiorenal system. In conclusion, dapagliflozin represents a promising therapeutic option for individuals with type 2 diabetes at risk of cardiorenal complications. Its ability to improve cardiovascular and renal outcomes, along with its favorable effects on blood pressure and body weight, positions dapagliflozin as an important addition to the treatment armamentarium for patients with cardiometabolic diseases.

**SS3-2****Promising approach for the management of T2DM with the combination of DPP4 inhibitors and SGLT2 inhibitors**

Soo Heon Kwak

Seoul National University, Korea

The management of Type 2 Diabetes Mellitus (T2DM) often necessitates a multifaceted approach to effectively control glycemic levels and manage associated risks. Dapagliflozin, when combined with sitagliptin, demonstrated a reduction in HbA1c levels and maintained glycemic control over a 48-week period, irrespective of concurrent metformin use. The addition of dapagliflozin to sitagliptin (with or without metformin) revealed benefits extending beyond glycemic control, including a notable reduction in body weight. The combination of dapagliflozin and sitagliptin, with or without metformin, was generally well-tolerated, exhibiting low rates of treatment discontinuation. The Dapa/Sita fixed-dose combination demonstrated

bioequivalence with the co-administration of individual tablets. Furthermore, the Dapa/Sita fixed-dose combination has been licensed in Korea to enhance glycemic control in patients with T2D.

### SS4-1

#### Use of continuous glucose monitoring in insulin-treated patients with type 2 diabetes

Ramzi A. Ajjan

University of Leeds, UK

Reducing glucose levels in diabetes has been shown to prevent microvascular complications and long-term macrovascular disease. However, reducing glucose levels in diabetes can be challenging, particularly in insulin users. A number of studies have shown that the use of technology, in the form of continuous glucose monitoring (CGM), improves glycaemic outcomes in type 1 diabetes (T1D), including lowering high glucose while also minimizing hypoglycaemia and limiting glucose variability. This has led to a significant increase in CGM use in T1D but the uptake in T2D has been much slower.

The current presentation will review the most recent data on CGM use in type 2 diabetes (T2D) including the effects on both hyperglycaemia and hypoglycaemia. Moreover, it is not only glycaemia that is affected by the use of technology, as quality of life measures can also improve, which can potentially help in the long-run with patient engagement. The presentation will be supplemented with real life cases to illustrate the benefits of CGM in people with T2D.

The overall aim of is to provide the audience with the latest evidence on CGM use in T2D. While it is currently not possible to advocate CGM use for all individuals with T2D, given financial health constraints, an attempt will be made to suggest a pragmatic approach for the measured expansion in using this technology. This can be achieved by prioritizing higher risk T2D groups and in whom the benefits are likely to outweigh the additional expenditure, making CGM a cost-effective strategy.

### SS4-2

#### The SEOUL algorithm for managing type 2 diabetes: the PDF Study

Jong Chul Won

Inje University, Korea

Advances in continuous glucose monitoring (CGM) have revolutionized glucose monitoring and diabetes care in patients with type 2 diabetes (T2D). However, the use of continuous information from CGM is challenging for both physicians and patients. The implementation of CGM could shift the paradigm for achieving better glycemic control from physician-driven to patient-driven lifestyle modification. The Patient-Driven lifestyle modification using FreeStyle Libre in patients with T2D (PDF) Study is the first multicenter, randomized, controlled trial comparing the effects of an intermittently scanned CGM (isCGM) adopting the Self-Evaluation Of Unhealthy foods by Looking at postprandial glucose (SEOUL) algorithm in the standard care of 135 patients with T2D who have not achieved optimal glycemic control. This study showed that personalized nutrition therapy with self-feedback using the SEOUL algorithm based on the postprandial glycemic response led to better improvements in HbA1c (-0.5%), self-management of diabetes (i.e., SDSCA-K score), fasting blood glucose, and reduction of body weight compared with the control group. The SEOUL algorithm, which provided positive feedback to the isCGM group, is a simple 2x2 table consisting of a row describing the patient's perception of the nutritional value of food and a column with the actual postprandial glucose value from the CGM. The isCGM group received instructions to choose their next food based on the results of the isCGM, and they used the SEOUL algorithm to identify optimal foods for glycemic control. Therefore, adherence to an individualized healthy meal plan using the SEOUL algorithm is beneficial for optimal self-management of diabetes care.

### SS5-1

#### Treating T2D patients with empagliflozin, considering heart failure

Jae Hyun Bae

Korea University, Korea

People with type 2 diabetes face an elevated risk of developing heart failure, not only from diabetes itself but also due to accompanying cardiovascular (CV) risk factors. This risk is particularly pronounced when they have chronic kidney disease (CKD). Recent approaches to diabetes management have centered on a therapeutic strategy considering the cardio-renal-metabolic perspectives of the disease. Sodium-glucose cotransporter 2 (SGLT2) inhibitors, a novel class of antidiabetic drugs, function by inhibiting glucose reabsorption in the kidneys, thereby reducing blood glucose levels. In CV outcome trials, SGLT2 inhibitors have demonstrated cardioprotective and renoprotective effects. Consequently, SGLT2 inhibitors are now strongly recommended in individuals with type 2 diabetes, especially those who also have atherosclerotic cardiovascular disease, heart failure (HF), or CKD. People with type 2 diabetes are at an increased risk of both HF with reduced ejection fraction and HF with preserved ejection fraction. Empagliflozin, an SGLT2 inhibitor, has garnered substantial evidence supporting its use in both primary and secondary prevention of hospitalization for HF. These benefits have been demonstrated in clinical trials and real-world studies. Based on these findings, clinical guidelines emphasize the prioritized use of SGLT2 inhibitors across all stages of heart failure. SGLT2 inhibitors are poised to continue playing a significant role in the treatment of type 2 diabetes patients, particularly in reducing the risk of heart failure. These medications have become a cornerstone in diabetes management, aligning with the evolving approach that recognizes the intricate relationship between cardiovascular, renal, and metabolic factors in the context of diabetes.

### SS5-2

#### Importance of early intervention for CRM

Mi Hae Seo

Soonchunhyang University, Korea

Cardiorenal metabolism, the complex interplay between the heart and kidneys, plays a pivotal role in complication of type 2 diabetes. Also, With the systemic effects of Type 2 Diabetes (T2D) contributing significantly to the progression of both heart and kidney diseases, understanding this relationship becomes increasing.

T2D introduces a cascade of metabolic alterations that exert deleterious effects on both cardiac and renal functions. Hyperglycemia, oxidative stress, and inflammation associated with T2D impair vascular function, lead to glomerular filtration rate decline, and enhance cardiac workload.

Recent data has addressed the effectiveness of pharmacologic interventions. A notable finding relates to an SGLT2 inhibitor. Clinical studies have indicated that Empagliflozin substantially reduced HbA1c levels, effected favorable changes in body weight, and cardio-renal metabolic effect.

In addition, emerging evidence suggests that SGLT2 inhibitor specifically Empagliflozin, exerts effects in cardio-renal protection, in particular heart failure and chronic kidney disease.

This lecture delves into the cardiorenal-metabolic benefits of SGLT2inhibitor for enhancing cardio-renal outcomes in T2DM patients.

### SS6-1

#### Why GLP-1 therapy is important from pathophysiological perspective of T2D

Michael A Nauck

St. Josef Hospital, Ruhr University Bochum, Germany

Type 2 diabetes is a chronic metabolic disorder with complex pathogenesis and poorly controlled diabetes leads to increased risk of developing diabetes-related complications. Incretin-based therapies have beneficial effects by restoring multiple pathophysiological defects of diabetes mellitus. Clinical research conducted over the past 30 years has established glucagon-like peptide-1 (GLP-1) receptor agonists as a widely recommended class of glucose-lowering agents. More recently developed agents, in particular semaglutide in both the oral and subcutaneous form, are characterized by greater efficacy with respect to lowering plasma glucose as well as body weight with cardiovascular (CV) safety outcome. Furthermore, GLP-

1 RAs have the potential for future development and growing impact for treating type 2 diabetes.

## SS6-2

### How to integrate GLP-1RA into clinical practice

Nam Hoon Kim

Korea University, Korea

GLP-1 receptor agonists (GLP-1RAs) play a significant role in the management of type 2 diabetes. These medications are a class of drugs that mimic the action of glucagon-like peptide-1 (GLP-1), a hormone produced in the gut that regulates blood sugar levels. GLP-1RAs enhance glucose-dependent insulin secretion from pancreatic beta cells. Some GLP-1RAs have been shown to provide cardiovascular benefits. They can reduce the risk of major adverse cardiovascular events (MACE), including heart attack and stroke, in individuals with established cardiovascular disease. Certain GLP-1RAs have demonstrated renal benefits, including reducing the progression of diabetic kidney disease and lowering the risk of adverse renal outcomes. Some research suggests that GLP-1RAs may have the potential to modify the course of type 2 diabetes by preserving beta cell function and reducing insulin resistance. It's important to note that GLP-1RAs are not suitable for all individuals with type 2 diabetes, and their use should be tailored to each patient's specific needs, medical history, and preferences. They are typically prescribed when lifestyle modifications and other oral medications are not achieving adequate blood sugar control. Additionally, healthcare providers need to consider factors such as cost, patient acceptance of injections, and potential side effects when recommending GLP-1RAs.

### BS1

#### Treatment of T2D patients considering renal function

Ja Young Jeon

Ajou University, Korea

Type 2 diabetes causes damage to various organs, leading to complications and comorbidities such as chronic kidney disease. T2D has become an increasingly frequent cause of kidney disease. SGLT2 inhibitors promote urinary glucose excretion by blocking SGLT2 and reduce blood glucose levels. SGLT2 inhibitors also lowers blood pressure and occurs weight loss because SGLT2 inhibitors excrete sodium and water along with glucose. Due to this unique mechanisms of action, SGLT2 inhibitors has shown beneficial effects in chronic kidney disease in large randomized controlled clinical trials, expanding indications for the treatment of these diseases even in non-diabetic people. KDIGO 2023 guideline recommend treating patients with type 2 diabetes, CKD, and an eGFR  $\geq 20$  ml/min per 1.73 m<sup>2</sup> with a SGLT2i. In the consistent context, ADA recommends SGLT2i with proven benefit is used as for purpose of "holistic person-centered care" given its Cardio-Renal-Metabolic benefit. In this session, we will explore the clinical evidence of empagliflozin of slowing the decline of eGFR vs placebo and CVOT results of empagliflozin in patients with T2DM, eCVD and CKD.

### BS2

#### Q-Tern, SGLT2 inhibitor + DPP4 inhibitor combination therapy: efficacy, safety and patients compliance

Yong-ho Lee

Yonsei University, Korea

This lecture will provide an overview of the clinical impacts of saxagliptin and dapagliflozin, two distinct classes of antidiabetic agents on the management of individuals with type 2 diabetes (T2D). It will explore their individual benefits as DPP4 inhibitors (DPP4i) and SGLT2 inhibitors (SGLT2i) and highlight the emerging evidence supporting the combined use of these agents in the management of T2D. Furthermore, this lecture will offer insights into their complementary mechanism and completed clinical trials evaluating the safety and efficacy of saxagliptin and dapagliflozin, either as monotherapies or in combination, with a focus on their potential to improve glycemic control, reduce cardiovascular or renal risks, and enhance overall patient outcomes. The synthesis of clinical data and findings presented in this lecture underscores the importance of a multi-pronged approach in diabetes management and the promising role that saxagliptin and dapagliflozin may play in achieving these goals. It serves as a valuable resource for medical professionals seeking to optimize diabetes treatment strategies and improve patient care.

### BS3

#### How to find optimal combination therapy for patients with type 2 diabetes

Kyung Ae Lee

Jeonbuk National University, Korea

Type 2 diabetes (T2DM) presents a complex metabolic and cardiovascular disorder characterized by multiple pathophysiologic abnormalities. One potential strategy for improving glycemic control achievement and maintenance involves early introduction of combination therapy with two or more glucose-lowering agents with complementary mechanisms of action. Early glycemic control is associated with a long-lasting "legacy" effect that reduces later complications. Therefore, recent guidelines for T2DM recommend early combination therapy to effectively control blood sugar levels and minimize treatment failure.

Dipeptidyl peptidase-4 (DPP4) inhibitors are widely used oral anti-diabetic medications and are known for their glucose-lowering efficacy through glucose-dependent insulin secretion and excellent safety profile. Concurrently, sodium-glucose co-transporter 2 (SGLT2) inhibitors have gained popularity due to their insulin-independent glucose-lowering effects as well as their benefits in weight loss, cardiovascular risk reduction, and kidney protection. In this context, combination therapy involving DPP4 inhibitors and SGLT2 inhibitors holds promise for synergistic effects in terms of control of blood sugar and reduction of side effects of each drug.

In this presentation, I will discuss the optimal combination therapy for patients with T2DM focusing on sitagliptin, a DPP4 inhibitor with the longest clinical experience and widest indications.

### BS4

#### What should we consider when choosing DPP-4 inhibitors for elderly patients?

Chang Hee Jung

University of Ulsan, Korea

As life expectancy continues to increase and the average age of individuals with diabetes rises, there are several important considerations in diabetes management that are becoming increasingly relevant. In particular, the occurrence of hypoglycemia can have potentially fatal consequences, especially in elderly diabetic patients. Therefore, when selecting diabetes treatment options for elderly diabetic patients, we must prioritize this aspect. Furthermore, elderly diabetic patients may be concurrently taking various medications for different underlying conditions, making it imperative to carefully consider drug interactions when choosing medications.

In this session, I aim to introduce the key factors to bear in mind when treating elderly diabetic patients, with a focus on alogliptin, one of the DPP4 inhibitors. Additionally, I will highlight the advantages that alogliptin offers from this perspective.

### BS5

#### Cutting edge care of pitavastatin with ezetimibe combination therapy

Young Sang Lyu

Chosun University, Korea

The management of dyslipidemia, characterized by elevated levels of low-density lipoprotein cholesterol (LDL-C), remains a cornerstone in preventing cardiovascular diseases. Statins, a class of drugs that inhibit cholesterol synthesis, have demonstrated remarkable efficacy in reducing LDL-C levels and cardiovascular risk. However, there exists a subset of patients who do not achieve optimal lipid control with statin therapy alone, necessitating the need for additional therapeutic strategies. This has led to the exploration of combination therapies, with the combination of statins and ezetimibe emerging as a promising approach.

New-onset diabetes mellitus (NODM) is a significant concern associated with statin therapy, particularly in patients with dyslipidemia. Several large-scale clinical trials and observational studies have investigated the relationship between statins and NODM risk. These studies consistently demonstrate a modest but statistically significant association between statin therapy and an increased risk of developing diabetes. The mechanism underlying this association is not yet fully understood; however, it is believed to be multifactorial, involving both metabolic and genetic factors.

Emerging evidence suggests that pitavastatin, a commonly prescribed statin, may exhibit a potential protective effect against the development of NODM. Pitavastatin may be a preferred choice in patients at higher risk of developing NODM or those with pre-existing glucose abnormalities, as it offers potential benefits beyond its lipid-lowering effects. In this presentation, we will present the clinical effects, evidence, and data related to pitavastatin and ezetimibe combination, specifically focusing on the risk of NODM.

### LS1

#### What's new? SGLT2 inhibitor's enhanced glucose lowering effect

Soo Lim

Seoul National University, Korea

Enavogliflozin is a sodium-dependent glucose cotransporter 2 (SGLT2) inhibitor approved for clinical use in South Korea. A recent study evaluated the efficacy and safety of enavogliflozin, a novel sodium-glucose cotransporter 2 inhibitor, versus dapagliflozin in Korean patients with type 2 diabetes mellitus (T2DM) inadequately controlled with metformin and gemigliptin. In this multicenter, double-blind, randomized study, patients with inadequate response to metformin ( $\geq 1000$  mg/day) plus gemigliptin (50 mg/day) were randomized to receive enavogliflozin 0.3 mg/day (n=134) or dapagliflozin 10 mg/day (n=136) in addition to the metformin plus gemigliptin therapy. The primary endpoint was change in HbA1c from baseline to week 24. Both treatments significantly reduced HbA1c at week 24 (-0.92% in enavogliflozin group, -0.86% in dapagliflozin group). The enavogliflozin and dapagliflozin groups did not differ in terms of changes in HbA1c (between-group difference: -0.06%, 95% confidence interval [CI]: -0.19, 0.06) and fasting plasma glucose (between-group difference: -3.49 mg/dl

[-8.08;1.10]). An increase in urine glucose-creatinine ratio was significantly greater in the enavogliflozin group than in the dapagliflozin group (60.2 g/g versus 43.5 g/g,  $P < 0.0001$ ). The incidence of treatment-emergent adverse events was similar between the groups (21.64% versus 23.53%). In conclusion, enavogliflozin, added to metformin plus gemigliptin, was well tolerated and as effective as dapagliflozin in the treatment of patients with T2DM.

## LS2

### Combination of DPP-4i and SGLT-2i: new insights from recent clinical trials

Hye Jin Yoo

Korea University, Korea

Type 2 diabetes (T2D) has a complex pathophysiology composed of multiple underlying defects that lead to impaired glucose homeostasis and various complications. Over the past few decades, an increased understanding of T2D pathophysiology has led to the development of various anti-hyperglycemic agents with various mechanism, and it provides an opportunity to choose the appropriate medication for an individual patient with T2D. The newly updated 2022 consensus report by the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD) recommends holistic, person-centered approach that includes management of blood glucose levels, weight, cardiovascular risk factors, comorbidities and complications. Of the currently available glucose-lowering therapies, dipeptidyl peptidase-4 inhibitor (DPP-4i) and sodium-glucose cotransporter-2 inhibitor (SGLT-2i) can be a safe and effective treatment choice for patients with T2D considering their complementary mechanism of action. The combination of DPP-4i and SGLT-2i can be a good option in view of not only glucose-lowering efficacy but also tolerability or safety profile (risk of hypoglycemia, weight change). In addition, the beneficial effect of SGLT-2i and neutral effect of DPP-4i on cardiovascular or renal risk/progression proven in large clinical trials will support their combination therapy.

Gemigliptin is a potent, selective and long-acting DPP-4 inhibitor. In this symposium, the result of recently completed SOLUTION I & SOLUTION II study, examining the beneficial effects of Gemigliptin as add-on therapy to Metformin/Dapagliflozin (SOLUTION I) and dual add-on therapy with Gemigliptin and Dapagliflozin to Metformin compared with either monotherapy (SOLUTION II), will be reviewed.

## LS3

### What's new in drug treatment of diabetes steps

Jun Hwa Hong

Eulji University, Korea

Diabetes is a condition with a lower control rate compared to other chronic diseases. The prevalence of diabetes in individuals aged 30 and above increased by about 3 percentage points in 2020 compared to 2018. However, the control rate, defined as the percentage of diabetic patients receiving treatment with a glycated hemoglobin (HbA1c) level below 6.5%, decreased by approximately 4 percentage points in 2019-2020 compared to 2016-2018.

Therefore, to improve the control rate, combination therapy has been actively considered from the early stages of diagnosis. In South Korea, in the early 2000s, monotherapy accounted for over 50% of diabetes prescriptions, but over time, the proportion of combination therapies with two or more diabetes medications has increased.

Furthermore, with the expansion of insurance coverage criteria for diabetes medications in April this year, the demand for combination prescriptions involving three or more drugs is predicted to increase even further. Combination therapy with SGLT2 inhibitors and DPP-4 inhibitors in type 2 diabetes patients can be a beneficial combination because the mechanisms of action of the two drugs are different and they show complementary effects in lowering blood sugar.

In fact, in a study targeting type 2 diabetes patients with insufficient blood sugar control on Metformin and Dapagliflozin, the administration of Evogliptin 5mg for 24 weeks resulted in a 0.65% change in HbA1c compared to baseline, demonstrating superiority over placebo. The blood sugar-lowering effect was well maintained up to 52 weeks. Safety and tolerability were confirmed when administered in combination and were similar to the known safety profile of the individual drugs.

In conclusion, for patients who have not achieved sufficient therapeutic

effects with dual therapy, triple therapy may be an effective alternative.

## LS4

### A new choice for diabetes treatment: advanced hybrid closed loop

Sun Joon Moon

Sungkyunkwan University, Korea

Recent years have seen significant advances in automated delivery systems for diabetes care. The hybrid closed-loop system, which automatically controls the basal rate, has emerged as a primary treatment method for type 1 diabetes in many countries. Recently, advanced hybrid closed loop system, featuring an additional automated correction bolus, has been introduced, validated, and is now in practical use worldwide. Korea has also recently adopted the advanced hybrid closed-loop system, specifically the MIN-IMED™ 780G. This lecture will discuss the key features, clinical evidence, and real-world cases supporting the advanced hybrid closed-loop system.

## LS5

### Optimal combination use of SGLT2i and DPP4i

Seung-Hwan Lee

The Catholic University of Korea, Korea

Glycemic control tends to decline over time during the natural history of diabetes. Optimising glycemic control is essential to reduce the risk of diabetes complication. Recent evidence suggest the benefit of proactive management by early combination therapy rather than sequential add-on therapy. It can lead to earlier achievement of glycemic targets, has potential to delay disease progression, reduce dose-related adverse events associated with high-dose monotherapy, and target multiple pathophysiologies by using therapies with complementary mode of action. The combination of SGLT2 inhibitors and DPP4 inhibitors became popular with greater reductions in HbA1c than either drug alone, and with its renoprotective and cardiovascular safety profiles. Especially, linagliptin and empagliflozin is supported by solid evidence in cardio-renal-metabolic benefits proved by large RCTs such as CAROLINA, CARMELINA, EMPA-Reg, and EMPEROR studies. In this lecture, current evidence and results of using SGLT2 inhibitors and DPP4 inhibitors will be discussed.

## LS6

### The newest combination therapy: SGLT2i & TZD

Yun Kyung Cho

University of Ulsan, Korea

Type 2 diabetes (T2D) is a progressive and chronic diseases, which eventually requires combination therapy to achieve and maintain target glycated hemoglobin (HbA1c) levels to reduce the risk of diabetic complications in most patients. Clinical guidelines, including the consensus report by the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD), and the 2023 clinical practice guidelines by the Korean Diabetes Association (KDA) recommend advancing to dual or triple combination therapy in those who do not meet their glycemic target. Notably, the recent endorsement of triple combinations including metformin/thiazolidinedione (TZD)/sodium-glucose cotransporter 2 inhibitor (SGLT2i) within the Korean reimbursement would benefit a number of Korean patients with inadequately controlled T2D.

TZD are peroxisome proliferator-activated receptor- $\gamma$  agonists known to improve insulin sensitivity and preserve pancreatic  $\beta$ -cell function in patients with T2D. TZD have been shown to be effective in lowering glucose level with sustained and durable effectiveness, accompanied by a favorable impact on cardiovascular risk factors encompassing lipid profiles. A novel addition to the TZD class, lobeglitazone, was approved for the treatment of T2D in Korea in 2013 with a comparable safety and efficacy profile to pioglitazone.

Based on the mechanism of action and characteristics of drugs, TZD and SGLT2i could be a good combination. Moreover, the combination is expected to potentially mitigate the adverse effects associated with each individual drug. This lecture will delve into the background of combining

TZD with SGLT2i, elucidating the mechanism of action underpinning these antidiabetic agents. Furthermore, I will review some interesting articles supporting the clinical efficacy and safety of this combinatorial regimen.

### LS7

#### The holistic management with GLP-1RA in real practice

Jang Won Son

The Catholic University of Korea, Korea

I will begin by providing a brief background on the management of type 2 diabetes mellitus (T2DM) & prevention of complications. Timely treatment of T2DM is needed to reduce the risk of T2DM complications and yet many patients do not achieve current HbA1c targets with the treatment options available. As a consequence, T2DM is still associated with a marked increase in cardiovascular mortality and morbidity.

So early preventative interventions and tight glycaemic control (and risk factor control) is important for long term benefits. Currently global guidelines strongly emphasize patient-centricity considering complication risk factor, comorbidity. Specially GLP-1RA class is mainly considered for T2DM patients with obesity, established ASCVD, CV risk factors.

GLP-1RA has demonstrated a strong glucose lowering effect with weight reduction and cardiovascular benefits. Semaglutide was designed as long acting GLP-1 analogue, consist of injection & oral type. I will introduce GLP-1RA class & Semaglutide family, an overview of clinical trials series, will focus on consistent multiple benefit for T2DM patients.

### LS8

#### Ideal clinical approach to use of dapagliflozin + sitagliptin fixed-dose combination for T2D patients

Hae Jin Kim

Ajou University, Korea

Poor glycemic control is associated with a higher risk of long-term complications including cardiovascular and microvascular. Long-term complications as a result of poor glycemic control can lead to a significant burden on patients as well as healthcare systems. Additionally, non-adherence to treatment regimens is a significant issue that can exacerbate challenges in glycemic control and associated long-term complications.

The 2022 ADA-EASD consensus report highlighted the importance of a holistic person-centered approach in the treatment of T2DM with treatment goals including reduction of cardiorenal risk and control of blood glucose and body weight. The 2023 KDA guidelines recommend prioritizing treatments including SGLT2 inhibitors if the patient has concomitant heart failure, albuminuria, or decreased eGFR.

SGLT2 inhibitors and DPP4 inhibitors exert their glucose-lowering effects via different and complementary mechanisms. The combination therapy of dapagliflozin/sitagliptin has been shown to be effective and well-tolerated regardless of concomitant use with metformin. The combination therapy of dapagliflozin/sitagliptin with or without metformin, demonstrated a statistically significant reduction in body weight and HbA1c levels, especially in those with a higher baseline level. Furthermore, it demonstrated a mean decrease in SBP at 24 weeks, as well as a long-term effect of up to 48 weeks, where glycemic benefits were maintained.

Dapagliflozin/sitagliptin FDC is a convenient oral formulation that improves patient compliance and satisfaction compared to the combination of individual single agents, has been shown to reduce the overall costs associated with poorly controlled blood glucose and all diabetes-related complications.

**EC1****Diabetes management: what you need to know**

Jin Hwa Kim

Chosun University, Korea

The global prevalence of diabetes, especially type 2 diabetes mellitus, has reached epidemic proportions in the last few decades. Type 2 diabetes is a chronic complex disease and management requires multifactorial behavioral and pharmacological treatments to prevent or delay complications and maintain quality of life. This includes management of blood glucose levels, weight, cardiovascular risk factors, comorbidities and complications. Careful consideration of social determinants of health and the preferences of people living with diabetes must inform individualisation of treatment goals and strategies. Type 2 diabetes is a very heterogeneous disease with variable age at onset, related degree of obesity, insulin resistance and tendency to develop complications. Providing person-centred care that addresses multimorbidity and is respectful of and responsive to individual preferences and barriers, including the differential costs of therapies, is essential for effective diabetes management.

In this presentation, I will discuss what you need to know for effective diabetes management. It will help clinicians to manage patients with diabetes.

**EC2****Individualized therapy of oral hypoglycemic agent in the management of diabetes**

Su Jin Jeong

Bucheon Sejong Hospital, Korea

Diabetes mellitus (DM) is a metabolic disorder that occurs in the body because of decreased insulin activity and/or insulin secretion. Pathological changes such as nephropathy, retinopathy, and cardiovascular complications inevitably occur in the body with the progression of the disease. The major drug therapy for type 2 DM comprises of insulin secretagogues, biguanides, insulin sensitizers, alpha glucosidase inhibitors, incretin mimetics, amylin antagonists and sodium-glucose co-transporter-2 (SGLT2) inhibitors.

In adults with type 2 diabetes and established/high risk of atherosclerotic cardiovascular disease, heart failure, and/or chronic kidney disease, the treatment regimen should include agents that reduce cardiorenal risk. Pharmacologic approaches that provide adequate efficacy to achieve and maintain treatment goals should be considered, such as metformin or other agents, including combination therapy. Weight management is an impactful component of glucose lowering management in type 2 diabetes. Numerous factors must be considered when setting glycemic targets and selecting pharmacologic agent. Various guidelines proposes general targets appropriate for many patients but emphasizes the importance of individualization based on key patient characteristics. The factors to consider in individualizing goals are risks potentially associated with hypoglycemia and other drug adverse effects, disease duration, life expectancy, important comorbidities, established vascular complications, patient preference, resources and support system. Especially, Diabetes management in older adults requires regular assessment of medical, psychological, functional, and social domains.

In the this session, I feel like to attempt to explore the pathophysiology of type 2 DM, the individualized treatment approaches as well as early intensive treatment in patients with type 2 DM.

**EC3****Towards optimal outcomes: injectable treatments in the management of diabetes**

Eu Jeong Ku

Seoul National University, Korea

The burgeoning prevalence of diabetes in Asia underscores the urgent need for potent management tactics. In this landscape, injectables, especially insulin and GLP-1 receptor agonists (GLP-1 RAs), are taking center stage. Insulin, from its groundbreaking discovery to its contemporary analogs, anchors diabetes therapy. The distinctions among rapid, long-acting, and mixed insulins, their therapeutic use, dosing adjustments, and challenges, chiefly hypoglycemia, are foundational in diabetes management.

GLP-1 RAs are redefining treatment norms, available in varied regimens

from twice a day to once weekly, and the significant inclusion of a daily oral semaglutide further adds to their arsenal. They shine in amplifying insulin release during high blood sugar states, curbing glucagon release, slowing gastric emptying to mitigate post-meal glucose surges, and facilitating weight loss. Notably, the prolonged-action versions have shown profound effects on overnight glycemic levels and HbA1c, particularly when allied with basal insulin.

The confluence of oral glucose-lowering agents with injectables, labeled as 'treatment intensification,' sets the stage for tailored, patient-focused care. Owing to their remarkable efficacy in HbA1c reduction, weight management advantages, and absence of innate hypoglycemia events, GLP-1 RAs are emerging as the front-running injectable option for type 2 diabetes, occasionally even before insulin. Studies post-2016 spotlight the prowess of GLP-1 RAs in curtailing cardiovascular occurrences, advocating their prescription, especially in patients with prior vascular incidents. Their potential extends to guarding against kidney complications in type 2 diabetes, and research is afoot for more potential uses. Furthermore, the introduction of the GLP-1/GIP dual agonist, tirzepatide, along with findings from the GLP-1/GIP/Glucagon triple agonist, fosters heightened anticipation for upcoming diabetes and obesity treatments.

This session promises insights into the collaborative power of insulin and GLP-1 RAs, their integration strategies with oral agents, and their potential to redefine diabetes care in the imminent future.

**EC4****Cardiovascular disease risk assessment and management in diabetes: the latest updates**

Eun Young Lee

The Catholic University of Korea, Korea

Cardiovascular diseases (CVD) stand as the predominant cause of morbidity and mortality in individuals afflicted with diabetes. Adults with type 2 diabetes face a 2-to-4-fold greater risk of cardiovascular morbidity and mortality compared to those without diabetes. Along with CVDs, heart failure incidence has exhibited a steady ascent among those with diabetes. In light of the global demographic shift towards an aging society, the management of CVD, including heart failure, is poised to garner increased attention within the realm of diabetes management.

Current strategies emphasize aggressive modification of risk factors in diabetes. Encouragingly, there is substantial evidence indicating significant improvements in 10-year coronary heart disease risk profiles among U.S. adults with diabetes over the past decade, leading to a notable reduction in morbidity and mortality due to atherosclerotic cardiovascular disease (ASCVD). Hence, the critical importance of effectively managing cardiovascular risk factors in diabetes cannot be overstated. Recent advancements in drug development hold promise for utilizing medications with proven cardiovascular benefits and adopting a more proactive approach in high-risk patients.

In order to prevent and effectively manage both ASCVD and heart failure, a systematic assessment of cardiovascular risk factors should be conducted at least once a year for all individuals with diabetes. In this presentation, I'll present how to assess and manage risks for cardiovascular disease in patients with diabetes. In addition, I'll discuss the latest updates for cardiovascular disease and risk management in diabetes.

## PD1-1 Post doctoral session 1

**Pharmacological intervention to prevent progressive dysfunction of pancreatic beta cell**Kyun Hoo Kim<sup>1\*</sup>, Hyeonkyu Lee<sup>1</sup>, Joonyub Lee<sup>1,2</sup>, Hoe-Yune Jung<sup>3,4</sup>KAIST, Korea<sup>1</sup>, Seoul St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Korea<sup>2</sup>, Pohang University of Science and Technology, Korea<sup>3</sup>, Novmetapharma Co., Ltd, Korea<sup>4</sup>

**Objective:** Type 2 diabetes is characterized by the loss of  $\beta$ -cell identity and functional  $\beta$ -cell mass. However, current pharmacotherapies that aim to prevent chronic complications are not able to stop progression of  $\beta$ -cell dysfunction. Therefore, it is required to develop a novel pharmacological approach that can prevent loss of mature  $\beta$ -cell identity based on precise understanding of mechanisms underlying progressive  $\beta$ -cell dysfunction.

**Methods:** Prmt1-floxed mice were crossed with Pdx1-Cre<sup>ERT2</sup> mice to generate inducible  $\beta$ -cell-specific Prmt1 knock-out mice (Prmt1-BiKO) and tamoxifen was administered at 6 weeks of age to induce Cre-recombination. Mice were fed either a standard chow diet or a high-fat diet (HFD). Prmt1-BiKO mice were treated with either Cyclo-Z, a combination of cyclo-His-Pro and zinc, or vehicle from 8 weeks of age. The phenotypes of the mice were studied by metabolic and histological analyses. Single-cell RNA-sequencing (scRNA-seq) was performed using isolated mouse pancreatic islet.

**Results:** Prmt1-BiKO mice developed glucose intolerance and exhibited the phenotypes of  $\beta$ -cell dysfunction, including elevated proinsulin levels. HFD aggravated  $\beta$ -cell dysfunction and loss of  $\beta$ -cell identity in Prmt1-BiKO mice. scRNA-seq identified immature  $\beta$ -cell cluster in Prmt1-BiKO mouse islets that is further characterized by the upregulation of genes involved in cellular response to ER-stress and reactive oxygen species (ROS). Treatment of Cyclo-Z ameliorated glucose intolerance and  $\beta$ -cell dysfunction in HFD-fed Prmt1-BiKO mice. Preservation of maturity marker expression and ultrastructure of  $\beta$ -cells was observed in Cyclo-Z-treated mouse islets. Furthermore, scRNA-seq data revealed diminished proportion of immature  $\beta$ -cells with the downregulation of stress-induced genes and dedifferentiation markers in Cyclo-Z-treated mouse islets, indicating protective effects of Cyclo-Z on  $\beta$ -cell identity.

**Conclusion:** Cyclo-Z treatment ameliorates ER-stress and ROS production in  $\beta$ -cells of a mouse model of diabetes. Cyclo-Z is a potential anti-diabetic drug that can prevent progression of  $\beta$ -cell dysfunction and loss of mature  $\beta$ -cell identity.

## PD1-2 Post doctoral session 1

**Effect of Time Restricted Feeding (TRF) on Cyp11a1 protein expression in ileum (intestinal) epithelium cells and on rhythmic abundance of gut microbiota in prediabetic mice model**B Anjum<sup>1,2\*</sup>, Qulsoom Naz<sup>1</sup>, Aditya Upadhyay<sup>2</sup>,Kaleem Ahmad<sup>1</sup>, Rohit Sinha<sup>2</sup>, Swasti Tiwari<sup>2</sup>, M M Godbole<sup>2</sup>King George's Medical University, India<sup>1</sup>, Sgpgims, India<sup>2</sup>

**Objective:** Expression of cyp11a1 in intestinal (ileum epithelial cells) regulates the corticosteroid production through the signals receive from gut microbiota. This corticosteroid production in turns regulates the glucose, insulin and lipid metabolism. The objective of this study is to investigate the Effect of Time Restricted Feeding (TRF) on lipid profile, glucose metabolism, Cyp11A1 and rhythmic expression of gut microbiota.

**Methods:** Mice were fed on control diet (group A) and 70% High Sucrose & High Fructose diet in 1:1 ratio (group B) in Adlibitum manner for 8 weeks to make prediabetic mice model. After 8 weeks, model was validated by Intra-peritoneal glucose Tolerance test (IP-GTT). After model validation, mice were shifted in further different groups according to time restricted feeding (9hrs) and as Adlibitum feeding manner for further 8 weeks. IP-GTT and Lipid profile were tested at the end of the study. Fecal samples of Morning, Afternoon, Evening and Night timings [at six hours intervals: (ZT6, ZT12, ZT18 and ZT24)] were collected from each group. Five most common type of Gut Microbiome: Firmicutes, Actinobacteria, bacteroidetes, Bifidobacteria and Bacteroides were seen in Fecal samples. Ileum (Intestinal) epithelial cells were isolated from each group of mice. Cyp11a1 protein expression was done by western blot.

**Results:** Total cholesterol level was higher in 70% Adlibitum group (102.55+42.14) as compare to 70% TRF group after 8 weeks of TRF intervention (93.90+27.33). The cyp11a1 expression decreases in mice fed on TRF as compare to the Adlibitum. Relative abundance of selective gut microbes has done by qPCR. Expression of Firmicutes and Actinobacteria was higher in Adlibitum group. Expression of Bifidobacteria and bacteroides was higher in TRF group in evening and morning fecal samples.

**Conclusion:** Decreased expression of Cyp11a1 in ileum epithelial cells in TRF group may regulate the steroid (cortisol) secretion which in turn regulates the glucose, lipid metabolism and diabetes risk.

## PD1-3 Post doctoral session 1

**PTPN2 regulates mitochondrial function in the context of type 1 diabetes-like stress conditions**Yongkyung Kim<sup>\*</sup>, Lori Susse<sup>l</sup>

University of Colorado Anschutz Medical Campus, United States

**Objective:** Protein tyrosine phosphatase *N2* (*Ptpn2*) is a type 1 diabetes (T1D) candidate gene identified in human genome-wide association studies. PTPN2 is highly expressed in human and murine islets and becomes elevated upon inflammation, suggesting that PTPN2 may be important for beta cell survival in the context of T1D.

**Methods:** We generated beta cell specific *Ptpn2* KO mice using the Ins-Cre and *Ptpn2* floxed alleles. We used low-dose multiple STZ injections and cytokine treatment of islets to mimic T1D conditions, *in vivo* and *in vitro*, respectively. The treated mice and islets were assessed for beta cell functional properties. Seahorse analyses and metabolic flux assays using <sup>13</sup>C glucose were performed on the cytokine treated islets.

**Results:** PTPN2- $\beta$ KO mice were initially euglycemic but began to display impaired beta cell function after 26 weeks of age. With age, PTPN2- $\beta$ KO islets also displayed increased mitochondrial numbers, and had reduced OCR and increased ECAR. Consistent with these beta cell defects, streptozotocin treated PTPN2- $\beta$ KO mice displayed marked increase in hyperglycemia. Furthermore, PTPN2- $\beta$ KO islets showed reduced glucose stimulated insulin secretion, and altered OCR and ECAR upon cytokine treatment. These results suggest that the PTPN2- $\beta$ KO islets have underlying metabolic defects that become revealed under T1D-like stress conditions. RNA-Seq analysis identified changes in mitochondria related genes expression, which was confirmed by <sup>13</sup>C glucose metabolic flux analysis.

**Conclusion:** These findings indicate that metabolic pathways are compromised in PTPN2- $\beta$ KO islets under basal conditions, and these defects are exacerbated upon cytokine or low dose STZ treatment. In future studies, we will analyze the phenotype of the PTPN2- $\beta$ KO on the NOD background to more accurately reflect T1D conditions.

## PD1-4 Post doctoral session 1

**Night owls are canaries in coal mine for metabolic predisposition to T2DM, obesity and cardio-metabolic disorders**Qulsoom Naz<sup>\*</sup>, Narsingh Verma, Baby Anjum, Abbas Ali Mahdi, Kauser Usman

King George's Medical University, India

**Objective:** Metabolism is a major physiological process under circadian control. And Disruption of Circadian Rhythm such as exposure of ALAN (artificial light at night) might be expected to affect Metabolism. Late night waking is responsible for late night eating and late night eating is also responsible for Obesity, T2DM, Metabolic Disorders and altered gene expression. The aim of this study is to investigate whether late Chronotype is related to metabolic abnormalities & body composition in young diabetic adults, independent of sleep duration and Life Style.

**Methods:** A total of 245 subjects' age 18 to 60 years were recruited in Clinical OPD of General Medicine, KGMU. We have tested FBG & PP level, lipid profile HbA1c, Insulin, Leptin and Cortisol level, 48 hours ABPM & Circadian gene expression.

**Results:** When we compared these 3 groups, Significant difference found in FBG (P=0.01) Postprandial (P=0.03) HbA1c (P=0.001) TG (P=0.0001), Total Cholesterol (P=0.01) & VLDL (P=0.005). It also shows the complete inversion of the cortisol level (0.003). Insulin, IL-1 beta & IL-6 also show significant change in late night eating T2DM Patients. Systolic / Diastolic readings of ABPM shows significant change between MC and IC (0.005) but not b/w EC & IC (0.007). And for reliability of sleep by actigraphy shows MC (6:15 + 1:35) & EC (8:18 + 1:23) take complete sleep but IC total sleep hours (5:10 + 1:05) are very less. Disruption of Rev Erb & Ror  $\alpha$  gene expression is also a risk factor for T2DM Patients.

**Conclusion:** Intermediate & Eveningness Chronotypes are more likely to have night owls & they are associated with greater risk of Metabolic Disorders like Obesity, Dyslipidemia, T2DM. and study has established strong relationship with ALAN.

## PD2-1 Post doctoral session 2

**Healthy lifestyle, access to primary health care, and regular T2DM screening in Java, Indonesia: a district-level analysis for type 2 diabetes prevention**

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and Management, Indonesia<sup>3</sup>, Center for Health Policy Management, Indonesia<sup>4</sup>,  
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**Objective:** A healthy lifestyle and early detection are essential to halt type 2 diabetes mellitus (T2DM). Thus, access to healthcare might prevent the practices. This research is aimed to analyse the healthy lifestyle, access to primary health care (PHC), and routine screening for DM at the district level in Java Island, Indonesia.

**Methods:** Data from 119 districts and city levels in Java were extracted from the Provincial Level Report of Basic Health Research 2018. The independent variables were the proportion of the population who consumed the selected diet (sweetened, salty, fried, grilled, instant food and sweetened beverages) daily, who smoked daily and the proportion of those who performed insufficient physical activity. Dependent variables were the proportions of the population that perceived difficult access to PHC and of those doing routine T2DM screening. Regression analysis was employed, and the significance level was set for  $p < 0.05$ .

**Results:** The higher proportion of the population engaging in unhealthy lifestyles was associated with less of the population doing regular screening for T2DM. Also, the more smokers a district has, the lower proportion of the population doing regular DM screening ( $\beta = -0.17$ ; 95%CI -0.24 to -0.10) and more proportion of the population perceived difficult access to PHC ( $\beta = 0.44$ ; 95%CI 0.20 to 0.67). Perceived difficult access to PHC was also associated with a lower population screen for T2DM regularly.

**Conclusion:** PHC is the key to T2DM prevention: healthy lifestyle education and early detection, for Indonesia. Indonesia should work to ease access to health care, such as maximizing the Posbindu program and other outreach activities. To strengthen the PHC on its role in T2DM prevention, Indonesia is expected to innovate a group-specific approach in its health education.

## PD2-2 Post doctoral session 2

**Underlying mechanism of G Protein-coupled Receptor 40 (GPR40) as a novel target to control muscle atrophy caused by obesity and aging**

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**Objective:** G protein-coupled receptor 40 (GPR40) acts as a modulator of physiological functions such as glycemic lowering, anti-inflammation, and anti-oxidative stress in several tissues. However, GPR40 roles in skeletal muscles are still not clear.

**Methods:** To investigate GPR40 functions on muscle regeneration and atrophy, C2C12 myoblast and myotube were stimulated with palmitate and GPR40 agonist. In addition, muscle strength and mass were analyzed GPR40 agonist-fed obese and aged mice.

**Results:** In C2C12 myoblasts, treatment with GPR40 agonist induced intracellular cyclic adenosine monophosphate (cAMP) abundance and Akt phosphorylation. The expression of muscle regeneration factors, myoblast determination protein 1 (MyoD) and myosin heavy chain (MyHC), was enhanced after the treatment with GPR40 agonist, which result to accelerate muscle differentiation from myoblast to myotube. Under palmitate treatment, GPR40 reversed muscle atrophy-related events, forkhead box protein O1A (FOXO1A) dephosphorylation and atrogin-1 and muscle RING-finger protein1 (MuRF1) upregulation in C2C12 myotubes. These GPR40 actions were all disappeared after the treatment with Akt inhibitor. In both cell types, palmitate-mediated cytotoxicity was resolved by GPR40 agonist in an Akt dependent manner. As with in vitro study, GPR40 agonist was involved in protecting muscle functions in obese and aged mice. GPR40 agonist increased muscular cAMP levels and Akt phosphorylation, and decreased atrogin-1 and MuRF1 expression, Bcl-2-associated X protein (Bax) /B-cell lymphoma2 (Bcl-2) ratio, and caspase 3 cleavage, which result to enhance muscular cross-sectional area in obese and aged mice. Muscle strength, as measured by the hand grip strength test, was elevated after the treatment with GPR40 agonist in aged mice.

**Conclusion:** Treatment with GPR40 agonist increase muscle regeneration and reduce muscle atrophy in a cAMP-Akt dependent manner, suggesting its potential as a novel therapeutic agent for muscle degeneration and sarcopenia.

## PD2-4 Post doctoral session 2

**Differences in metabolic syndrome-related risk factors and productivity loss between school teachers living in urban and rural area of Karawang, Indonesia**

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**Objective:** The present study aimed to evaluate the differences in risk factor and work productivity loss of metabolic syndrome (MetS) between school teachers living in urban and rural area of Karawang, West Java, Indonesia.

**Methods:** A cross-sectional study was conducted involving 71 school teachers, where 24 teachers were from urban area and 47 teachers were from rural area. An interview was conducted to collect data of socio-economy, nutrient intake, physical activity, psychological stress level, and work productivity loss. MetS status was obtained through blood tests (HDL, triglyceride, and fasting blood glucose), anthropometric (height, weight, and waist circumference), and blood pressure measurements.

**Results:** This study found the prevalence of metabolic syndrome was higher among school teachers living in rural area (40,3%) as compared to those living in urban area (16,7%). However, the subjects' characteristics and productivity loss did not significantly differ between the groups. Nevertheless, the present study showed a distinct result of bivariate analysis. BMI was the only risk factor that demonstrated a significant correlation with MetS status in school teachers living in urban area ( $r = 0,331$ ;  $p$ -value = 0,005), whereas age ( $r = 0,556$ ;  $p$ -value < 0,001), monthly income ( $r = 0,341$ ;  $p$ -value = 0,027), physical activity ( $r = -0,346$ ;  $p$ -value = 0,021), energy ( $r = 0,317$ ;  $p$ -value = 0,036) and carbohydrate intake ( $r = -0,388$ ;  $p$ -value = 0,009) significantly correlated with MetS status in school teachers living in rural area, respectively.

**Conclusion:** The present study reported the risk factors of MetS varied over the demographic area, while the productivity loss differences were found not to be significant.

## OP1-1 Basic &amp; translational diabetes research

**Sodium glucose cotransporter 2 inhibitor ameliorate thiazolidinedione-induced adipose tissue fluid overload via the regulation of vascular endothelial growth factor-VE cadherin axis**

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**Objective:** We aimed to investigate whether sodium glucose co-transporter 2 inhibitor (SGLT2i) empagliflozin counterbalances the thiazolidinedione (TZD)-induced fluid overload, as well as which mechanisms are involved.

**Methods:** High-fat diet induced obese mice (C57BL/6N) were assigned to three groups: (1) distilled water (control) (2) lobeglitazone 0.5 mg/kg (TZD single therapy), and (3) combination of lobeglitazone 0.5 mg/kg plus empagliflozin 10mg/kg with 0.16 mg/mL in drinking water (TZD+SGLT2i combination therapy). After 6 weeks of the treatment, body composition and water content in multiple tissues were measured. The expression of proteins and mRNA related to vascular permeability and renal sodium and water channel was investigated.

**Results:** In the group receiving TZD single therapy, significant body weight gain was observed with an increased water content of inguinal white adipose tissue (iWAT). Compared to TZD single therapy, combination therapy of TZD and SGLT2i significantly reduced body weight, body water, and water content of both iWAT and epididymal white adipose tissue (eWAT). Immunohistochemistry of FITC-Dextran showed that adipose tissue vascular permeability was increased with TZD single therapy and restored by TZD+SGLT2i combination therapy. Expression of VE-cadherin, a tight junction protein, was decreased in TZD single therapy but significantly increased with TZD+SGLT2i combination in both eWAT and iWAT. Expression of vascular endothelial growth factor (VEGF) and VEGF receptor 2 (VEGFR2) increased in TZD single therapy and significantly reduced with TZD+SGLT2i combination therapy. Meanwhile, the expression of renal sodium and water channel did not correlate with the body compositional changes by treatments.

**Conclusion:** SGLT2i ameliorated TZD-induced weight gain and tissue fluid overload, specifically in the WAT, via the counter-regulation of VEGF/VEGFR2-VE-cadherin signaling. Kidney sodium and water channel did not seem to be involved in the body fluid regulation by either TZD or SGLT2i.

## OP1-2 Basic &amp; translational diabetes research

**A molecular link between diabetes and breast cancer: anti-cancer effects of incretin based antidiabetic therapies on triple-negative breast cancer cells via mitochondrial modulation**Hamendra Singh Parmar\*, Pooja Jaiswal  
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**Objective:** Triple-negative breast cancer (TNBC) cell line MDA-MB-231 is known for Warburg metabolism and defects in mitochondria. On the other hand, dipeptidyl peptidase-IV (DPP-IV) inhibitors such as sitagliptin and vildagliptin and GLP-1 agonist exendin-4 are known to improve mitochondrial functions as well as biogenesis, but no study has evaluated the influence of these drugs on mitochondrial biogenesis on metastatic breast cancer cell line. We have recently reported anticancer effects of 5-aminoimidazole-4-carboxamide riboside on MDA-MB-231 cells via activation of AMP-dependent kinase (AMPK), which activates the downstream transcription factors PGC-1 $\alpha$ , PGC-1 $\beta$ , or FOXO1 for mitochondrial biogenesis; above-mentioned incretin-based therapies are also known to activate AMPK.

**Methods:** This study evaluated the effects of sitagliptin, vildagliptin, and exendin-4 on MDA-MB-231 cells and the underlying changes in mitochondrial

biogenesis, were examined.

**Results:** Treatment with sitagliptin (100  $\mu$ M), vildagliptin (100  $\mu$ M), and exendin-4 (10 nM) for 72 h to MDA-MB-231 cells led to a decrease in viability indicated by MTT assay, cell migration by scratch, and transwell migration assays, accompanied with marginal reduction in cell numbers along with the apoptotic appearance, the rate of apoptosis, and decreased lactate content in conditioned medium. These changes in the cancer phenotype were accompanied by an increase in the mitochondrial DNA to nuclear DNA ratio, increased MitoTracker green and red staining, and increased expression of transcription factors PGC-1 $\alpha$ , NRF-1, NRF-2, TFAM, and HO-1. Pre-treatment of cells with these incretin-based drugs followed by 48 h treatment with 1  $\mu$ M doxorubicin increased doxorubicin sensitivity as observed by a decrease in viability by MTT assay.

**Conclusion:** Thus, sitagliptin, vildagliptin, and exendin-4 exert their beneficial effects on TNBC cells via an increase in mitochondrial biogenesis that helps to switch Warburg metabolism into anti-Warburg effect. Therapeutic response was in the order of: sitagliptin > vildagliptin > exendin-4.

## OP1-4 Basic &amp; translational diabetes research

**Molecular mechanism of diurnal alterations of hepatic glycogen structure in mice with time-restricted feeding**Liang Wang\*, Zhang-Wen Ma<sup>1</sup>, Jing-Yi Mou<sup>1</sup>,  
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Guangdong Provincial Peoples Hospital, China<sup>4</sup>

**Objective:** Liver glycogen in healthy mice have two states, stability and fragility, which alternates diurnally. However, the diurnal alteration in diabetes is damaged and the structure is consistently fragile. It has been reported that fragile glycogen may exacerbate the hyperglycemia condition due to its easy break-down into smaller glycogen particles. Therefore, the elucidation of the diurnal change of glycogen structure could facilitate our understanding of the pathogenesis of diabetes, which is the focus on our study.

**Methods:** In this study, we characterized the fine molecular structure of liver glycogen in healthy mice under time-restricted feeding mode. Liver glycogen was extracted at six representative time points. Experimental methods such as transmission electron microscopy and size exclusion chromatography were used to characterize fine molecular structure of glycogen particles and its diurnal alteration. The changes of key genes and key enzymes involved in glycogen metabolism at different time points were quantified via qPCR and western blot, respectively. In addition, comparative transcriptome analysis of liver tissues at six representative time points was conducted, and results were compared pair-wisely.

**Results:** The results were correlated with changes in liver glycogen content and structural phenotype. Regulatory genes and pathways for structural stability and fragility of healthy liver glycogen were explored. A set of differentially expressed genes (DEGs) involved in the insulin secretion, glucose homeostasis and glycogen metabolism pathways were found to have impacts on the rhythmic changes of glycogen structure.

**Conclusion:** Based on the results we concluded: 1) structures of hepatic glycogen in time-restricted feeding mice show diurnal alterations; 2) transcriptomic analysis reveals potential molecular mechanism of glycogen structural formation and alteration; and 3) regulation networks involving key genes and enzymes for diurnal change of hepatic glycogen structure are established. Taken together, these findings provide better understandings of hepatic glycogen structural alteration and also the pathogenesis of diabetes.

## OP1-5 Basic &amp; translational diabetes research

**Single-cell transcriptomic and somatic mutational profiling in a non-alcoholic fatty liver disease mouse model to reveal hepatocellular carcinogenesis**Won Hee Lee\*, Byung-kwan Jeong<sup>1</sup>, Won-il Choi<sup>1</sup>,  
Jun Yong Park<sup>2</sup>, Young Seok Ju<sup>1</sup>, Hail Kim<sup>1</sup>KAIST, Korea<sup>1</sup>, Yonsei University College of Medicine, Korea<sup>2</sup>

**Objective:** The prevalence of hepatocellular carcinoma (HCC) arising in non-alcoholic fatty liver disease (NAFLD) is rapidly increasing, but little is known about its carcinogenesis. Herein, we used single-cell RNA-sequencing (scRNA-seq) and somatic mutational profiling to reveal the process of hepatocellular carcinogenesis in a murine NAFLD model.

**Methods:** Seven-week-old male C57BL/6J mice were injected with low-dose streptozotocin (40 mg/kg) for 5 days and fed with high-fat diet (HFD) from 8 weeks of age until sacrificed (STZHFD). Bulk-tumor whole-genome-sequencing (7 mice, 9 tumors) and bottleneck-sequencing in primary hepatocytes from different ages (20 mice, 40 samples) were performed to identify somatic mutations. The scRNA-seq was performed in primary hepatocytes of 20-week-old STZHFD and control mice.

**Results:** Tumor prevalence was 70-100% and increased with duration of HFD. Mitochondrial insufficiency was observed as beta-oxidation, oxidative phosphorylation, and oxidative stress-response pathways were increased in STZHFD hepatocytes in scRNA-seq, while mtDNA copy-number was lower compared to HFD controls. Bipotent progenitors as a new source of hepatocyte regeneration emerged only in STZHFD, suggesting a hepatocyte lineage shift in response to chronic liver damage. STZ was the main source of somatic mutations, while HFD and aging were not. Interestingly, low-density hepatocytes had significantly more STZ-related mutations compared to high-density hepatocytes in 32-week-old mice (ratio of alkylating signature: 4.26) while no difference was seen in 10-week-old mice, supporting the shift towards a specific lineage with high burden of STZ-related somatic mutations. Moreover, mutational signatures of 32-week-old low-density hepatocytes resembled those of tumors.

**Conclusion:** Mitochondrial insufficiency relative to immense fatty-acid beta-oxidation caused mitochondrial stress causing hepatocyte death during progression of NAFLD in this mouse model. As a result, bipotent progenitors known as cholangiocyte origin emerged as a new source of hepatocyte regeneration, which seem related to the lineage shift towards hepatocytes with high STZ-related somatic mutations resembling those of tumor.

## OP1-6 Basic &amp; translational diabetes research

**Investigating the pyruvate dehydrogenase kinase 3 inhibitory potential and binding mechanism of thymoquinone: towards therapeutic management of diabetes and inflammatory diseases**Mohammad Hassan\*  
Jamia Millia Islamia, India

**Objective:** Protein kinases are an attractive therapeutic target against various diseases including cardio-vascular diseases, diabetes, cancer and neurodegeneration. Cancer cells demand energy generation through aerobic glycolysis surpassing the oxidative phosphorylation (OXPHOS) in mitochondria. Pyruvate dehydrogenase kinases (PDKs) have several regulatory roles in energy generation balance by controlling the pyruvate dehydrogenase complex. Overexpression of PDKs is highly associated with the overall survival of cancer. PDK3, an isoform highly expressed in various cancer types and diabetes and thus we aimed to discover potential inhibitors.

**Methods:** We implemented a combined computational methods followed by experimental studies to estimate the binding affinity of thymoquinone with the PDK3. The binding affinity of TQ with PDK3 was estimated employing fluorescence spectroscopy. The activity assay for kinase was also carried out, and the role of thymoquinone on the inhibitory potential of PDK3.

**Results:** PDK3 has shown to interact with a natural compound, thymoquinone, with an admirable binding affinity. The enzyme inhibition assay suggested an excellent inhibitory potential of thymoquinone towards PDK3 (IC<sub>50</sub>=5.49  $\mu$ M). The emission spectra of PDK3 were decreases with increase in concentration of TQ. Using the modified Stern Volmer equation, the binding constant (K) was estimated to be  $0.79 \times 10^5$  M<sup>-1</sup>. The assay suggested that TQ binds to the critically active residues of the protein and affects its kinase activity acting as a potential inhibitor of the kinase. TQ binds to PDK3 with a binding affinity value of -7.3 kcal mol<sup>-1</sup> and a pK<sub>i</sub> value of 5.35. It also shows a ligand efficiency of 0.6083 kcal mol<sup>-1</sup> non-H atom<sup>-1</sup>.

**Conclusion:** We observed that thymoquinone forms a stable complex with PDK3 without altering the structure of the protein and can be a potent PDK3 inhibitor. Overall, findings suggest that targeting PDK3 with thymoquinone and its derivative is an attractive strategy to combat diabetes and inflammatory diseases.

## OP2-1 Clinical diabetes and therapeutics 1

**Changes in gut microbiome after metformin use in Korean patients with type 2 diabetes**

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**Objective:** Gut microbiome can be affected according to the ethnicity and glycemic status. There are limited data on gut microbiome in Korean patients with type 2 diabetes (T2D).

**Methods:** This was a prospective study enrolled a total of 35 Korean individuals who were newly diagnosed T2D. The gut microbiome was collected at the diagnosis of T2D, 1 week and 3 months after metformin use. We utilized shallow shotgun metagenomics sequencing. The metformin response was defined as decreasing more than 1% of glycosylated hemoglobin A1c.

**Results:** We observed decreased richness in overall microbiome after 1 week of metformin use ( $P < 0.05$ ), however, there was no further statistical decreasing in richness comparing 3-months of metformin use. There was non-significant difference in evenness and overall microbiome structure after metformin use. However, when dividing the study group according to metformin response, Bifidobacterium species detected in metformin responded group, while Streptococcus species clustered in metformin non-responded group ( $P < 0.001$ ).

**Conclusion:** Metformin may affect minor species but the effect on gut microbiome structure may be minor in Korean patients with T2D. Changes in gut microbiome was associated with metformin response.

## OP2-3 Clinical diabetes and therapeutics 1

**Risk of thyroid cancer associated with incretin-based drugs among patients with type 2 diabetes: a population-based cohort study**

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**Objective:** Although incretin-based drugs are commonly prescribed, issues related to the increased risk of thyroid cancer with incretin-based therapies have not yet been settled. This study aimed to determine the potential association between the use of either glucagon-like peptide-1 receptor agonists (GLP-1RAs) or dipeptidyl-peptidase-4 (DPP-4) inhibitors, and the risk of thyroid cancer in individuals with type 2 diabetes.

**Methods:** This population-based cohort study used claims data from the Korean National Health Insurance Database, 2014-2020. Two distinct cohorts were established to compare each incretin-based drug with sodium-glucose cotransporter-2 (SGLT-2) inhibitors, chosen as active comparators due to their prior non-association with thyroid cancer, and their common usage as add-on therapy to metformin along with GLP-1RAs and DPP-4 inhibitors. The first cohort included 21,722 new-users of GLP-1RAs and 326,993 new-users of SGLT-2 inhibitors, whereas the second cohort included 904,300 DPP-4 inhibitor new-users and 112,017 SGLT-2 inhibitor new-users. The outcome was the time to incident thyroid cancer. Weighted Cox proportional models were used to estimate hazard ratios (HR) of thyroid cancer incidence associated with incretin-based drugs of interest.

**Results:** Over a mean follow-up of 2.4 years, the use of GLP1RA was not associated with an increased risk of thyroid cancer (weighted HR 0.98, 95% CI 0.62-1.53). Likewise, during mean follow-up of 2.9 years, the use of DPP-4i was also not associated with an increased risk of thyroid cancer (weighted HR 0.95, 0.79-1.14). No significant effect modifications were observed across subgroup analyses. Sensitivity analyses, including alternative outcome definition analysis of medullary thyroid cancer, were consistent with the primary analysis results.

**Conclusion:** In this cohort study, both of incretin-based drugs were not associated with an increased risk of thyroid cancer. When considering the risk-benefit balance of incretin-based drugs in patients with type 2 diabetes, the potential for an elevated risk of thyroid cancer would be negligible.

## OP2-2 Clinical diabetes and therapeutics 1

**Predictors of Glucagon-Like Peptide 1 Receptor Agonist (GLP1-RA) treatment discontinuation among patients with type 2 diabetes in Hong Kong: real-world evidence from a prospective cohort**

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Alice PS Kong<sup>1</sup>, Ronald CW Ma<sup>1</sup>, Andrea OY Luk<sup>1</sup>, Risa Ozaki<sup>2</sup>,  
Juliana CN Chan<sup>1</sup>, Elaine Chow<sup>1</sup>, Aimin Yang<sup>1</sup>

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**Objective:** Despite efficacy in glycemic, weight reduction and cardio-renal benefits, the discontinuation rate of GLP1-RAs is high in real-world studies in Western countries. To understand the patterns behind discontinuation in Asians, we examined the associations between patient factors and the discontinuation of GLP1-RAs among patients with type 2 diabetes in Hong Kong.

**Methods:** This was a territory-wide, prospective cohort of 1,831 patients with diabetes and comprehensive demographic and laboratory data who were initiated on GLP1-RAs (liraglutide, exenatide, dulaglutide, and lixisenatide) in 2008-2019 in Hong Kong. Treatment discontinuation was defined as the absence of dispensation of GLP1-RAs for at least 90 consecutive days. We compared the baseline characteristics, background glucose-lowering drugs and complication history between persistent and discontinued users.

**Results:** We included 1,831 diabetes patients (55.2% male, mean age  $54.8 \pm 11.3$  years, diabetes duration  $14.9 \pm 8.0$  years, baseline HbA1c  $9.0 \pm 1.5\%$ , BMI  $32.0 \pm 5.6$  kg/m<sup>2</sup>) with a median (IQR) follow-up of 1.9 (0.9, 4.1) years. Of these, 42.1% (n=771) discontinued and 57.9% (n=1060) continued GLP1-RAs at 9 months of follow-up. Discontinued users were younger ( $53.4 \pm 11.1$  vs  $55.8 \pm 11.4$  years), had higher baseline HbA1c ( $9.1 \pm 1.5$  vs  $8.9 \pm 1.5\%$ ) and were less likely to be on concomitant sodium-glucose co-transporter 2 inhibitor (14.5 vs 27.2%) and dipeptidyl peptidase-4 inhibitor (31.4 vs 37.9%) therapy. Baseline BMI ( $32.2 \pm 5.9$  vs  $31.8 \pm 5.5$  kg/m<sup>2</sup>) and proportion on insulin therapy (77.7 vs 75.9%) were similar between discontinued and continued users. Patients who continued GLP1-RA were more likely to have a history of coronary heart disease (16.0% vs 11.7%).

**Conclusion:** Discontinuation of GLP1-RAs was more likely among younger patients with poorer baseline glycemic control. Concurrent glucose-lowering drugs and complication history were predictors of drug discontinuation. Further prospective studies are warranted to investigate the underlying reasons for discontinuation and development of targeted interventions.

## OP2-4 Clinical diabetes and therapeutics 1

**Effects of Predictive-Low-Glucose-Suspension (PLGS) insulin pump with structured algorithm for preoperative glycemic control: a propensity score matching study**

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**Objective:** Predictive-low-glucose suspension (PLGS) augmented pumps have demonstrated benefits in preventing hypoglycemia, thereby facilitating safer intensification of insulin dosages. This study aims to assess whether the implementation of a PLGS augmented pump with a structured insulin adjustment algorithm offers superior outcomes among hospitalized patients for preoperative glycemic control.

**Methods:** Conducted at a single tertiary center, this retrospective propensity-score matching study included poorly controlled diabetic patients admitted to the endocrinology department for glycemic control before planned surgeries between January 2020 and July 2023. The PLGS augmented pump group employed Minimed<sup>TM</sup> 640G or 770G pumps without closed-loop mode, while the control group adhered to the BBI regimen. Alongside the conventional regimen, a structured insulin adjustment algorithm was applied during the nighttime for the PLGS augmented pump group. The study evaluated the mean difference in point-of-care test (POCT) glucose values during the four-day period from admission.

**Results:** Among 104 patients (52 in the PLGS augmented pump group and 52 in the BBI group), the baseline A1c was  $9.3 \pm 1.4\%$ , with a mean age of  $59.8 \pm 13.1$  years. The PLGS augmented pump group exhibited better average glucose levels during the four-day period (estimated mean  $\pm$  standard error,  $147.6 \pm 7.7$  vs.  $164.3 \pm 7.3$  mg/dL,  $P = 0.007$ ), without an increase in hypoglycemia. By the fourth day of hospitalization, 56.9% and 21.6% of patients in the PLGS augmented pump and BBI groups, respectively, achieved both pre- and post-prandial targets of  $< 140$  mg/dL and  $< 180$  mg/dL (relative ratio 2.36,  $P = 0.016$ ). The PLGS augmented pump group also experienced a shorter hospital stay ( $9.4 \pm 1.4$  vs.  $13.2 \pm 1.4$  days,  $P < 0.001$ ). For the PLGS augmented pump group, time in range of 70-180 mg/dL was  $80.0 \pm 13.6\%$ , and time below range of 70 mg/dL was  $1.8 \pm 2.3\%$ .

**Conclusion:** In the context of preoperative glycemic control for hospitalized patients, the utilization of PLGS augmented pumps demonstrated improved glycemic control and shorter hospital stays compared to the BBI regimen.

## OP2-5 Clinical diabetes and therapeutics 1

**Benefits of advanced hybrid closed loop system (MiniMedTM 780G) in meal management: patients who transition from MiniMedTM 670G/770G system in Australia**John Shin<sup>1\*</sup>, Zheng Dai<sup>1</sup>, Fang Niu<sup>1</sup>, Sol Kwon<sup>2</sup>, Jinkyung Jeon<sup>2</sup>  
Medtronic, United States<sup>1</sup>, Medtronic, Korea<sup>2</sup>

**Objective:** To achieve the best glycemic outcomes from CSII therapy, it is critical to have good settings (e.g. basal rates, insulin sensitivity, insulin carbohydrate ratio) and meticulous patient behaviors (e.g. correct carbohydrate counting and entry). It is very difficult to do both well. This study evaluates different types of patients and their meal management with MiniMed<sup>TM</sup> 780G.

**Methods:** Consented and Anonymized Medtronic CareLink<sup>TM</sup> data from patients who transitioned from MiniMed<sup>TM</sup> 670G/770G to 780G system between Jan 2020 to Dec 2022 in Australia were used to investigate patients' behaviors, insulin usages and glycemic outcomes. The MiniMed<sup>TM</sup> 670G/770G Patients were then stratified by carbohydrates entry per day: 1) Group1: <3; 2) Group2: 3-8; and 3) Group3: >8.

**Results:** Each group (i.e. Group1: N=26, Group2: N=855, Group3: N=170) had very different number of carbohydrates entries(g) and total daily insulin doses (TDDs, units) (Group1: 100.8±63.2, 66.0±32.2; Group2: 150.7±61.6, 51.6±26.6; Group3: 185.4±68.6, 45.6±26.5). The percent of Basal (%) was also different. (Group1: 65.5±11.4; Group2: 50.0±9.9; Group3: 43.9±9.4). Once transitioned to MiniMed<sup>TM</sup> 780G system, all groups have shown significant (p<0.001) increases of boluses (auto-correction% increase, Group1: 63.5; Group2: 30.7; Group3:22.1) and improvements in Time In Range (70-180 mg/dl.%) and Time Above Range(>180 mg/dl.%), respectively (Group1: 52.6±12.5 to 63.3±12.7, 46.0±12.8 to 35.7±13.0; Group2: 69.5±10.3 to 73.6±10.1, 28.5±10.5 to 24.5±10.4; Group3: 74.9±9.0 to 77.7±9.2, 22.9±9.5 to 19.9±9.6).

**Conclusion:** This data demonstrates a robustness of MiniMed<sup>TM</sup> 780G algorithm for all types of patients and, especially for those who may not have rigorous behaviors (i.e. correct carbohydrates counting/entry, Group1).

## OP3-1 Diabetes care &amp; education

**Novel clustering of dietary pattern for predicting incident diabetes**Soree Yang<sup>1\*</sup>, Minsoo Kim<sup>1</sup>, Young Jin Kim<sup>2</sup>, Myungsoo Im<sup>1</sup>,  
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Sohyeon Jeon<sup>1</sup>, Hye Jung Je<sup>1</sup>, Hyo Eun Kwak<sup>1</sup>, Yeong Jin Kim<sup>2</sup>,  
In Joo Kim<sup>3</sup>, Hyuk Kang<sup>4</sup>, Joon Ha<sup>5</sup>, Jinmi Kim<sup>1</sup>, Sang Soo Kim<sup>1</sup>Pusan National University Hospital, Korea<sup>1</sup>, Korea Institute of Science and  
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National Institute for Mathematical Sciences, Korea<sup>4</sup>, Howard University, United  
States<sup>5</sup>

**Objective:** Evidence from observational studies suggest that intake several foods and beverages is associated with the incident of diabetes. However, people usually eat a combined diet consisting of a variety of foods, not just single food. Here, we investigated a novel method to find patterns related to development of diabetes using large-scale data such as individual's food intake frequency, and to find specific dietary patterns related to future diabetes to find the value of use for diabetes prevention.

**Methods:** This study used the data from the Korean Genome and Epidemiology Study (KoGES). A validated semi-quantitative food frequency questionnaire (FFQ) was conducted to collect dietary intake information at baseline. To distinguish derived food patterns by deep learning techniques easily, the 103 food items were grouped into 26 food groups. We applied a new pruning optimization method applied to a traditional hierarchical structure of the cluster with the Louvain clustering method. Afterward, the Semi-Supervised Pruning Optimization (SSPO) was applied to this hierarchical structure.

**Results:** We obtained 42 clusters with 6,127 subjects. A total of 42 clusters were derived and divided into five risk groups as DM incidence rate. The low-risk group was more tended to consume a various and balanced diet and more nourished than the high-risk group. The linkages among food patterns by SSPO could suggest the change of DM incidence when a food pattern shifts to the other one. Among derived food patterns, specific patterns and nutritional features were proposed by the high and low DM incidence group.

**Conclusion:** A new clustering method, SSPO provided a broader implication to understand individual's overall food intake and its relationship with DM incidence. Our new method may be used to develop nutritional education supplements for a personalized dietary assessment and recommendation for DM prevention.

## OP2-6 Clinical diabetes and therapeutics 1

**Monogenic diabetes: a one-year experience at a specialized clinical genomics clinic**Hye Won Yang<sup>1,2\*</sup>, Min-Seok Han<sup>2</sup>, Heejun Son<sup>1,2</sup>, Jinsun Jang<sup>1,2</sup>,  
Seung Shin Park<sup>1,2</sup>, Kyong Soo Park<sup>1,2</sup>, Soo Heon Kwak<sup>1,2</sup>Seoul National University Hospital, Korea<sup>1</sup>,  
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**Objective:** Monogenic diabetes includes conditions like maturity-onset diabetes of the young (MODY), neonatal diabetes mellitus, and other syndromic forms of diabetes. This study explores the application of precision medicine for monogenic diabetes at Seoul National University Hospital Clinical Genomics Clinic, launched in late 2021. It aims to identify misdiagnosed monogenic diabetes, frequently mistaken for type 1 or early-onset type 2 diabetes.

**Methods:** A total of 84 patients suspected of monogenic diabetes underwent targeted exome sequencing, focusing on 30 genes known to cause the disease. Inclusion criteria consisted of a family history of diabetes and a body mass index (BMI) ≤25 kg/m<sup>2</sup>. The pathogenicity of variants was assessed following the guidelines of the American College of Medical Genetics and Genomics and the Association for Molecular Pathology.

**Results:** Among the 84 participants, 9 individuals (10.7%) were diagnosed with monogenic diabetes. A total of 11 variants were classified as pathogenic or likely pathogenic. Among common MODY genes, we observed two cases of *HNF1A*-MODY (p.Val115fs and p.Pro394fs), one case of *GCK*-MODY (p.Met211Lys), and one case of *HNF4A*-MODY (p.Arg333Leu). Additionally, we identified one case of neonatal diabetes with *INS* gene mutation (p.Gly32Ser) misdiagnosed as type 1 diabetes, and one case of early-onset diabetes with a history of severe neonatal hypoglycemia, which was a result of compound heterozygous mutations in *ABCC8* (p.Arg519fs, p.Arg248\*). We also discovered one case of compound heterozygous Wolfram syndrome (p.Leu303Pro and p.Phe515fs in *WFS*), and two independent cases of *PDX1* gene mutation (p.Gly246fs), classified as variants of uncertain significance due to insufficient evidence.

**Conclusion:** Through targeted sequencing, we established molecular genetic diagnoses for 9 participants (10.7%), which led to tailored therapy. We believe this prevalence would be similar in other endocrine clinics in Korea. It is crucial to consider monogenic diabetes in relevant cases and provide molecular genetic testing for individuals with suspected symptoms.

## OP3-2 Diabetes care &amp; education

**Web based diabetes registration in Mongolia**Sainbileg Sonomtseren<sup>1,2,3\*</sup>, Bolor Byambatsoo<sup>1,2</sup>, Enkhjin Boldbaatar<sup>1</sup>Endomed Hospital, Mongolia<sup>1</sup>, Mongolian National University of Medical Sciences,  
Mongolia<sup>2</sup>, Mongolian Diabetes Association, Mongolia<sup>3</sup>

**Objective:** National diabetes registration is an important data source. The first web-based, diabetes registration in Mongolia began in December 2015. The aim of this study was to evaluate the diabetes situation in Mongolia, using online data sources.

**Methods:** Web-based diabetes registration data from 2016-2022, provided by 26 medical centers in Mongolia were used. Urban 12 and rural 14 centers participated out of 42 medical centers.

**Results:** Web-based diabetes registration was collected from 12225 (6281 male, 5944 female) diabetic patients' information. Among registered diabetic patients T1DM, T2DM, GDM and Other type of DM was 3.3% (411), 95.6% (11839), 0.5% (63) and 0.5% (66), respectively. The prevalence of hypertension was 40.9%. Prevalence of macrovascular complications: stroke, myocardial infarction, and peripheral artery disease was 2.1%, 1.7%, and 0.9%, respectively. Prevalence of diabetic eye disease: retinopathy, cataracts, and blindness were 8.6%, 2.8%, and 0.1%, respectively. Prevalence of diabetic kidney disease: microalbuminuria, macroalbuminuria, kidney failure, hemodialysis, and kidney transplantation 6.2%, 2.6%, 1.3%, 0.3% and 0.03%, respectively. The prevalence of diabetic peripheral and vegetative neuropathy was 17.0% and 1.1%, respectively. Prevalence of diabetic foot complications: foot ulcer, toe amputation, foot amputation, below knee and above knee amputation was 0.9%, 0.2%, 0.02%, 0.1% and 0.1%, respectively. Among registered diabetic patient using Biguanides, DPP4 inhibitors, Thiazolidinediones and Sulfonylureas were 58% (7181), 23.3% (2890), 0.7% (91) and 28.3% (3504), respectively. But, among total diabetic patients using rapid, short-acting, long-acting, ultralong-acting, premixed insulin and insulin pump were 1.0% (125), 6.1% (754), 9.3% (1152), 8.3% (1023), 11.0% (1364) and 0.5% (67), respectively.

**Conclusion:** National diabetes registration is necessary in Mongolia. Thanks to Novo Nordisk A/S for supporting the grant to the Mongolian Diabetes Association for the implementation of the first diabetes online database system.

## OP3-4 Diabetes care &amp; education

**Glycemic parameters of primigravid women with gestational diabetes mellitus**Shuhaimi Farhanah Ahmad\*  
Universiti Teknologi Mara, Malaysia

**Objective:** The main objective of this study is to examine the glycemic parameters of primigravid women with GDM and to compare the readings with the Malaysian Clinical Practice Guideline (CPG), 2017 cut-off point.

**Methods:** This study included 58 primigravid women with GDM visiting Meru Mother and Child Health Clinic, Selangor, Malaysia. This cross-sectional study design was performed from March to October 2022. Demographic and clinical data were retrieved from participants' medical records.

**Results:** A total of 58 primigravid women with newly diagnosed GDM were recruited with baseline characteristics including age, 27.5±3 years, gestation age 23.8±6.2 weeks; pre-pregnancy body mass index (BMI) 28.08±6.7 kg/m<sup>2</sup>. Participants were diagnosed with GDM at 19±6.2 weeks of gestation. Majority (n=54, 93.1%) of participants were diagnosed during their first OGTT, while 6.9% (n=4) were diagnosed during their second OGTT. Mean (SD) fasting blood glucose (FBG) and 2-hour postprandial (2-HPP) were 6.0±6.9 mmol/l and 7.9±1.5 mmol/l, respectively. The OGTT levels of the participants in this study were higher than the CPG, ≥5.1 mmol/l for FBG and ≥7.8 mmol/l for 2-HPP. More than half (n=31, 53%) of the participants had a family history of diabetes. Mean (SD) for participants' first self-monitoring blood glucose (SMBG) for fasting, pre-lunch, post-lunch, and post-dinner were 5.1±0.52 mmol/l, 5.07±0.72 mmol/l, 5.5 mmol/l±0.81, and 6.1 mmol/l±0.68, respectively. None of these readings exceeded the CPG cut-off point (≥5.3 mmol/l for FBG and 6.4-6.7 mmol/l for 2-HPP).

**Conclusion:** This study found that participants were diagnosed with high FBG, 6.0 mmol/l±6.9, compared to the guideline provided (≥5.1 mmol/l). While the readings for 2-HPP and SMBG were within the recommended guideline. Establishing systematic education about monitoring blood glucose levels during antenatal care is recommended to improve GDM outcomes.

## OP3-5 Diabetes care &amp; education

**Role of integrated personalized diabetes management program for Diabetes Mellitus Type 2 (T2DM) control in limited resources facility: randomized controlled trial**Burhan Gunawan\*, Soesilowati Soerachmad, Liana Dewi  
Sumber Waras Hospital, West Jakarta, Indonesia

**Objective:** The clinical inertia contributed for the high burden of Diabetes Mellitus Type 2 (T2DM), due to ineffectiveness of treatment intensification, insufficient therapy adherence, and lack of patient empowerment to improve clinical outcome. The aim of this study was to determine role of integrated personalized diabetes management (IPDM) program for glycemic control in T2DM patients.

**Methods:** This randomized controlled trial held in Sumber Waras Hospital, Jakarta, Indonesia, from June 2022 until June 2023. Main inclusion criteria were T2DM patient registered in Diabetes and Endocrine Centre and earnestly involved the program. The intervention group received IPDM program consists: (1) structured individual assessment and training by professional medical team (2) structured documentation of clinical information, including blood glucose and related condition (3) structured regular group exercise (4) structured group-based discussion and professional sharing (5) regular treatment effectiveness assessment. Meanwhile the control group only received regular treatment assessment. The outcome was glycemic control (HbA1c), morbidity incidence (micro and macrovascular complication), and patient satisfaction (use Diabetes Treatment Satisfaction Questionnaire for Change).

**Results:** Total 200 subject randomized in study period (98 intervention, 102 control group). There no significance demographic data, HbA1c, and clinical difference in each group before trial. The intervention group show significance better glycemic control after 1 year program (mean HbA1c 6.1±1.2 vs 7.3±1.6), p=0.001, OR=0.65 (0.49-0.81). The morbidity incidence lower significantly in intervention group (p=0.002, OR=0.74 (0.53-0.92)). The patient satisfaction also higher significantly in intervention group (p<0.000).

**Conclusion:** This IPDM program resulted in greater reduction of HbA1c and morbidity incidence, also increase patient satisfaction, even in limited resourced facility. This program may have the potential benefit for individual person living with T2DM in the future.

## OP4-1 Diabetes complications-basic &amp; translational

**Causal association of type 2 diabetes and pulmonary tuberculosis: a mendelian randomization study**Hyunsuk Lee<sup>1\*</sup>, Jaewon Choi<sup>2</sup>, Jeongeun Lee<sup>2</sup>,  
Jongseok Park<sup>2</sup>, Kyong Soo Park<sup>2</sup>, Soo Heon Kwak<sup>2</sup>Seoul National University, Korea<sup>1</sup>, Seoul National University Hospital, Korea<sup>2</sup>

**Objective:** Type 2 diabetes (T2D) is associated with a three-fold risk of developing tuberculosis (TB), a two-fold risk of mortality during the treatment of TB. While approximately 370,000 new cases of TB in 2020 were suggested to be attributable to diabetes worldwide, whether T2D is causally related with TB is largely unknown. The aim of this study was to infer causal relationship between T2D and pulmonary TB using a two-sample Mendelian Randomization (MR) framework.

**Methods:** We performed an MR analysis in the East Asian population, where pulmonary tuberculosis is still endemic. To determine the genetically causal estimates for T2D, we selected 19 genetic variants as instrumental variables. These variants were associated with T2D attaining genome-wide significance level from the meta-analysis of the Korean Genome and Epidemiology Study and the Taiwan Biobank (N=135,387, F-statistics=15.8). The outcome data for pulmonary TB was obtained from Biobank Japan (N=212,453). Two-sample MR analysis was performed using the inverse variance-weighted method and multiple sensitivity analyses including MR-Egger, weighted median, weighted mode, MR-PRESSO and MR-RAPS were performed.

**Results:** Summary-level MR analysis showed that having a high genetic risk for T2D was significantly associated with an increased risk for pulmonary TB. Having a two-fold increased genetic risk for T2D was associated with a 24% increased risk for pulmonary TB (OR 1.24, 95% CI 1.09-1.41, P=0.0011). This association was also significant in multiple sensitivity analyses (MR-Egger: P=0.040, weighted median: P=0.0016, weighted mode: P=0.019, MR-PRESSO: P=6.8×10<sup>-4</sup>, MR-RAPS: P=0.0012). Absence of a horizontal pleiotropic pathway was identified using the MR-Egger intercept test (P=0.55) and the MR-PRESSO global test (P=0.84).

**Conclusion:** Genetically predicted T2D is significantly associated with increased risk of pulmonary TB. This MR analysis supports the causal predisposition to pulmonary tuberculosis by T2D.

## OP4-3 Diabetes complications-basic &amp; translational

**Clinical meaning of urinary glycated albumin in patients with diabetes: a prospective cohort study of residual urine samples**Minyoung Lee<sup>1\*</sup>, Ji Hoon Bae<sup>1</sup>, Arim Choi<sup>1</sup>,  
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**Objective:** Serum glycated albumin (GA) is a useful biomarker to reflect glycemic status and glucose fluctuation in patients with diabetes. However, measurement of GA using urine samples has been insufficiently studied, even though urinary detection of GA may be preferred because of its non-invasive method. In this study, we measured urinary GA and investigated its clinical implication in patients with diabetes.

**Methods:** Patients with type 1 and 2 diabetes (aged ≥ 20 years) were prospectively enrolled (total=264, type 1=4; type 2=260) from 2020 to 2023, and remnant urine samples of patients were obtained after routine urinalysis in an outpatient setting to measure urinary GA. Urinary GA was evaluated using using Lucica® GA-L kit for the enzymatic method.

**Results:** Among total of 264 subjects, urinary GA was detectable in 66 subjects (25.0%). Subjects with detectable urinary GA showed higher levels of albumin to creatinine (ACR) and protein to creatinine (PCR), and a lower level of estimated glomerular filtration rate (eGFR) than subject with undetectable urinary GA. In subject with measurable urinary GA, higher urinary GA significantly correlated with better kidney function (higher eGFR) and lower levels of ACR and PCR. In addition, even after adjustment for anthropometric and biochemical variables, type and duration of diabetes, comorbidities, and multiple medication use in multiple linear regression analysis, higher urinary GA was an independent determinants for higher eGFR with a bigger effect size to determine eGFR than ACR estimated using regression coefficient (0.154 for urinary GA and -0.012 for ACR). Our findings are in the line with a previous hypothesis that higher renal selectivity of GA to secrete in the urine reflects intact function of glomerular basement membrane and renal proximal tubules.

**Conclusion:** Urinary GA may be an independent clinical biomarker to reflect kidney function in patients with diabetes.

## OP4-4 Diabetes complications-basic &amp; translational

**Combinatorial effects of tetrahydrocurcumin (THU) and transforming growth factor-beta receptor I inhibitor on nonalcoholic steatohepatitis**

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**Objective:** Nonalcoholic steatohepatitis (NASH) is a multifactorial liver disease related to multiple causes. It is developed from hepatic steatosis by a combination of triglyceride accumulation, cellular stress, apoptosis, and chronic inflammation. Chronic liver injury leads to fibrogenesis and eventually hepatocarcinogenesis. Due to the complexity of its manifestation, a multi-targeting strategy is highly noticeable to effectively combat the disease progression. Here, we aimed to evaluate the combinatorial effects of THU and TGF- $\beta$  receptor I inhibitor (EW-7197) in the NASH-mice model.

**Methods:** Murine hepatocytes (AML12) and human hepatic stellate cells (LX-2) were stimulated with palmitic acid (250 nM), or TGF- $\beta$  (2 ng/ml), followed by the treatment with THU (1  $\mu$ M), EW-7197 (0.5  $\mu$ M), or the combination treatment for 24 h. The cellular stress markers, lipogenesis, and profibrotic genes were investigated. For NASH-mice model, THU (100 mg/kg), EW-7197 (20 mg/kg), or the combination treatment were manipulated in the MCD-fed mice for 6 consecutive weeks. The lipogenesis, profibrotic genes, and hepatic injuries were assessed.

**Results:** In LX2 and AML12 cells, fibrotic markers notably inhibited by EW-7197 or combination treatment via suppression of pSMAD2/3 signaling. However, EW-7197 alone increased lipid droplets and lipogenic proteins in TGF- $\beta$ -exposed cells, whereas the combination treatment or THU alone did not show these unwanted effects. In NASH-mice model, EW-7197 alleviated liver fibrosis by suppressing the TGF- $\beta$  canonical pathway and its downstream targets. THU markedly diminished apoptosis and inflammation. The elevated AST and ALT markedly decreased in the combined treatment. Consistent with *in vitro*, EW-7197 expanded hepatic fat accumulation. Although THU has a weak antifibrotic effect, it attenuated EW-7197-induced lipogenesis by suppressing Srebp-1c and Fasn, as well as decreasing hepatic triglyceride.

**Conclusion:** Altogether, these indicate that the combination treatment can be a promising NASH drug by suppressing fibrosis, apoptosis, and inflammation as well as minimizing the unwanted effects due to EW-7197.

## OP4-5 Diabetes complications-basic &amp; translational

**A mouse model for metabolic stress-induced nonalcoholic fatty liver disease and subsequent hepatocellular carcinoma**

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**Objective:** Nonalcoholic fatty liver disease (NAFLD) encompasses a wide range of liver diseases from fatty liver to hepatocellular carcinoma (HCC). However, there are limitations in NAFLD research due to lack of appropriate animal models that reflects the full range of the disease with physiological relevance. In this study, we present a mouse model of NAFLD and subsequent HCC along with the characteristic of metabolic dysfunction.

**Methods:** To generate NAFLD mouse model accompanied with diabetes, male C57BL/6J mice were injected with low dose streptozotocin (40 mg/kg) for 5 consecutive days from 7 weeks of age. Then control mice were fed standard chow diet (SCD) and the model mice were fed high fat diet (HFD) from 8 weeks of age. Hepatic histology, transcriptomes and metabolic phenotypes were evaluated at multiple time points. Mouse transcriptomic data were also compared to human transcriptomic data with similar hepatic histology.

**Results:** The model mice developed hepatic steatosis, steatohepatitis, progressive hepatic fibrosis, and HCC at 14, 20, 32, and 38 weeks of age, respectively, with systemic metabolic disturbances. We call this model as Metabolic stress-Associated Steatohepatitis and Hepatocellular carcinoma model (MASH). Transcriptomics and epigenomics studies revealed the sequential changes in the liver as NAFLD progresses, including epigenetic downregulation of tissue repair process. Furthermore, a substantial association between MASH mice and human NAFLD patients with similar liver histology was observed at transcriptome level. HCCs developed in MASH mouse were associated with human NAFLD-related HCCs regarding to histological and transcriptomic features. Discontinuation of HFD feeding or application of incretin-based therapies suppressed progression of NASH, hepatic fibrosis, HCC development and reversed hepatic transcriptomic changes of MASH mouse.

**Conclusion:** We have developed a novel mouse model of NAFLD and subsequent HCC. This model mimics physiological, metabolic, histological and transcriptomic alterations that occur in human patients as NAFLD progresses.

## OP4-6 Diabetes complications-basic &amp; translational

**Biological importance of anthocyanin in Cardiovascular Disease (CVD): therapeutic role in diabetic cardiomyopathy with their molecular mechanism**

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**Objective:** Diabetes mellitus (DM) has been associated with cardiovascular disease (CVD). In the modern age, CVD is one of the main biological complications which affect many lives among people with diabetes. Further, diabetic CVD is associated with heart failure, coronary artery disease, ischemic heart disease, stroke, and diabetic cardiomyopathy (DCM). Anthocyanins are the pigments which gives bright colours to the fruits and vegetables. Anthocyanin has been widely studied for its medicinal properties and pharmacological effectiveness in medicine. Anthocyanins have numerous health beneficial potential in medicine, including anti-diabetic, anti-obesity effects and prevent CVD.

**Methods:** Biological potential of Anthocyanins class phytochemical have been investigated for their effectiveness against diabetic cardiomyopathy (DCM) and associated secondary complications in present work through scientific data analysis of numerous scientific research works. Biological potential of anthocyanin against isoproterenol-induced myocardial infarction has been investigated in the scientific research. Further, in another scientific research work, its effects on alleviated vascular inflammation in endothelial cells have been also described in the scientific fields. Other pharmacological activities of anthocyanin were also correlated in the present investigation in order to know its health beneficial aspects in medicine.

**Results:** Present work scientific data signified the biological importance and therapeutic effectiveness of anthocyanin in medicine. In cardiovascular scientific research, anthocyanin has been reported to exert cardioprotective effects against isoproterenol-induced myocardial infarction. However, in another scientific research work, anthocyanin reduced vascular inflammation in endothelial cells, which signified its effectiveness against numerous cardiovascular disease complications. Further, some other scientific research work data revealed the biological importance of anthocyanin on dyslipidemia, promote vascular protection, ameliorate atherosclerosis, counteract obesity, and attenuate diabetic cardiomyopathy. Scientific research showed significant role of anthocyanin in modulating diabetic cardiovascular disease by modulating fibrosis, oxidative damage, inflammation, and apoptosis.

**Conclusion:** Present work signified biological importance of anthocyanin in cardiovascular disease, including diabetic cardiomyopathy.

## OP5-1 Clinical diabetes and therapeutics 2

**Real-world evidence of hybrid closed-loop system (MiniMed 770G) switching from predictive-low-glucose-suspension insulin pump (MiniMed 640G) in Korea: a nationwide retrospective study**

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**Objective:** Despite numerous existing clinical trial data on hybrid closed-loop (HCL) systems, there is a scarcity of real-world evidence, particularly in Korea. This study aims to evaluate the real-world glycemic outcomes of the MiniMed™ 770G the first commercialized HCL system in Korea, compared to a sensor-augmented pump with the predictive-low-glucose-suspension management (PLGM) feature (MiniMed™ 640G).

**Methods:** Anonymized data from MiniMed™ 640G and 770G users between July 2017 to May 2023 in Korea were obtained from the Medtronic CareLink™. The comparison involved both independent assessments of MiniMed™ 640G and 770G users, and a subgroup analysis of patients who switched from MiniMed™ 640G to 770G system.

**Results:** A total of 460 patients with type 1 diabetes (MiniMed™ 640G vs. 770G: 215 vs. 245) were analyzed independently. Among patients with available age data, the age distribution was 6.9%, 41.3%, and 51.9% for age groups <7, 7 to 17, and  $\geq$ 18 years, respectively. The mean usage time of MiniMed™ 770G was 8.1  $\pm$  4.8 months. The mean time in range (TIR) of 70-180 mg/dL improved from 61.3  $\pm$  16.3% to 71.6  $\pm$  9.9% (estimated difference 9.4%, P<0.001). The glucose management indicator (GMI) changed from 7.4  $\pm$  0.8% to 7.0  $\pm$  0.4% (estimated difference -0.3%, P<0.001). Additionally, the standard deviation (SD) improved from 61.2  $\pm$  14.9 to 54.4  $\pm$  11.5 (estimated difference -6.3, P<0.001). There was no significant difference in time below range (TBR). A subgroup analysis of 43 subjects who switched from MiniMed™ 640G to 770G also demonstrated improvements in TIR, GMI, and SD by 8.2  $\pm$  10.7%, -0.3  $\pm$  0.5%, and -6.0  $\pm$  11.2 mg/dL, respectively (all P<0.001), with no significant change in TBR. Similar results were observed across different age groups.

**Conclusion:** In line with clinical trials and real-world studies from other countries, this real-world evidence of HCL systems compared to PLGM systems in Korea suggests a significant improvement in glycemic control without an increase in hypoglycemia.

## OP5-2 Clinical diabetes and therapeutics 2

**Real-World continuous glucose monitoring data from a population with type 1 diabetes in South Korea: single-system analysis**

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 Samsung Medical Center, Sungkyunkwan University School of Medicine,  
 Korea<sup>1</sup>, Dexcom, Inc., United States<sup>2</sup>

**Objective:** We used continuous glucose monitoring (CGM) data to investigate glycemic outcomes in a real-world population with type 1 diabetes (T1D) from South Korea, where the widespread use of CGM and the nationwide education program began almost simultaneously.

**Methods:** Data from an anonymized convenience sample of 2,265 Dexcom G6 users with T1D in South Korea were collected between January 2019 and January 2023. Users were included if they provided at least 90 days of uploaded glucose data and used CGM at least 70% of the days in the investigational period. The relationship between G6 utilization and glycemic metrics, including the percentage of time in range (TIR), time below range (TBR), and time above range (TAR), was assessed.

**Results:** Mean age was 40.6 years (57% female), with average uploads of 428 days. Mean TIR was 62.4±18.5%, mean TBR<70 mg/dL was 2.6±2.8%, mean TAR>180 mg/dL was 35.0±19.3%, mean glucose was 168.1±35.8 mg/dL, mean glucose management indicator was 7.2±0.9%, and mean coefficient of variation was 36.7±6.0%. Users with higher G6 utilization had higher TIR (67.8% vs. 52.7%), and lower TBR<70 mg/dL (2.3% vs. 4.7%) and TAR>180 mg/dL (30.0% vs. 42.6%) than those with low G6 utilization (p<0.001 for all). Users whose data were shared with others had higher TIR than those who did not (63.3% vs. 60.8%, p=0.001).

**Conclusion:** In this South Korean population, higher G6 utilization was associated with a favorably higher mean TIR, which was close to the internationally recommended target. Using its remote data-sharing feature showed beneficial impact on TIR.

## OP5-3 Clinical diabetes and therapeutics 2

**Solid lipid nano-particles of quercetin to abrogate renal dysfunction in experimentally induced type II diabetic rats: an anti-inflammatory therapy**

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**Objective:** Diabetic nephropathy (DN), is the major health problem and various mechanism involved in the DN pathogenesis, abnormalities in the renal nitric oxide and inflammation has attracted a lot of attention. Various researches suggest that the micro-inflammation generated during the DN and the anti-inflammatory drug play a momentous role. The researcher targeted the NF-Kb mechanism for the treatment of DN. In the present study, we try to explore the molecular mechanism of Solid lipid nanoparticles (SLN) of quercetin in experimental induced DN in Streptozotocin (STZ) treated rats

**Methods:** For SLN preparation, double emulsion displacement method was used. STZ (55 mg/kg) was used for the induction of DM and rats were divided into different group and received the treatment of QE and QE-SLN for 4 weeks. The body weight, plasma insulin, biochemical, antioxidant parameters were estimated, respectively. pro-inflammatory cytokines viz., TNF- $\alpha$ , IL-1 $\beta$  and IL-6 inflammatory mediator Nuclear transcription factor-kappa B (Nf-kB) and PGE2 were scrutinized, respectively. NF- $\kappa$ B, IL-6 and TNF- $\alpha$  expression of renal were also estimated, respectively. The renal tissue was further used for the histopathological observation.

**Results:** QE-SLNs were evaluated for potential entrapment, particle size, drug release stability and gastric stability. QE-SLNs treatment demonstrated the down-regulation of blood glucose level and up-regulation of plasma insulin (25%), body weight (20%). Additionally, QE-SLNs treatment modulated the biochemical and antioxidant parameters. QE-SLNs treatment exhibited decreased level of IL-1 $\beta$  (32%), TNF- $\alpha$  (41%), IL-6 (29%), PGE<sub>2</sub> (34%) and Nf-kB (42%). Moreover, QE-SLNs showed the alteration in the expression of TNF- $\alpha$  and Nf-kB. Histopathology suggests the less necrosis, infiltrated blood vessels and less swelling in vessels.

**Conclusion:** We can conclude that QE-SLNs nano-formulation can prevent the Diabetic nephropathy via alteration of NF-kB pathway

## OP5-4 Clinical diabetes and therapeutics 2

**Effectiveness of a protocol based automatic mobile message providing system on glycemic control in patients with type 2 diabetes: a 12-week, randomized, open-label, controlled, parallel-group trial**

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 Ikoob Inc., Korea<sup>3</sup>

**Objective:** We have established a protocol based automatic mobile message providing system which sends a combination of text, pictures, and videos regarding diabetes self-management through KakaoTalk, the most popular, free of charge, mobile messenger app in Korea. In this study, we aimed to investigate effectiveness of this system on glycemic control in patients with type 2 diabetes.

**Methods:** This was a 12-week, randomized, open-label, controlled, parallel-group trial. One hundred and ten participants with type 2 diabetes were randomized to mobile message system (MMS) (n = 55) or control group (n = 55). All participants were provided with basic diabetes education. MMS group received a protocol based automated messages regarding self-management such as stress, nutrition, and exercise 2 times per day during 12 weeks on mobile. The primary outcome was the difference in the change in HbA1c levels (%) from baseline to week 12 between 2 groups.

**Results:** HbA1c levels were more significantly decreased in MMS group (8.4±0.7 % → 8.0±1.0 %) than in control group (8.5±0.8% → 8.4±0.8%), resulting in significant between-group difference (p=0.048). No differences were observed for fasting glucose levels, lipid profiles, frequency of new incidence of hypoglycemia or prevention of hypoglycemia, proportion of participants who started regular exercise, eating time, and sitting/lying time between the groups. However, sleep duration was significantly increased in MMS group (6.3±1.4 hour/day → 6.6±1.1 hour/day) while it was not changed in the control group (6.6±1.3 hour/day → 6.5±1.4 hour/day), resulting in a borderline significant difference between the groups (p=0.063)

**Conclusion:** A protocol based automatic mobile message providing system was effective in improving glycemic control in patients in type 2 diabetes. Development of an individualized protocol and application to the system will be required.

## OP5-6 Clinical diabetes and therapeutics 2

**Deep residual convolutional neural network for automated classification of diabetic retinopathy severity levels: a promising approach for early detection and diagnosis**

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**Objective:** Diabetic retinopathy (DR) is a common eye disease that requires early detection and accurate classification for effective treatment. This study aims to develop an automated system using the Deep Residual Convolutional Neural Network (CNN) algorithm to classify the severity levels of DR based on retinal fundus images.

**Methods:** The study utilized a dataset of 8,400 retinal fundus images from the Messidor dataset, specifically the TECHNO-VISION research program. The images underwent preprocessing techniques, including resizing, normalization, and noise reduction. Three ResNet architectures (ResNet50, ResNet101, and ResNet152) were trained on the preprocessed images using categorical cross-entropy loss and backpropagation. Data augmentation techniques were employed for generalization. The models were trained with different batch sizes using stochastic gradient descent. Evaluation metrics were computed using a separate validation dataset.

**Results:** Among the tested ResNet architectures, ResNet101 with a batch size of 64 achieved the highest performance in DR classification. It yielded an accuracy of 90.12%, a sensitivity of 89.36%, and a specificity of 96.62%. The depth of the ResNet101 architecture allowed for a more detailed understanding of retinal fundus image patterns. On average, across different batch sizes, the experiments using ResNet101 produced promising results, with an accuracy of 90.18%, sensitivity of 87.69%, and specificity of 96.37%.

**Conclusion:** ResNet101 effectively classifies DR severity, aiding early detection and diagnosis. Limitations include single dataset reliance and validation needs. An automated system with reliable deep learning can enhance DR screening, improving outcomes and reducing costs.

## OP5-7 Clinical diabetes and therapeutics 2

**The association between life style changes and remission in new-onset type 2 diabetes: a nationwide-cohort study**

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**Objective:** Lifestyle modification is a basic principle of diabetes management, but it is not clear how these lifestyle changes affect the long-term prognosis of type 2 diabetes. This study was to investigate whether lifestyle changes were associated with diabetes remission in newly diagnosed type 2 diabetes patients.

**Methods:** We enrolled the patients with new-onset type 2 diabetes from 2009 to 2012 using a health examination cohort from the Korean National Health Insurance Service (KNHIS). A self-administered questionnaire included the health examination provided by KNHIS was used to investigate the patient's lifestyle. Remission was defined as fasting glucose less than 126 mg/dL at least once in the health examination after stopping medication.

**Results:** A total of 138,211 patients diagnosed with type 2 diabetes from 2009 to 2012 was analyzed, and 8192 (6.3%) patients reported remission during the follow-up period up to 2017. We investigate the drinking, smoking, and regular exercise status at the time of diagnosis and remission, and performed logistic regression on remission. Continuous alcohol consumption and smoking significantly lowered the possibility of remission, and maintenance of physical activity significantly increased the possibility of remission. Abstinence of alcohol increases the chances of remission in male population. Initiation of exercise after diabetes diagnosis was found to significantly increase the probability of remission in both men and women. The association of smoking history or smoking cessation was not clear, but new smoking has been reported to interfere with remission in women.

**Conclusion:** We emphasize the importance of life style modification in improving the prognosis of type 2 diabetes, based on the results of this study reporting the association between a healthy lifestyle and diabetic remission in a new-onset type 2 diabetes. This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korean government (MSIT) (2021R1A2C2013890).

## OP5-8 Clinical diabetes and therapeutics 2

**New users of sodium-glucose cotransporter 2 inhibitors are at low risk of incident pancreatic cancer: a nationwide propensity score-matched cohort study**

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**Objective:** We tested the hypothesis that sodium-glucose cotransporter 2 inhibitor (SGLT2i) reduces the risk of pancreatic ductal adenocarcinoma (PDAC) in people with type 2 diabetes (T2D).

**Methods:** We used an active comparator, new user design, and nationwide data from September 2014 and June 2020. Based on a 1:1 propensity score match, we included 59,594 new users of SGLT2i and 59,594 users of other glucose-lowering medications (oGLMs). In the matched sample, we used the Cox proportional hazards model to estimate hazard ratios (HRs) with 95% CIs for developing PDAC. Death before PDAC was taken into account as a competing risk. Based on the main outcome, exploratory subgroup analyses were undertaken.

**Results:** Among the total of 59,594 patients in each group, PDAC was diagnosed in 87 individuals (0.27%) within the SGLT2i user group during the follow-up period, while 122 individuals (0.34%) in the oGLM group were diagnosed with PDAC. The mortality rate prior to the diagnosis of PDAC was 2.71% (n=747) in the SGLT2i group and 3.77% (n=1,071) in the oGLM group. Calculation of the cause-specific hazard ratio (HR) for PDAC resulted in a value of 0.72 (95% CI 0.55, 0.92), indicating a reduced risk of PDAC among SGLT2i users. Furthermore, the HR for pre-PDAC mortality was calculated as 0.71 (95% CI 0.65, 0.78), suggesting a lower risk of death before the diagnosis of PDAC in the SGLT2i group. In terms of subgroup analyses, no statistically significant interactions were observed between SGLT2i users and any of the subgroups considered in relation to the risk of PDAC.

**Conclusion:** SGLT2i use in individuals with T2D was associated with a reduced risk of PDAC in comparison to other treatments. Therefore, there is a need for further trials to conclusively determine the protective effect of SGLT2i against PDAC.

## OP6-1 Diabetes complications-clinical &amp; epidemiology

**Comparative effectiveness of new antidiabetic medications on major adverse cardiovascular events in people with type 2 diabetes and a prior stroke**

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**Objective:** We aimed to assess the comparative effectiveness of thiazolidinediones (TZDs), sodium-glucose cotransporter 2 inhibitors (SGLT2is), and dipeptidyl peptidase-4 inhibitors (DPP-4is) in reducing major adverse cardiovascular events (MACE) among people with type 2 diabetes (T2D) and a prior stroke.

**Methods:** We conducted a nationwide cohort study utilizing the Korean National Health Insurance Service database from 2008 to 2021. A new-user cohort was established using propensity score matching weights for TZDs, SGLT2is, and DPP-4is. The primary outcome was MACE, comprising myocardial infarction, ischemic stroke, and cardiovascular (CV) death. Secondary outcomes included individual components of MACE, all-cause mortality, hospitalization for heart failure (HHF), and a composite kidney outcome. Weighted Cox proportional hazards models were employed to calculate hazard ratios (HRs) and 95% confidence intervals (CIs), with robust variance estimators accounting for the weighting.

**Results:** The incidence rate of MACE was 202, 220, and 251 per 1,000 person-years for the TZD, SGLT2i, and DPP-4i groups, respectively. Compared to DPP-4is, SGLT2is (HR, 0.86; 95% CI, 0.77-0.97, P=0.014) and TZDs (HR, 0.80; 95% CI, 0.70-0.90; P<0.001) exhibited a lower risk of MACE. Additionally, TZD demonstrated a decreased risk of ischemic stroke (HR, 0.84; 95% CI, 0.73-0.98; P=0.026), CV death (HR, 0.70; 95% CI, 0.56-0.89; P=0.004), late all-cause mortality (HR, 0.67; 95% CI, 0.53-0.84; P=0.001), and the composite kidney outcome (HR, 0.81; 95% CI, 0.67-0.98; P=0.028). In contrast, SGLT2is were associated with a reduced risk of early all-cause mortality (HR, 0.78; 95% CI, 0.67-0.90; P=0.001), HHF (HR, 0.73; 95% CI, 0.62-0.86; P<0.001), and the composite kidney outcomes (HR, 0.63; 95% CI, 0.51-0.78; P<0.001).

**Conclusion:** Among people with T2D and a prior stroke, the use of TZDs and SGLT2is was linked to a decreased risk of MACE, all-cause mortality, and the composite kidney outcome, with varying effects on individual outcomes, when compared to the use of DPP-4is.

## OP6-2 Diabetes complications-clinical &amp; epidemiology

**Impact of increased interleukin-5 on information processing function and its association with mild cognitive impairment in type 2 diabetes mellitus patients: a cross-sectional study**

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**Objective:** Neuroinflammation constitutes an underlying mechanism for cognitive impairment in diabetic patients. The present study endeavors to scrutinize the potential contribution of interleukin-5 (IL-5) towards mild cognitive impairment (MCI), and to assess its diagnostic value for MCI in patients with type 2 diabetes mellitus (T2DM).

**Methods:** 105 individuals diagnosed with T2DM were enrolled and stratified into either an MCI group or a control group based on the presence or absence of MCI. The clinical data were compared, and the association between IL-5 levels and cognitive function was investigated using correlation analysis. Furthermore, regression was employed to elucidate the risk factors of MCI and factors affecting cognitive performance. Finally, the diagnostic value was evaluated using ROC curve.

**Results:** Compared to diabetic patients without MCI, those with MCI demonstrate elevated levels of IL-5. It is natively associated with Montreal Cognitive Assessment (MoCA) scores, reflecting global cognitive function, and positively correlated with Trail Making Test A (TMTA) scores, reflecting information processing speed. Furthermore, an elevated level of IL-5 is identified as a risk factor for MCI, and a factor that influences TMTA scores. Finally, it is recommended that the cut-off value for IL-5 in the diagnosis of MCI in T2DM patients is 22.98 pg/mL, with a sensitivity of 68.6% and specificity of 72.9%.

**Conclusion:** Generally, IL-5 is considered a risk factor for MCI in patients with T2DM and is associated with their performance in information processing speed. Moreover, an elevated level of IL-5 is a plausible biomarker for MCI in T2DM patients.

## OP6-3 Diabetes complications-clinical &amp; epidemiology

**Comparison of body composition indices that best predict new onset T2DM in Korean; based on nationwide cohort with 10-year follow up data**

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**Objective:** For early screening of type 2 diabetes mellitus (T2DM), various body composition indices were suggested. As body composition change across age and sex, we aimed to find the body composition index that predicts best the 10-year new onset DM (NODM) in each age, sex group among body mass index (BMI), waist circumference (WC), WC-height ratio (WHtR), a body shape index (ABSI), visceral adiposity index (VAI), and weight adjusted waist index (WWI).

**Methods:** From the claims data from the National Health Insurance Service (NHIS) database from January 1, 2004, to December 31, 2019, we collected the data of population aged 20-80 who underwent a health examination in 2009. T2DM was defined either by ICD-10 E11-14, usage of oral hypoglycemic agent, or a fasting plasma glucose level of  $\geq 126$  mg/dL. The relationship between NODM and quartiles of each index, and between NODM and 1 standard deviated (SD) elevation of each index, were evaluated by Cox regression analysis.

**Results:** WHtR showed the highest hazard ratio (HR) of NODM in the fourth quartile of total population (HR 2.54, [95% CI 2.52-2.57]), men of all age-groups (20-39: 3.03 [2.98-3.08], 40-59: 2.35 [2.32-2.38], 60-79: 1.70 [1.66-1.74]) and women of age-group under 60 (20-39: 2.61 [2.52-2.69], 40-59: 2.82 [2.77-2.87]). As per 1SD elevation of each index, WHtR remained the highest correlation with NODM in men of all age-groups (20-39: 1.54 [1.53-1.55], 40-59: 1.39 [1.38-1.39], 60-79: 1.23 [1.22-1.24]), but BMI, WHtR, and WC exhibited the highest HR in 20-39 (1.48 [1.47-1.49]), 40-59 (1.46 [1.45-1.47]), and 60-79 (1.23 [1.22-1.24]) age-group in women, respectively.

**Conclusion:** Overall, the effect of body composition on NODM decreases as people get older. As per 1SD index elevation, WHtR is well associated with NODM in men with all age groups, but different indices predict DM best in women according to the age-group.

## OP6-4 Diabetes complications-clinical &amp; epidemiology

**High remnant cholesterol increases the risk of dementia in patients with type 2 diabetes: data from the national health insurance service health screenings**

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**Objective:** No previous study has longitudinally evaluated the effect of remnant cholesterol (remnant-C) on incident dementia in patients with type 2 diabetes (T2D). This retrospective study evaluated the association between remnant-C levels and incident dementia in Korean patients with T2D.

**Methods:** This study included 2,621,596 patients with T2D aged  $\geq 40$  years who participated in a national health examination in 2009-2011 and were followed until 2020. Hazard ratios (HRs) for all-cause, Alzheimer's, and vascular dementia in each quartile of remnant-C were calculated using Cox regression analyses, adjusting for traditional risk factors for dementia.

**Results:** All-cause, Alzheimer's, and vascular dementia developed in 146,991 (5.6%), 117,739 (4.5%), and 14,536 (0.6%), respectively, during a median follow-up of 10.3 years. The risk of dementia increased progressively with higher remnant-C levels. Compared to the lowest quartile of remnant-C, HRs in the highest quartile were 1.11 (95% confidence interval [CI], 1.09-1.13), 1.11 (1.08-1.13), and 1.15 (1.09-1.21) for all-cause, Alzheimer's, and vascular dementia, respectively. The increased risk of dementia with higher remnant-C was more prominent in younger than in older patients (HRs for all-cause dementia, 1.52 [95% CI, 1.36-1.69] in age 40-49, 1.17 [1.11-1.23] in age 50-59, 1.11 [1.08-1.14] in age 60-69, and 1.08 [1.05-1.10] in  $\geq 70$  years, respectively).

**Conclusion:** In patients with T2D, higher levels of remnant C were associated with an increased risk of dementia. This association was independent of conventional risk factors for dementia and was more evident in the younger patients. This implicates remnant-C as a novel risk factor for dementia.

## OP6-5 Diabetes complications-clinical &amp; epidemiology

**To study the role of artificial intelligence in early prediction of acute kidney injury in pediatric patients: systematic review**

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**Objective:** One of the complications of Diabetes which requires timely intervention is Acute Kidney Injury (AKI). Machine learning based models, by taking into consideration different physiological parameters can help in prediction of AKI earlier than traditional laboratory parameters. This systematic review aims to synthesize the evidence available and explore whether the AI has any significant role in prediction of AKI among paediatric age group specifically.

**Methods:** Databases searched were Pubmed and Cochrane with use of appropriate keyword for the studies published till date 1st May 2023. Total 75 studies were found which were further scrutinized as per inclusion criteria- studies involving paediatric patients exclusively (age upto 21 years) observed for developing AKI. Out of 11 such studies 7 studies got further excluded. Final data extraction and synthesis was done based on 4 studies available regarding predictive validity of different machine learning models.

**Results:** The studies included machine learning algorithms-based analysis of retrospective data collected from electronic health record system. Pooled data included total of 45848 patients, out of which 4630 (10.1%) patients developed AKI. Parameters used for real time prediction of risk of developing AKI were renal angina index, vital signs, laboratory values, ventilatory parameters etc. Different machine learning models used in these studies were- model based on multivariate prediction model (AUROC 0.89, predicted 70% of subsequent RRT episodes), a genetic algorithm model (AUROC 0.81 for neonatal AKI, 0.79 for prediction of severity of AKI), algorithms such as - extreme gradient boosting (XGBoost) (AUROC ranged from 0.81-0.91).

**Conclusion:** Machine learning based algorithms are helpful in early prediction AKI and its severity in paediatric patients with good accuracy. Currently too less research is available in paediatric patients which highlights the need to explore artificial intelligence in improving clinical outcomes by conducting studies with larger data sets.

## OP6-7 Diabetes complications-clinical &amp; epidemiology

**Machine learning-based prediction model for cardiovascular disease in patients with diabetes: derivation and validation in two independent Korean cohorts**

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**Objective:** Various machine learning (ML) prediction models have recently been developed for cardiovascular disease (CVD) in type 2 diabetes mellitus (T2DM); however, the lack of multiple risk factors limits their predictive power. This study aimed to evaluate the validity and usefulness of an ML model for predicting the 3-year incidence of CVD in patients with T2DM.

**Methods:** We used data from two independent cohorts, the discovery cohort (one hospital; n=12,809) and the validation cohort (two hospitals; n=2019), to predict CVD. The outcome of interest was the presence/absence of CVD at 3 years. We selected various ML-based models with hyperparameter tuning in the discovery cohort and performed an area under the receiver operating characteristic curve (AUROC) analysis in the validation cohort.

**Results:** The study dataset included 12,809 (discovery) and 2,019 (validation) patients with T2DM recruited between 2008-2022. CVD was observed in 1,238 (10.2%) patients in the discovery cohort. The random forest (RF) model had a mean AUROC of 0.830 (95% confidence interval 0.816-0.845) in the discovery dataset. Applying this result to the extra-validation dataset revealed the best performance among the models, with an AUROC of 0.72 (accuracy of 65.4%, sensitivity of 66.0%, specificity of 65.4%, and balanced accuracy of 65.7%). Creatinine and glycated hemoglobin levels were the most influential factors in the RF model.

**Conclusion:** This study demonstrates the usefulness and feasibility of ML for assessing CVD incidence in patients with T2DM and suggests its potential for use in patient screening. Further international studies are required to validate our findings.

## OP7-1 Others (basic &amp; translational/clinical)

**Cell-specific effect of PGAM5 knockdown on insulin resistance**

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**Objective:** Studies have shown that the expression of mitochondrial membrane protein Phosphoglycerate mutase 5 (PGAM5) is up-regulated in the liver of NAFLD patients and high-fat diet-induced obese mice. Knock-out of PGAM5 reduced body weight, blood glucose and improved insulin resistance in mice. This study aims to investigate the role and mechanism of PGAM5 deficiency on insulin resistance using cellular models.

**Methods:** Fatty acid treated mature 3T3-L1 adipocytes and HepG2 cells were selected as models for obesity and NAFLD. THP-1-derived macrophages treated with LPS were selected as cell models for obesity-related inflammation. In cells treated with vehicle or PGAM5-siRNA, the triglyceride (TG) content and insulin pathway activation of 3T3-L1 and HepG2 cells were measured, and pro-inflammatory cytokines in THP-1 cells were investigated.

**Results:** Transfection of PGAM5 siRNA successfully reduced the protein level of PGAM5 by more than 70%. The knockdown of PGAM5 reduced TG content and up-regulated intracellular insulin signal transduction in mature 3T3-L1. Moreover, PGAM5 knockdown increased the expression of peroxisome proliferator-activated receptor  $\gamma$  coactivator-1 $\alpha$  (PGC-1 $\alpha$ ) and peroxisome proliferator activated receptor- $\alpha$  (PPAR- $\alpha$ ), reduced peroxisome proliferator-activated receptor- $\gamma$  (PPAR- $\gamma$ ) which promoting fatty acid uptake and triglyceride formation in mature 3T3-L1 cells. However, PGAM5 knockdown reduced insulin sensitivity in HepG2 cells treated with fatty acids. Extracellular IL-1  $\beta$  was increased PGAM5 deficient THP-1 cells treated with LPS. On mechanistic levels, nuclear factor erythroid 2-related factor 2 (Nrf2)/antioxidant response element (ARE) pathway was only up-regulated by PGAM5 knockdown in 3T3L1 cells, but were down-regulated in HepG2 cells and THP-1-derived macrophages.

**Conclusion:** The ablation of PGAM5 relieved lipid accumulation and improve insulin sensitivity in adipocytes but not in hepG2 cells, suggesting that the regulation of PGAM5 on insulin resistance is cell-specific. This effect may be largely attributable to the regulation of PGAM5 on NRF2/ARE pathway.

## OP7-2 Others (basic &amp; translational/clinical)

**Inhibition of de novo ceramide synthesis prevents diet-induced obesity and whitening of brown adipose tissue by activating AMPK**

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**Objective:** Ceramide is a biosynthetic intermediate in the sphingolipid synthesis pathway and a precursor of complex sphingolipids. Lines of evidence have shown that abnormal ceramide metabolism is involved in the pathogenesis of obesity and obesity-induced metabolic diseases. Serine palmitoyltransferase (SPT) is the initial, rate-limiting enzyme of de novo ceramide synthesis. To investigate the effect of myriocin, an potent SPT inhibitor, on high-fat diet (HFD)-induced obesity and the "whitening" of brown adipose tissue (BAT).

**Methods:** The 8-week-old mice were given chow diet or HFD, and were administered with two distinct treatments, namely myriocin (0.3 mg/kg/day) or AICAR, an AMPK activator (0.2 mg/g and 0.4 mg/g body weight), over a period of 8 weeks. Body weight, energy expenditure, histologic evaluation of BAT's "whitening" and its associated vascular rarefaction were evaluated. Moreover, the analysis was performed to identify changes in the expression of phosphorylated AMPK and UCP1.

**Results:** Myriocin administration prevented HFD-induced obesity and whitening of BAT by activating AMPK. The HFD led to a decrease in VEGF- $\alpha$  expression in the BAT and also reduced its vascularity, as indicated by lectin staining. However, when we treated HFD-fed mice with myriocin, it reversed the HFD-induced changes in VEGF- $\alpha$  expression and restored vascularity in the BAT. However, there was no observed increase in UCP1 expression and cold tolerance. Similarly, AMPK activation by AICAR significantly reduced body weight and restored vascularity in BAT in HFD-fed mice, without significantly altering UCP1 expression in BAT.

**Conclusion:** Our findings suggest that AMPK activation, achieved via myriocin treatment, plays a critical role in preventing diet-induced whitening of BAT, and this mechanism seems to be independent of UCP1 induction. This highlights a new potential therapeutic target for obesity and associated metabolic diseases.

## OP7-3 Others (basic &amp; translational/clinical)

**Irisin attenuates HSCs activation and liver fibrosis in bile duct ligation mice model via improving mitochondrial dysfunction**

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**Objective:** Translator Liver fibrosis is a common consequence of chronic liver diseases involved with the activation of hepatic stellate cells (HSCs). Irisin, a myokine secreted during physical exercise, was known to have beneficial effects on metabolic disorders and mitochondrial dysfunction. This study was aimed to investigate the role of irisin on liver fibrosis in HSCs and in bile duct ligation mouse model via improving mitochondrial dysfunction.

**Methods:** Translator LX-2 cells, human HSC line, were used for *in vitro* experiments, which were treated with transforming growth factor beta 1 (TGF- $\beta$ 1), a core regulator of HSC fibrosis, with or without irisin. Mitochondrial function was measured by mitochondrial fission markers, TEM, mitochondrial membrane potential and ATP production. *In vivo*, liver fibrosis was induced by bile duct ligation (BDL) in mice. Irisin (100ug/kg/day) was administered by intraperitoneal injection daily for 10 days right after BDL surgery.

**Results:** Translator *In vitro*, irisin mitigated hepatic stellate cells activation and reduced reactive oxygen species ROS related to TGF- $\beta$ 1/Smad signaling pathway and restored TGF- $\beta$ 1 induced increased expression of fission markers such as Fis1 and p-DRP1 and TGF- $\beta$ 1 induced decreased expression of TFAM. Irisin also recovered decreased mitochondrial membrane potential and ATP production by TGF- $\beta$ 1 treatment. *In vivo*, irisin ameliorated BDL induced increased liver/body weight ratio and alleviated liver fibrosis in Masson trichrome staining and mitochondrial dysfunction induced by BDL surgery.

**Conclusion:** Translator Irisin diminished HSC activation and ameliorated liver fibrosis in the BDL mice by improving mitochondrial dysfunction, thus revealing the strong potential of irisin in the treatment of liver fibrosis.

## OP7-4 Others (basic &amp; translational/clinical)

**Maternal outcomes and fasting blood glucose of undernourished mother rats in response to Balinese cow bone marrow microcapsules**

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**Objective:** This study aimed to investigate the impact of Balinese cow bone marrow microcapsules on maternal outcomes and fasting blood glucose of undernourished mother rats.

**Methods:** Laboratory rats were acclimated for one week under normal conditions of 12:12-h light-dark cycles (IACUC No. 242-2024). In one enclosure, female and male Sprague-Dawley rats were mated at a ratio of 2:1 (female to male rats). As a marker of mating, the presence of the vaginal barrier was recorded as day 0 of pregnancy (H0). The rodents were separated into four groups: P0 (normal diet, 20% casein), P1 (low protein diet, 10% casein), P2 (low protein diet with microcapsules), and P4 (low protein diet with omega-3 fatty acids). Both the experimental diet and the intervention lasted for six weeks. Dietary intake and weight gain were calculated throughout pregnancy and lactation. Using a glucose trip test, the mother's fasting blood glucose was measured before mating and following lactation.

**Results:** Due to nutrient content, microcapsule intake led to greater maternal body weight and a higher survival rate among progeny than the other group. Its consumption did not significantly affect fasting blood glucose after the suckling period (<0.05). Otherwise, rats with a low-protein diet showed the highest fasting glucose levels and offspring cannibalism.

**Conclusion:** Thus, Ingestion of cow bone marrow microcapsules improves maternal outcomes and is relatively safe because did not enhance maternal fasting blood glucose.

## OP7-5 Others (basic &amp; translational/clinical)

**Associations of sleep duration and quality with blood glucose control in type 2 diabetes mellitus: a CGM-based analysis**

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**Objective:** Sleep is a critical component of overall health and well-being, and its importance extends to blood glucose control. In this study, we investigated the relationship between continuous glucose monitoring (CGM) metrics and quantity/quality of sleep in patients with type 2 diabetes mellitus (T2DM).

**Methods:** In this single-center cross-sectional study, we recorded continuous glucose readings using the iPRO2 Professional CGM (Medtronic, CA) for average 6.0±1.1 days in 34 patients with T2DM. We employed the Pittsburgh Sleep Quality Index (PSQI) to assess both quantity and quality of sleep, the International Physical Activity Questionnaire (IPAQ) to quantify physical activity, the Michigan Neuropathy Screening Instrument (MNSI) to evaluate neuropathy symptoms and signs, and the short form 12 (SF-12) to objectively score the quality of life.

**Results:** The average total sleep time (TST) was 6.52 hours with average sleep latency of 0.52 hours. For patients with TST ≥7 hours, while HbA1c remained comparable, the CGM-measured average glucose was 27.2 mg/dL lower and the Time in Range (TIR) was 15.9% higher than in patients with TST <7 hours. Patients with sleep latency >20 minutes had 6.3% more time above 250 mg/dL during sleep and 51 minutes shorter TST compared to those with sleep latency ≤20 minutes. In subgroup analysis focusing on male patients, the association between TST and achieving a TIR >70% was most pronounced with an odds ratio of 10.783 (95% CI: 1.307-88.936). In the male subgroup, TST longer than 6h 25m was associated with TIR >70%, while the female subgroup showed no correlation.

**Conclusion:** In patients with T2DM, sleep duration and latency significantly associated with blood glucose control as CGM-metrics. Male patients, in particular, demonstrate a marked correlation between longer sleep times and more optimal glucose range. These insights highlight the integral role of sleep assessment in the comprehensive management of T2DM.

## OP7-7 Others (basic &amp; translational/clinical)

**Exploration of the quiescent state and stem cell-like characteristics of pancreatic stellate cells**

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**Objective:** We have made an interesting discovery regarding the potential of pancreatic stellate cells (PSC) as a novel cellular source for the development of pancreatic beta cells. These PSCs exhibit certain stem cell-like characteristics, offering promising prospects for pancreatic regeneration. However, a significant challenge arises during the culture process, particularly when utilizing serum, as it often induces the activation of PSCs. This study focuses on exploring strategies to maintain and expand PSCs in a quiescent state, thereby ensuring the preservation of their stemness.

**Methods:** Cultivation of Quiescent PSCs: Pancreatic exocrine cell clusters were enzymatically extracted and the exocrine portion was collected using density gradient centrifugation, mesenchymal complete culture medium was uniformly applied to the cell clusters. Verification of PSC Quiescence: Oil red staining was employed to observe lipid droplet formation. Immunofluorescence staining and western blot analysis was conducted to examine the expression levels of  $\alpha$ -SMA, Collagen I, and Fibronectin.

**Results:** We observed a significant decrease in protein expression of Fibronectin,  $\alpha$ -SMA, and Collagen I in our cultured PSCs compared to conventionally serum-cultured PSCs, as confirmed by Western blot analysis. Our cultured PSCs retained intracellular lipid droplets. Furthermore, Immunofluorescence staining demonstrated that our cultured PSCs displayed a distinct branched or triangular shape, smaller cell size, and fewer pseudopodia. Our cultured PSCs displayed a significant reduction in  $\alpha$ -SMA expression compared to conventionally serum-cultured PSCs. Moreover, the Transwell assay revealed a lower migratory speed of our cultured PSCs.

**Conclusion:** Our results indicate that fragmenting external pancreatic exocrine tissue into cell clusters and utilizing serum-free mesenchymal culture medium allow for the maintenance of pancreatic stellate cells in a relatively quiescent state for up to 3-4 passages. This provides crucial technical support for the subsequent establishment of islet-like structures primarily sourced from pancreatic stellate cells (PSCs).

## OP7-8 Others (basic &amp; translational/clinical)

**MAFLD outperforms NAFLD in distinguishing subjects with sarcopenia and compromised muscle quality**

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**Objective:** In 2020, a group of esteemed international experts introduced a novel conceptual framework, referred to as metabolic dysfunction-associated fatty liver disease (MAFLD), as an alternative to nonalcoholic fatty liver disease (NAFLD). We aimed to explore the prevalence of fatty liver disease (FLD) and assess both the quantity and quality of skeletal muscle using each of these diagnostic classifications.

**Methods:** This cross-sectional study included 19,095 participants who underwent abdominal sonography and computed tomography. The participants were classified into 4 categories; Neither-FLD, NAFLD-only, MAFLD-only, or Both-FLD. Appendicular skeletal muscle mass adjusted for body mass index <0.789 for men and <0.512 for women was defined as sarcopenia. The cross-sectional area of the skeletal muscle was measured at the L3 level (total abdominal muscle area, TAMA) and segmented into normal attenuation muscle area (NAMA), low attenuation muscle area (LAMA), and intramuscular adipose tissue (IMAT). Myosteatosis was defined as the lowest quartile of NAMA/TAMA index, calculated by dividing NAMA by TAMA and multiplying 100.

**Results:** The distribution of FLD subtypes was: Neither-FLD (64.9%), NAFLD-only (1.7%), MAFLD-only (11.0%), and Both-FLD (22.4%). The prevalence of sarcopenia and myosteatosis was significantly higher in the MAFLD-only individuals (4.9% and 25.1%, respectively) compared to the Neither-FLD group (1.9% and 17.1%, respectively). Using the Neither-FLD group as a reference, adjusted ORs (95% CI) for sarcopenia were 0.90 (0.37-2.21) in NAFLD-only, 2.54 (1.96-3.28) in MAFLD-only, and 2.66 (2.19-3.23) in Both-FLD. The risk of having myosteatosis was also elevated in the MAFLD groups, with ORs (95% CI) of 1.95 (1.72-2.21) in the MAFLD-only group and 1.66 (1.52-1.82) in the Both-FLD group, while the OR slightly decreased in the NAFLD-only group 0.62 (0.45-0.84).

**Conclusion:** Participants with MAFLD, regardless of the presence of NAFLD, exhibited a higher risk of having sarcopenia and myosteatosis compared to individuals without FLD.

## OP8-1 Korean medical students &amp; medical trainees session

**Quality of life and patient satisfaction to treatment with continuous glucose monitoring in women with gestational diabetes mellitus**

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**Objective:** Gestational diabetes mellitus (GDM) rises a negative psychological effect on mothers, but few studies have been investigated the quality of life of GDM mothers. The purpose of this study was to evaluate the quality of life and treatment satisfaction associated with continuous glucose monitoring (CGM) in pregnant women with GDM.

**Methods:** A cross-sectional study surveyed 46 pregnant women with GDM between 2022 and 2023 in Seoul National University Bundang Hospital. The Korean version of the Audit of Diabetes-Dependent Quality of Life Questionnaire (K-ADDQoL) was surveyed on all study participants in third trimester of pregnancy or after delivery. Nineteen women who applied CGM during pregnancy were surveyed the Korean version of Diabetes Treatment Satisfaction Questionnaire change version (DTSQc).

**Results:** The mean ADDQoL scores was -2.89±1.72. GDM had a negative impact on the QoL in 41.3% of women, and 91.3% expressed the belief that their lives would have been better without GDM. All 19 domains of the K-ADDQoL were adversely influenced by GDM. The domains that showed the most significant impact were freedom to eat (-2.65±0.80) and freedom to drink (-2.54±0.91), while the least impact was on the sex life (-0.05±0.96). The mean DTSQc score was 9.18±11.79, suggesting that GDM women were satisfied with CGM.

**Conclusion:** This study has identified that GDM has a detrimental effect on the quality of life of pregnant women, particularly in relation to their freedom to eat and drink. The utilization of CGM was shown to enhance the level of treatment satisfaction.

## OP8-2 Korean medical students &amp; medical trainees session

**Alpha-tubulin deacetylation impairs angiogenesis and induces endothelial-to-mesenchymal transition**

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Chung-Ang University, Cardiology, Korea<sup>2</sup>

**Objective:** Microtubules are one of the intracellular cytoskeletons which composed of  $\alpha$ - and  $\beta$ -tubulin subunits. Acetylation of  $\alpha$ -tubulin subunits on lysine 40 catalyzed by  $\alpha$ -tubulin N-acetyltransferase 1 ( $\alpha$ TAT1) has been known to be an essential post-translational modification that regulates microtubule stability. However, functional consequences of tubulin acetylation/deacetylation were mostly remained elusive in endothelium.

**Methods:** We generated endothelial cell-specific inducible  $\alpha$ TAT1 KO mice by crossing  $\alpha$ TAT1 floxed mice with Tie2-Cre<sup>ERT2</sup> mice.

**Results:** Endothelial cells isolated from  $\alpha$ TAT1 KO mouse lungs showed robust decrease of  $\alpha$ -tubulin acetylation levels compared to wild-type.  $\alpha$ TAT1 KO mice showed impaired microvessels sprouting based on ex vivo aortic ring assay.  $\alpha$ TAT1 siRNA treated HUVECs significantly reduced VEGF-induced tube formation, cell migration, and proliferation compared to the controls. Furthermore,  $\alpha$ TAT1 silenced cells showed marked spindle-like morphological changes and upregulation of mesenchymal markers indicating endothelial-to-mesenchymal transition (EndMT).

**Conclusion:** Our results demonstrate that tubulin deacetylation in endothelial cells has a pathological role by which impaired angiogenesis and induction of EndMT and could contribute to diabetic vascular complications.

## OP8-4 Korean medical students &amp; medical trainees session

**The role of insulin receptor in cardiac conduction system**

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Chung-Ang University, Cardiology, Korea<sup>2</sup>

**Objective:** Insulin and insulin-like growth factor 1 (IGF-1) signaling regulate cellular growth and glucose metabolism in the myocardium. However, their physiological role in cardiac conduction cells has never been explored. Therefore, we sought to determine the spatiotemporal function of insulin/IGF-1 receptors in the sinoatrial node (SAN).

**Methods:** We generated cardiac conduction cell-specific inducible IGF-1 receptor (IGF-1R) knockout (KO) (CSIGF1RKO), insulin receptor (IR) KO (CSIRKO), and IR/IGF-1R double KO (CSDIRKO) mice and evaluated their phenotypes.

**Results:** Telemetry measured electrocardiography found regular sinus rhythm in CSIGF1RKO mice, indicating that IGF-1R is dispensable for normal pacemaking. In contrast, CSIRKO and CSDIRKO mice exhibited profound sinus bradycardia. CSDIRKO mice showed a typical sinus node dysfunction characterized by junctional rhythm and sinus pauses on electrocardiography. Interestingly, the lack of an insulin receptor in the SAN cells of CSIRKO and CSDIRKO mice caused sinus nodal fibrosis. Mechanistically, hyperpolarization-activated cyclic nucleotide-gated channel 4 (HCN4) protein expression significantly decreased in the CSIRKO and CSDIRKO mice relative to the controls. A patch-clamp study of the SAN cells of CSIRKO mice marked a significant decrease in the funny current, which is responsible for spontaneous diastolic depolarization in the SAN. This result suggested that insulin receptor loss reduces the heart rate via downregulation of the HCN4 channel. Additionally, HCN1 expression was decreased in CSDIRKO mice explaining sinus node dysfunction.

**Conclusion:** Our results reveal a previously unrecognized insulin/IGF-1 signaling role in the sinus node structural maintenance and pacemaker function.

## OP8-3 Korean medical students &amp; medical trainees session

**Higher plasma HDL cholesterol levels are associated with a reduced risk of cardiovascular disease: a 16-year follow-up community-based cohort study**

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**Objective:** Low plasma levels of high-density lipoprotein cholesterol (HDL-C) have consistently been identified as a crucial predictor of cardiovascular disease (CVD) risk. However, the controversy surrounding whether high plasma levels of HDL-C reduce the risk of CVD prompted our study. Our aim was to assess whether increased plasma HDL-C levels are associated with a reduced risk of CVD.

**Methods:** We conducted a 16-year follow-up of a community-based cohort (Ansung-Ansan cohort). Individuals with a history of cancer, CVD, chronic kidney disease (CKD) with a glomerular filtration rate (GFR) $<$ 30 mL/min, or currently on dyslipidemia medication were excluded from participation. Participants were categorized into four groups based on baseline plasma HDL cholesterol levels: HDL  $<$ 40, 40-60, 60-80, and  $>$ 80 mg/dL. The primary endpoint was incident CVD, which includes acute myocardial infarction, coronary artery disease, and cerebrovascular disease. We employed Logistic regression to calculate odds ratios of incident CVD in different HDL-C subgroups.

**Results:** Both men and women with HDL-C  $>$ 80 mg/dL demonstrated lower incidences of CVD. In the Logistic analysis, the odds ratios for the respective HDL cholesterol groups (with the reference group being HDL-C  $<$ 40 mg/dL) were 0.86 (P-value 0.067), 0.81 (P-value 0.126), and 0.26 (P-value 0.027) for the 40-60 group, 60-80 group, and  $>$ 80 group, respectively.

**Conclusion:** In this prospective cohort study conducted in a Korean population, we observed a significant association between higher plasma HDL cholesterol levels and a reduced risk of CVD.

## OP8-5 Korean medical students &amp; medical trainees session

**Cases of Maturity Onset Diabetes of the Young (MODY)**

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Maturity-Onset Diabetes of the Young (MODY) refers to a collection of inherited disorders characterized by non-autoimmune diabetes mellitus that develops at a young age. Here, we present two cases of MODY, specifically MODY1 (HNF4a) and MODY2 (GCK). Notably, we have identified a novel mutation in the GCK gene, which has not been previously reported. The first case involves a 21-year-old black female with no significant medical history, who visited an outpatient clinic for a health screening conducted by the US Army. Her HbA1c level was found to be 6.2%. Her father had a history of diabetes, while her mother did not. The patient had a body mass index of 19.33 kg/m<sup>2</sup> and had not experienced recent weight changes. Initial laboratory tests revealed a glucose level of 113 mg/dL and an HbA1c of 6.4%. The C-peptide level was 1.7 ng/ml. Genetic testing was performed and revealed a c.74T>C p.Leu25Pro mutation in the GCK gene, specific to the MODY subtype. This mutation was determined to be likely pathogenic. Importantly, this mutation had never been reported previously. The second case involves a 64-year-old male who was diagnosed with type 2 diabetes at the age of 20. His father, mother, and brother were all diagnosed with diabetes, and his son was diagnosed at the age of 26. The patient had a normal body mass index of 21.8. Laboratory tests revealed a glucose level of 93 mg/dL, an HbA1c of 7.1%, and a C-peptide level of 1.7 ng/ml. GAD Ab was negative. Genetic testing revealed a heterozygous c.200G>A p.Arg67Gln mutation in the HNF4A gene, which was determined to be likely pathogenic. The GCK MODY case described here highlights the discovery of a novel mutation that functions as a causal gene. Genetic testing plays a crucial role in accurately diagnosing atypical cases of diabetes.

## PE001 Basic &amp; translational diabetes research

**Exploring molecular pathway involved in microglial activation in diabetic rats to improve cognition**Dharmendra Kumar Khatri\*, Anika Sood, Shashi Bala Singh  
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**Objective:** One of the major complications of type 2 diabetes is cognitive deficiency. Sphingosine 1-phosphate receptors (S1PRs) are associated with neurodegenerative and metabolic conditions. The relationship between S1PRs and type 2 diabetes cognition remains ambiguous. Neuronal damage mediated by microglia may result in cognitive deficits. This study examined the effects of S1PR2 inhibition on cognition in mice fed a high-fat diet and diabetic mice induced by streptozotocin. The activation and polarisation pathways of microglia were investigated.

**Methods:** In this investigation, adult male C57BL6 mice (8 weeks old) were used. Mice were given either a standard pellet diet (NPD; 13.1% kcal fat) or a high-fat diet for 16 weeks (HFD; 60 percent kcal fat). Streptozotocin (STZ; 100 mg/kg/i.p.) Diabetic mice were further divided into two groups: diabetic mice that were administered vehicle (T2D), and diabetic mice that were administered JTE013 at 10 mg/kg, i.p., for 15 days (T2D+JTE013). Various physiological, Biochemical, behavioral and molecular parameters were studied.

**Results:** JTE013 increased anti-inflammatory microglia by elevating Arg-1, CD206, and YM-1 in the hippocampus and PFC while decreasing iNOS, CD16, and MHCII. TIGAR, a glycolysis and apoptosis regulator induced by TP53, may aid anti-inflammatory microglia. However, inhibiting p53 may improve TIGAR suppression. Reduces apoptosis by elevating p-Akt, TIGAR, and decreasing p53 in the PFC and hippocampus of rats with type 2 diabetes. Palmitate mimicked sphingolipid dysregulation in BV2 cells after Neuro2A cells were exposed to conditioned media. Anti-inflammatory microglia in JTE013 prevented neuronal mortality induced by palmitate.

**Conclusion:** Inhibiting S1PR2 improves cognitive performance and shifts microglia towards an anti-inflammatory phenotype in rodents with type 2 diabetes, suggesting a neuroinflammation treatment.

## PE004 Basic &amp; translational diabetes research

**Nephroprotective potential of gallic acid metformin against streptozotocin induced diabetic nephropathy in Wistar rats via inhibition of DPP-4 and TGF-beta**Vikas Kumar<sup>1\*</sup>, Firoz Anwar<sup>2</sup>Sam Higginbottom University of Agriculture, Technology & Sciences, India<sup>1</sup>,  
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**Objective:** Dipeptidyl-peptidase IV inhibitors (DPP-4) have gained popularity day by day as anti-diabetic agents and now are broadly used in the treatment of type 2 diabetes with chronic renal dysfunction. DPP-4 inhibitors have potential to reduce the glucose level independent of the renal function either reduce the level of glycated albumin without inducing the hypoglycaemic effects. Studies suggest that DPP-4 exert the renal protective effect via maintain the incidence of albuminuria. The current experimental study was made attempt to explore the renal protective effect of gallic acid- metformin (GA-Met) against the STZ induced diabetic rats via inhibition of DPP-4 and TGF- $\beta$ .

**Methods:** GA-Met was scrutinizing against the DPP-4 inhibitor. GA-Met were also examined via Insilco study with the structure of DPP-4 to identify the critical interactions for its bioactivity. STZ was used for induction the type 2 diabetes and blood glucose level, biochemical, antioxidant, cytokines and inflammatory mediators were estimated.

**Results:** DPP-4 assay, GA-Met was found as potential drug with IC50 value=4.34  $\mu$ M. GA-Met Insilco interacted with various residue of DPP-4 inhibitor. GA-Met significantly reduced the blood glucose level (67%) and increased the plasma insulin level (45.5%). GA-Met improve the interstitial fibrosis, tubulointerstitial injury and inflammatory cell infiltration in animal tissue. GA-Met exhibited the significantly decrease the level of TNF- $\alpha$  (45%), IL-1 $\beta$  (54.3%), IL-6 (56.1%), caspase-1 (43%), caspase-3 (40.4%), COX-2 (65%), PGE2 (60.3%) and NF-kB (52.3%). Oxidative stress marker and the expression of transforming growth factor- $\beta$  (TGF- $\beta$ ) in the renal tissue of diabetic rats were significantly ( $P < 0.001$ ) altered by GA-Met treated group rats.

**Conclusion:** The current investigation suggests that GA-Met exert the renal protective effect against the STZ induced DN rats via inhibition of DPP4 and TGF- $\beta$ .

## PE005 Basic &amp; translational diabetes research

**A meta-analysis on the association between the mnSOD Val16Ala polymorphism and the development of diabetic nephropathy**Ivy Cayabyab\*, Joey Kyle Mallari, Arch Raphael Manalac,  
Rima Pabalan, Archie Policarpio, Gestrelle Lides Sarmiento,  
Joanna Marie Sison, Raphael Enrique Tiongco  
Angeles University Foundation, Philippines

**Objective:** Diabetic nephropathy (DN) is a severe complication of diabetes mellitus (DM) that contributes to significant morbidity and mortality. Previous studies have reported inconsistent findings regarding the association between the mnSOD Val16Ala polymorphism and the development of DN.

**Methods:** We conducted a meta-analysis to investigate the relationship between the mnSOD Val16Ala polymorphism and the development of DN. We performed a comprehensive search of four major electronic databases to identify studies containing genotypic data of the mnSOD Val16Ala polymorphism in DM and DN groups. Data were collected and analyzed using ReviewManager 5.4.1 by calculating the odds ratios (ORs) and 95% confidence intervals (CIs).

**Results:** We initially identified 30 studies in the comprehensive search and included five studies in the meta-analysis after applying our inclusion criteria. The total sample size was 3,644, divided into DM (n=1613) and DN (n=2031) groups. Initial analysis using the allelic model showed heterogeneous outcomes, which prompted us to identify the source of heterogeneity. After removing the heterogeneous studies, the post-outlier outcomes were homogenous but non-significant for all genotypic models.

**Conclusion:** Our meta-analysis suggests no significant association between the mnSOD Val16Ala polymorphism and the development of DN, as the post-outlier findings were homogenous but non-significant. These findings have important implications for the understanding of the genetic basis of DN and may have clinical implications for the management and prevention of this condition. It is important to continue investigating other genetic factors and environmental influences that contribute to the development of DN.

## PE006 Basic &amp; translational diabetes research

**Serum ferritin as a potential complementary marker to fasting blood glucose in diagnosing type 2 diabetes mellitus: a pilot study among Kapampangans**Raphael Enrique Tiongco\*, Daryll Nicole Romero, Clarice Cabague,  
Eloisa Joy Escoto, Kyla Alexis Miranda, Dena Marie Nicole Nulud,  
Alvin Mark Pabalan, Jamie Vergara, Meryn Cruz  
Angeles University Foundation, Philippines

**Objective:** Diabetes mellitus is a predominant metabolic disorder in the Philippines, requiring early diagnosis and prompt intervention. Hence, it is crucial to identify diagnostic biomarkers that complement existing diagnostic parameters to diagnose type 2 diabetes mellitus (T2DM) accurately. The study aims to determine if serum ferritin can be used as a potential complementary marker to fasting blood glucose in diagnosing T2DM.

**Methods:** With ethical approval, a cross-sectional study was performed, and seventy-five males and non-pregnant females were recruited from various rural health units in Angeles City, Philippines. The participants were grouped based on their fasting blood glucose (FBG) levels (non-diabetics, pre-diabetics, and diabetics). Serum concentrations of ferritin from each participant were determined using an enzyme-linked immunoassay. Other variables such as age, body mass index, waist-hip ratio, and blood pressure were also noted.

**Results:** Pearson's correlation showed that serum ferritin levels are significantly associated with participant age, systolic blood pressure (SBP), and FBG. One-way ANCOVA (adjusted for age and SBP) showed that serum levels are significantly higher among diabetics and pre-diabetics than non-diabetics. ROC curves were also drafted and showed that serum ferritin could predict T2DM.

**Conclusion:** Overall, the results suggest the potential of serum ferritin as a complementary marker in diagnosing T2DM due to its good correlation with FBG, elevated levels among people with diabetes, and high AUC values, as shown by the ROC curve. However, further studies are still needed to confirm the study's claims.

## PE008 Basic &amp; translational diabetes research

**Association of selected climatological variables with the incidence of new-onset hypertension and type 2 diabetes in Central Luzon, Philippines**

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 Angeles University Foundation, Philippines<sup>1</sup>,  
 Pampanga State Agricultural University, Philippines<sup>2</sup>

**Objective:** Previous studies have noted the association of selected weather variables with newly detected type 2 diabetes; studies on the topic are still scarce and require further geographically distributed studies to establish the association. Hence, in this research, we determined the association of mean temperature, relative humidity, and amount of rainfall with the incidence of new-onset hypertension and type 2 diabetes in Central Luzon, Philippines.

**Methods:** Secondary data on the incidence of new-onset hypertension and type 2 diabetes were obtained from the annual Field Health Service Information System of the Department of Health of the Philippine Department of Health. Whereas climatological data were obtained from the Climate and Agrometeorological Data Section of the Philippine Atmospheric, Geophysical and Astronomical Services Administration. All data were then consolidated into a structured Microsoft Excel spreadsheet and were statistically analyzed.

**Results:** Data starting from 2019 to 2021 were obtained from the relevant government agencies. All data obtained were treated as non-parametric. Climate variables were compared based on the year, and significant findings were obtained for mean temperature, showing increasing temperature from 2019 to 2021. Using Spearman's correlation, we were able to show that new-onset hypertension is significantly associated with mean temperature ( $r=-0.596$ ,  $p<0.001$ ) and amount of rainfall ( $r=0.537$ ,  $p=0.02$ ). On the other hand, new-onset type 2 diabetes is significantly associated with all three climatological variables tested, with strong correlations noted on mean temperature ( $r=0.788$ ,  $p<0.001$ ).

**Conclusion:** Overall, based on our knowledge, this is the first study in the Philippines that explored the relationship between lifestyle diseases and climatological variables. Our findings suggest that climatological factors affect disease onset, particularly hypertension and type 2 diabetes. However, further longitudinal studies are needed to verify these claims.

## PE009 Basic &amp; translational diabetes research

**EndoC-BH5, primary-like human beta cell model: finally!! a robust and reliable cell line for T1D and T2D disease modeling**

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 Human Cell Design, France

**Objective:** Due to limitations of current options, diabetes research and drug discovery would strongly benefit from reproducible and easily accessible human beta cells. Our aim was to create a human primary-like beta cell line that can be used to answer all needs related invitro disease modelling.

**Methods:** In this study, we developed the unique EndoC- $\beta$ H5 by integrative gene transfer of immortalizing transgenes into human fetal pancreas. Following EndoC- $\beta$ H5 was used to develop other models and protocols for glucolipotoxicity, cytokine mediated inflammation, T lymphocyte activation and mediated killing.

**Results:** With their robust and strong insulin secretion, EndoC- $\beta$ H5 can be used in insulin secretagogues screening assays. This was shown by their reproducible response to glucose, GLP1, GIP, and glucagon. Furthermore, we developed a derivative that models glucolipotoxicity, GLTx EndoC- $\beta$ H5. GLTx EndoC- $\beta$ H5 undergoes cytotoxicity when cultured in presence of palmitate and elevated glucose, hence modelling type 2 diabetes. We then developed a model of cytokine mediated inflammation in EndoC- $\beta$ H5. Cytokine treated EndoC- $\beta$ H5 cells undergo cell death accompanied by impaired insulin secretion, confirming the mechanistic relevance of the model. Furthermore, these effects are prevented by JAK1/2 inhibitor, Baricitinib, approved for rheumatoid arthritis. Finally, we addressed modelling of type 1 diabetes with beta cell/T lymphocyte interaction assays. We generated HLA-A2 expressing EndoC- $\beta$ H5 which elicit HLA-A2 allo-reactive CD8 T cell activation. This effect is potentiated by IFN $\gamma$  and blocked by Baricitinib. We also demonstrated HLA-A2 EndoC- $\beta$ H5 specific killing by diabetogenic HLA-A2 restricted prepro-insulin PPI15-24 epitope recognizing CD8 T lymphocytes.

**Conclusion:** Overall, EndoC- $\beta$ H5 cells and their derivatives allowed us to model several beta cell defects that are associated to T1D and T2D and thus represent models for screening new therapeutic approaches, validating candidate molecules and characterizing molecular targets at small, medium and large scale taking advantages of readily available and highly reproducible EndoC- $\beta$ H5 cells.

## PE010 Basic &amp; translational diabetes research

**Phenolic acids in the management of diabetes and its associated complications**

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**Objective:** Present study was conducted to examine the effects of two phenolic acids on diabetes and its associated complications by using in vitro, ex vivo and in vivo experimental models.

**Methods:** Caffeic acids and ferulic acids were investigated to examine their effects on in vitro and ex vivo antioxidant activities, cholinergic, angiotensin converting, gluconeogenic, nucleotide hydrolyzing and lipid digesting enzymes activities and cardiac lipid profile. Their effects were further investigated in an experimentally induced animal model of type diabetes via measuring glucose tolerance test, in vivo antioxidant effects, lipid peroxidation, serum ACE, lipase activity, liver gluconeogenic enzyme activities, serum lipid profile as well as liver and kidney function tests. Additionally, histopathological examination and microscopy and microanalysis were conducted on pancreatic tissue.

**Results:** Caffeic acid could significantly increase the antioxidant activity via increasing the level of reduced glutathione and antioxidant enzymes activities as well as reducing lipid peroxidation level. It also significantly decreased ACE, fructose-1,6-bis-phosphatase, glucose-6-phosphatase, glycogen phosphorylase, ATPase and lipase activities compared to untreated sample. Treatment with caffeic acid also significantly ameliorated dyslipidemia in cardiac tissue. Ferulic acid significantly decreased blood glucose level, glucose intolerance, insulin resistance (HOMA-IR) while increased the level of serum insulin via improving pancreatic beta-cell function (HOMA-beta) in diabetic rats. It also significantly reduced the activity of gluconeogenic enzymes activities in liver as well as increased live glycogen content and in vivo antioxidant status, while significantly ameliorated serum dyslipidemia and decreased serum and pancreatic ACE activities in treated group compared to the diabetic control group. Pancreatic histopathology and ultrastructure morphology were significantly improved in the ferulic acid treated groups compared to the DBC group.

**Conclusion:** Data of this study suggest that caffeic and ferulic acids can be excellent candidate for the development of novel alternative medicines for diabetes and its associated complications.

## PE011 Basic &amp; translational diabetes research

**Swietenia macrophylla king extract extenuate streptozotocin-induced diabetic infertility in male Sprague Dawley rats**

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**Objective:** Diabetes mellitus is a metabolic disorder that occurs due to the inability of the pancreas to produce enough insulin, leading to hyperglycemia. Prolonged hyperglycemia may result in systemic damage, leading to male infertility. Swietenia macrophylla King (SMK) is widely known as an alternative treatment for diabetes mellitus in certain parts of the world. This present study was undertaken to evaluate the possible protective effects of Swietenia macrophylla King extract (SMK) on fertility in diabetic-induced rats.

**Methods:** Twelve male Sprague-Dawley rats were divided into three groups: control (group 1), diabetic non-treated (group 2), and SMK-treated diabetic rats (group 3). Diabetic induction was carried out via a single injection of streptozotocin (STZ) (65 mg/kg) intraperitoneally for group 2 and 3. Blood glucose levels were monitored for 14 days consecutively to confirm the diabetic state. Then, group 3 rats were orally fed with SMK methanolic extract at a dose of 500mg/kg for 30 days. Group 1 and 2 were fed with normal saline orally. After 30 days of treatment, all rats were euthanized, and sperm were collected via the cauda epididymis for routine sperm analysis and the testes were subjected to histological evaluation.

**Results:** Our results suggested that SMK-treated groups showed increased sperm accumulation when compared with group 2 and almost comparable with group 1. The histological appearance of testes in SMK-treated group was almost comparable with group 1 and group 2 showed extensive damage all over the sections.

**Conclusion:** Thus, our findings suggest that Swietenia macrophylla King extract possesses potential correction effects in reducing testicular damage and increasing fertility in diabetic male rats.

## PE013 Basic &amp; translational diabetes research

**Dynamical modeling of chronic inflammation-induced insulin resistance: insights into molecular pathways and therapeutic targets**Prihantini Prihantini<sup>1\*</sup>, Priyanka Aruan<sup>2</sup>, Asfirani Umar<sup>1</sup>Yogyakarta State University, Indonesia<sup>1</sup>,  
Bandung Institute of Technology, Indonesia<sup>2</sup>

**Objective:** This study aimed to develop a dynamic mathematical model to explore the molecular pathways underlying the development of insulin resistance induced by chronic inflammation. Chronic inflammation has been implicated as a key driver of insulin resistance, a hallmark of type 2 diabetes. By constructing a mathematical model, we sought to gain insights into the temporal dynamics and interactions of key molecular components involved in chronic inflammation-induced insulin resistance, with the ultimate goal of identifying potential therapeutic targets.

**Methods:** Our mathematical model integrated ordinary differential equations (ODEs) with established physiological knowledge and experimental evidence. The model incorporated variables representing pro-inflammatory cytokines (e.g., interleukin-6, tumor necrosis factor- $\alpha$ ), adipokines (e.g., adiponectin), insulin signaling molecules, and glucose transporters. ODEs were utilized to describe the dynamic behavior of these variables over time. Model parameters were estimated by fitting the model to experimental data from relevant studies.

**Results:** Our dynamic mathematical model successfully reproduced insulin resistance progression caused by chronic inflammation. Simulations showed that elevated pro-inflammatory cytokines disrupted insulin signaling, impairing glucose uptake by peripheral tissues. The model predicted a 30% increase in cytokine levels resulting in a 40% reduction in insulin sensitivity. Furthermore, sustained 50% cytokine elevation led to a significant 70% decrease in insulin sensitivity, highlighting the quantitative impact of chronic inflammation on exacerbating insulin resistance.

**Conclusion:** The model successfully replicated the progression of insulin resistance and demonstrated the disruptive effect of increased pro-inflammatory cytokine levels on insulin signaling and glucose uptake. Moreover, our simulations highlighted the dose-dependent nature of chronic inflammation, emphasizing the quantitative impact on insulin sensitivity. These findings contribute to the identification of potential therapeutic targets for managing insulin resistance in type 2 diabetes.

## PE015 Basic &amp; translational diabetes research

**Protective effects of ellagic acid and its fabricated solid lipid nanoparticles on diabetic nephropathy induced by streptozotocin-nicotinamide in mice via alteration of oxidative stress and apoptosis**Deepika Singh<sup>\*</sup>  
Shuats, India

**Objective:** Chronic albuminuria, a progressive decline in glomerular filtration rate (GFR), and rising plasma levels of creatinine (Cr) are all symptoms of diabetic nephropathy (DN), often known as progressive kidney disease. The purpose of the current study is to assess the Preventive effects of ellagic acid and its fabricated solid lipid nanoparticles on diabetic nephropathy induced by streptozotocin-nicotinamide in mice via alteration of oxidative stress and apoptosis.

**Methods:** Solid lipid nanoparticles of ellagic acid were prepared by solvent emulsion method. Fabricated ellagic acid loaded SLN were characterized with various instruments such as FTIR, DSC, TEM, SEM. Mice were received diabetes plus ellagic acid 3, 5, and 9 mg/kg, and diabetes plus SLN containing ellagic acid at a same dose. For experimental, histological, real-time PCR, and apoptotic evaluations after the experimental phase, plasma and tissue samples were taken.

**Results:** Prepared SLN was found to be in the range of 20 nm and zeta potential of good value. The result of the present study shows that the level of creatinine, urine and albumin level catalase, total antioxidant capacity glomerular filtration rate were all found to be reduced whereas the kidney weight, MDA, urine level of potassium, sodium albumin and glucose, and fractional excretions of potassium and sodium were found to be increased after the induction of STZ -diabetic mice. Administration of ellagic acid and its fabricated SLN recovered the all parameters. It was also found that ellagic acid-loaded SLN also modulates the transforming growth factor- $\beta$  (TGF- $\beta$ ) and nuclear factor kappa B (NF- $\kappa$ B) gene expression, accumulation of red blood cells and inflammatory cells infiltration, and apoptosis of kidney.

**Conclusion:** Ellagic acid-loaded SLN were found to be effective against STZ induced diabetic nephropathy and can be used in clinical trail.

## PE016 Basic &amp; translational diabetes research

**Type II diabetes mellitus patients from the North Indian population and OCT-1 gene polymorphism**Hina Parveen<sup>\*</sup>, Dilutpal Sharma

King George's Medical University, India

**Objective:** To investigate the possible association of organic cation transporter- 1(OCT1) gene polymorphism (A-G) in type II Diabetes mellitus.

**Methods:** 100 diagnosed T2DM patients were recruited for the study and the genotypes for OCT-1 gene polymorphism using polymerase chain reaction (PCR) followed by restriction fragment length polymorphism (RFLP) were done.

**Results:** We did not find any significant association between GG homozygous alleles ( $p < 0.079$ ) and AG heterozygous alleles ( $p = 0.209$ ) in type 2 diabetes mellitus patients compared to the control. In this case-control study, the frequency of the G allele of OCT-1 was found significant in alcoholic type 2 diabetes mellitus patients ( $p = 0.026^*$ ).

**Conclusion:** OCT-1 gene G allelic polymorphism is associated with type 2 diabetes mellitus patients in the north Indian population.

## PE017 Basic &amp; translational diabetes research

**Oestrogen receptor in insulin resistance and type 2 diabetes mellitus: from molecular mechanism to clinical evidence**Muhammad Zulfiqah Sadikan<sup>1\*</sup>, Haryati Ahmad Hairi<sup>1</sup>,Putri Ayu Jayusman<sup>2</sup>, Nurul Izzah Ibrahim<sup>2</sup>, Ahmad Nazrun Shuid<sup>3</sup>Faculty of Medicine, Manipal University College Malaysia, Jalan Batu Hampar, Bukit Baru, 75150 Melaka, Malaysia<sup>1</sup>, Faculty of Dentistry, Universiti Kebangsaan Malaysia, Jalan Yaacob Latif, Bandar Tun Razak, Cheras, 56000 Kuala Lumpur, Malaysia<sup>2</sup>, Faculty of Medicine, Universiti Teknologi Mara (UiTM), Jalan Hospital, 47000 Sungai Buloh, Selangor, Malaysia<sup>3</sup>

**Objective:** Estrogens' biological actions are mediated by the estrogen receptor  $\alpha$  or  $\beta$  (ER $\alpha$  or ER $\beta$ ), which are members of a broad nuclear receptor superfamily. ER $\alpha$  has a more significant effect on  $\beta$ -cell pancreatic function, insulin sensitivity, and glucose homeostasis. This review assesses current understanding on the protective role of ER in the critical pathways and molecular mechanisms related to insulin resistance and type 2 diabetes mellitus (T2DM), as well as the efficacy of menopausal hormone therapy (MHT) in menopausal women at risk for T2DM.

**Methods:** The online PubMed and Medline search engines were used to collect publications published between 2003 and 2023. This was accomplished by studying the abstracts and full papers of all included sources using a single or combination of keywords, such as estrogen receptor, glucose homeostasis, insulin resistance, type 2 diabetes mellitus, and menopausal hormone therapy. All publications cited were published in English-language.

**Results:** Modulation of ER on GLUT4 expression in skeletal muscle and certain gene transcription that are involved in glucose homeostasis have opened new avenues for the development of T2DM coadjuvant treatments. Preclinical evidence has shown that estrogen receptor knockout mice are more vulnerable to oxidative stress, which causes  $\beta$ -cell death and insulin-deficient diabetes. Reduction in ovarian function is also associated with the reduction of pancreatic  $\beta$ -cell function, which is linked to glucose metabolism and diabetes risk. Menopause is associated with insulin resistance and T2DM risk. Clinical trials showed that MHT has a positive effect on glucose metabolism as well as a good treatment for perimenopausal women with T2DM. MHT has a lower risk of venous thromboembolism, and the risk does not increase if administered in the early postmenopausal period.

**Conclusion:** In conclusion, this review shows that ER is critical in  $\beta$ -cell function, insulin action, glucose homeostasis, and the etiology of insulin resistance, diabetes and its consequences.

## PE018 Basic &amp; translational diabetes research

**2-Deoxy-D-ribose induces ferroptosis in renal tubular epithelial cells via ubiquitin-proteasome system-mediated xCT protein degradation**

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Jeju National University Hospital, Korea<sup>2</sup>

**Objective:** Ferroptosis is a novel form of cell death triggered by iron-dependent lipid peroxidation. Recent findings suggest that inhibiting system  $\alpha\text{-c}$  induces ferroptosis by reducing intracellular cystine levels, and that ferroptosis in renal tubular epithelial cells (RTECs) contributes to diabetic nephropathy. Moreover, 2-deoxy-D-ribose (dRib) has been shown to inhibit cystine uptake through xCT, the functional unit of system  $\alpha\text{-c}$ , in  $\beta$ -cells. This study aimed to investigate if dRib induces ferroptosis in RTECs and identify the underlying mechanisms.

**Methods:** Researchers measured L-[14C] cystine uptake, GSH content, and cell viability in NRK-52E cells and primary RTECs from rat kidney. Lipid peroxidation was evaluated using flow cytometry with C11-BODIPY dye, measuring intracellular malondialdehyde and 4-hydroxynonenal levels. Furthermore, they overexpressed the xCT gene in NRK-52E cells using a lentivirus.

**Results:** Treatment with dRib reduced cystine uptake and GSH content, while increasing levels of malondialdehyde (MDA), 4-hydroxynonenal (4-HNE), lipid reactive oxygen species (ROS), and cell death in both NRK-52E cells and primary RTECs. However, inhibitors of ferroptosis counteracted these effects of dRib, protecting against lipid peroxidation and cell death. Additionally, 2-mercaptoethanol treatment or xCT gene overexpression safeguarded cells from dRib-induced changes. Transmission electron microscopy revealed that dRib caused mitochondrial shrinkage, reduced cristae numbers, and ruptured the outer membrane. dRib treatment upregulated genes associated with ferroptosis and downregulated xCT and GPX4 protein expression. The reduction in xCT protein levels caused by dRib was consistently observed, even when protein synthesis was inhibited. However, treatment with the proteasome inhibitor MG132 reversed the dRib-induced decrease in xCT protein expression, but not the decrease in GPX4 protein expression. Additionally, dRib increased xCT protein ubiquitination.

**Conclusion:** In conclusion, dRib induces ferroptosis in RTECs by degrading xCT protein through ubiquitin-proteasome system (UPS), resulting in reduced intracellular cystine uptake. Targeting the regulation of system  $\alpha\text{-c}$  through UPS could be a potential therapeutic approach for diabetic nephropathy.

## PE019 Basic &amp; translational diabetes research

**The impact of obesity & modern lifestyle on stress, anxiety and depression in North Indian adult population**

Diksha Devi\*, Sandeep Bhattacharya  
Phd Scholar, India

**Objective:** The aim of this study is to assess the impact of obesity and modern lifestyle on stress, anxiety and depression in North Indian adult population.

**Methods:** Total forty newly diagnosed patients from 18-45 years of both male and female gender were recruited and diagnosed by obese history and clinical examinations. Depression, anxiety, stress scale (DASS-21) was used to assess the severity of psychological stress also we measured serum cortisol level in fasting state of obese patient, suggests abnormality of thoughts. Social, occupational functioning assessment scale (SOFAS) was used to assess overall level of functioning.

**Result:** The subjects were 82% male and 18% female. The average serum cortisol level was (10.62±4.28). The result indicates that depression scores of 58% obese patient indicating mild stress (Score: 10-13), 30% respondents moderate depression (Score: 14-20) and 8% were found severe depression (Score: 21-27). Anxiety scores of 53% obese patient indicating mild anxiety (Score: 8-9), 30% were found moderate anxiety (Score: 10-14) and 13% were respondent severe anxiety (Score: 15-19). Stress score of 63% obese patient indicating mild stress (score: 15-18) also 30% were respondent moderate stress (score: 19-25).

**Conclusion:** The majority of obese patient had mild and moderate depression. According to the findings of this study, screening for psychological conditions in adults with chronic illnesses is also crucial because managing obesity alone will not improve patients' quality of life. A large sample size should be used for this study in order to obtain more accurate results in future.

## PE020 Basic &amp; translational diabetes research

**Biological effect of plantamajoside in sepsis-regulated organ dysfunction, Chronic Heart Failure (CHF) and Hypoxia-Reoxygenation (H/R) injury with their molecular mechanism**

Dinesh Kumar Patel\*

Faculty of Health Science, Shuats, India

**Objective:** Plantamajoside, is found to be present in *Plantago asiatica*. Plantamajoside has a wide range of biological activities, including anti-inflammatory, antioxidant, anti-malignant cell proliferation, and anti-inflammatory properties as well as antitumor effects. Plantamajoside has been reported to exert a suppressive effect in liver cancer also. Advanced glycation end products (AGEs) have been identified to transduce fibrogenic signals via inducing the activation of their receptor (RAGE)-mediated pathway. Disrupting AGE-RAGE interaction has become a promising therapeutic strategy for chronic heart failure (CHF).

**Methods:** Biological potential of plantamajoside in sepsis-regulated organ dysfunction has been investigated in the scientific field, with its mechanism of actions using C57BL/6 male mice. Further, biological effect of plantamajoside on CHF has also been investigated with the underlying mechanism. However, biological effects of plantamajoside on hypoxia-reoxygenation (H/R) injury in H9c2 cardiomyocytes have also been investigated in the scientific study with the underlying molecular mechanisms of the treatment. Detailed pharmacological potential of plantamajoside have been investigated in the present work in order to investigate its therapeutic effectiveness against chronic heart failure (CHF) and associated secondary complications.

**Results:** Plantamajoside remitted sepsis-mediated heart injury and suppressed organ dysfunction by regulating the TRAF6/NF- $\kappa$ B axis, signifying its biological potential as a novel strategy for sepsis-caused damage. Plantamajoside was found to attenuate cardiac fibrosis and dysfunction, suppress EndMT, and reduce autophagy levels and serum levels of AGEs in another scientific study which signified its anti-cardiac fibrosis effect through binding RAGE to suppress the AGEs-activated RAGE/autophagy/EndMT pathway. Plantamajoside revealed protective effects against H/R injury in H9c2 cells, due to its antioxidant potential and through the activation of the ILK/c-Src/Akt pathway and inhibition of the mitochondrial apoptosis. Plantamajoside also exerts significant cardioprotective effects against ISO-induced cardiac hypertrophy.

**Conclusion:** Present work scientific data signified the therapeutic potential of plantamajoside in sepsis-regulated organ dysfunction and chronic heart failure (CHF).

## PE022 Basic &amp; translational diabetes research

**Therapeutic potential of kakkalide in the medicine for the treatment of diabetes and related secondary complications through their effectiveness on insulin resistance, insulin-resistant endothelial dysfunction and aldose reductase enzyme**

Dinesh Kumar Patel\*, Kanika Patel

Sam Higginbottom University of Agriculture, Technology and Sciences, India

**Objective:** Plants have been used as a good source of alternative medicine for the treatment of diabetes and associated secondary complications. Medicinal plants and their derived secondary metabolites have been used as a medicine and food mainly due to its rich content of natural active phytochemicals. Plant derived products have been used in medicine for the treatment of human health complications since very ancient times. Kakkalide is the isoflavone class phytochemical found to be present in the *Pueraria lobata*.

**Methods:** Therapeutic potential of kakkalide for the treatment of diabetes and related secondary complications have been investigated in the present work through scientific data analysis of different scientific research work. Here in the present work, antidiabetic, Hypolipidemic and aldose reductase potential of kakkalide has been investigated through scientific data analysis of research works. Biological potential of kakkalide in the medicine for the treatment of Human metabolic disorders have also been investigated. However, molecular mechanism of kakkalide for their anti-diabetic potential has been also investigated through its effectiveness on insulin resistance, insulin-resistant endothelial dysfunction, aldose reductase, total cholesterol and triglyceride level.

**Results:** Scientific data analysis revealed the biological importance of kakkalide in the medicine for their significant antihyperlipidemic, and antioxidant activity. Scientific data analysis of different scientific research work revealed their biological potential on insulin resistance and ameliorated insulin-resistant endothelial dysfunction. Further scientific data also signified the potential of kakkalide in medicine for their inhibitory potential on rat lens aldose reductase enzyme, which could be beneficial for the treatment of diabetes and associated secondary complications including glaucoma. However, in some other scientific research work kakkalide have significant effect on total cholesterol and triglyceride level in the hyperlipidemic mice.

**Conclusion:** Scientific data analysis revealed the therapeutic potential of kakkalide in the medicine for the treatment of diabetes and related secondary complications.

## PE023 Basic &amp; translational diabetes research

**Biological potential of cirsimaritin for the treatment of diabetes and associated secondary complications through its therapeutic effectiveness on cell viability and protection of INS-1 cells**

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**Objective:** Flavonoids are an important class of secondary metabolites found to be present in numerous medicinal plants. Flavonoids have anti-oxidant, anti-cancer, anti-inflammatory, anti-bacterial and hepatoprotective properties in medicine. Cirsimaritin commonly called 4',5-Dihydroxy-6,7-dimethoxyflavone is an important class of flavonoidal class secondary metabolites. Cirsimaritin was found to be present in the *Cirsium martimum* and have been well known in medicine for their medicinal properties and pharmacological activities.

**Methods:** Numerous scientific data have been analyzed in the present work, in order to know the therapeutic potential of cirsimaritin in medicine for the treatment of diabetes mellitus. Therapeutic effectiveness of cirsimaritin against various forms of diabetic disorders and associated secondary complication has been investigated in the present investigation through its therapeutic effectiveness on cell viability and protection of INS-1 cells against STZ-induced damage. However, biological role of cirsimaritin on the reduction of intracellular oxidative stress has been also investigated in another scientific research work.

**Results:** Scientific data analysis of different research work revealed the therapeutic effectiveness of cirsimaritin in the medicine for the treatment of diabetes mellitus. Scientific data analysis revealed the biological importance and therapeutic potential of cirsimaritin against diabetes mellitus, as cirsimaritin improved cell viability and protects INS-1 cells against STZ-induced damage in the scientific research work. Further, cirsimaritin treatment also reduced the intracellular oxidative stress in the scientific research work, which signified its effectiveness on diabetes mellitus and associated secondary complications.

**Conclusion:** Scientific research data revealed the therapeutic potential of cirsimaritin in medicine for the treatment of diabetes and associated secondary complications.

## PE025 Basic &amp; translational diabetes research

**Impact of type 2 diabetes-associated PAX4 variant on pancreatic beta cell function**Jungsun Park<sup>1\*</sup>, Kyun Hoo Kim<sup>1</sup>, Joon Ho Moon<sup>1,2</sup>,Hyunsuk Lee<sup>2</sup>, Jong Il Kim<sup>2</sup>, Kyong Soo Park<sup>2</sup>, Hail Kim<sup>1</sup>KAIST, Korea<sup>1</sup>, Seoul National University College of Medicine, Korea<sup>2</sup>

**Objective:** Pax4 is a key transcription factor that regulates pancreas development and  $\beta$ -cell differentiation. It has been reported that PAX4 amino acid variants, Arg192His (R192H) and Arg192Ser (R192S), were associated with increased risk of type2 diabetes (T2D) in Korean. This study aims to unveil the mechanism underlying PAX4 R192H variant-related T2D phenotypes.

**Methods:** For human studies, we analyzed 4,610 participants without T2D at baseline from Ansung-Ansan Cohort with oral glucose tolerant tests taken biennially for 14 years. Animal model of human PAX4 R192H variant was generated by knock-in of point mutation in Pax4 gene locus. Pax4<sup>WT/WT</sup> (Pax4-WT) and Pax4<sup>R192H/R192H</sup> (Pax4-R192H) mice were fed either standard chow diet (SCD) or high-fat diet (HFD) and the phenotypes were determined by metabolic and histological analyses. Single-cell RNA-sequencing (scRNA-seq) was performed using isolated mouse pancreatic islets.

**Results:** Carriers of Pax4 variants showed a faster decline of disposition index compared to non-carriers, which was driven by a significant difference in the trajectory of the insulinogenic index but not the insulin sensitivity index. Pax4-R192H mice also showed early impairment of both glucose tolerance and glucose-stimulated insulin secretion compared to Pax4-WT mice during the period of HFD feeding, while HFD-induced  $\beta$ -cell proliferation was delayed in Pax4-R192H mice. Islet scRNA-seq data further revealed aberrant upregulation of ER-stress response genes and concomitant downregulation of genes governing  $\beta$ -cell function in  $\beta$ -cells of Pax4-R192H mice after 4 weeks of HFD feeding, indicating altered response of  $\beta$ -cell to metabolic stress.

**Conclusion:** People who have Pax4 amino acid variants exhibited early impairment of  $\beta$ -cell functions before onset of diabetes. Mice with PAX4 R192H variant showed aberrant response of  $\beta$ -cell to HFD-induced metabolic stress. These findings suggest that the susceptibility of PAX4 R192H variant to T2D could be attributed to the early loss of  $\beta$ -cell function in response to metabolic stress.

## PE026 Basic &amp; translational diabetes research

**The association of miR-302 expression levels and non-alcoholic fatty pancreas disease**Chih-Li Lin<sup>1\*</sup>, Sing-Hua Tsou<sup>2</sup>, Lee-Kuo Chang<sup>3</sup>, Hsu-Heng Yen<sup>3</sup>,Hsuan-Kai Lee<sup>1</sup>, Ying Chen<sup>1</sup>, Chien-Ning Huang<sup>1</sup>Chung Shan Medical University, Taiwan<sup>1</sup>, Chung Shan Medical University Hospital, Taiwan<sup>2</sup>, Changhua Christian Hospital, Taiwan<sup>3</sup>

**Objective:** Non-alcoholic fatty pancreas disease (NAFPD) is a disease in which excessive lipids accumulate in the pancreas. Although little has been known about this disease in the past, recent studies have shown that NAFPD can cause damage directly to pancreatic  $\beta$ -cells and is therefore strongly related to the pathogenesis of type 2 diabetes (T2D). Interestingly, a miRNA associated with the characteristics of stem cells called miR-302 appears to be involved in the lipid metabolism process. However, the underlying mechanism is not yet clear.

**Methods:** It was a cross-sectional study in which the glycemic status of 27 NAFPD patients with ultrasonographic evidence of increased pancreatic echogenicity. Demographic data and blood samples have been collected and measured, including miR-302 expression in leukocytes. The results were compared with data from 12 healthy controls. In addition, some *in vitro* experimental results were also performed simultaneously to strengthen the above inference.

**Results:** The results show that the expression of miR-302 in healthy controls leukocytes was significantly higher than in the NAFPD group. Furthermore, miR-302 suppression was associated with the glycemic control and lipid profiles of subjects. The *in vitro* results also demonstrated that miR-302 overexpression in culture  $\beta$ -cells actually inhibited the accumulation of lipid droplets, suggesting the inference that miR-302 may be related to the progression of NAFPD.

**Conclusion:** Our study first revealed that NAFPD may be associated with a decrease in miR-302. Further clarification of the role of miR-302 in the regulation of lipid metabolism in the pancreas may help develop new NAFLD prevention, diagnosis, or treatment strategies based on our findings.

## PE027 Basic &amp; translational diabetes research

**Genistein synergically increases the protection of liraglutide against beta cell apoptosis induced by glucolipototoxicity**Sing-Hua Tsou<sup>1\*</sup>, Chien-Ning Huang<sup>2</sup>, Ying-Jui Ho<sup>1</sup>, Chih-Li Lin<sup>1,2</sup>,Sheng-Chieh Lin<sup>1,2</sup>, Chien-Yin Kuo<sup>1,2</sup>, I-Ting Cheng<sup>1</sup>, Zong-Han Lin<sup>1</sup>Chung Shan Medical University Hospital, Taiwan<sup>1</sup>,Chung Shan Medical University, Taiwan<sup>2</sup>

**Objective:** Metabolic syndrome (MetS) is characterized by abnormalities in metabolic markers such as blood sugar, blood pressure, lipids, and waist circumference. Up to 60% of patients diagnosed with MetS are estimated to develop diabetes in the future. As MetS progresses, visceral obesity significantly increases the blood levels of free fatty acids (FFA), contributing to insulin resistance in peripheral tissues and leading to hyperglycemia. Chronically high glucose and FFA levels are known to lead to  $\beta$ -cell dysfunction and apoptosis, which are the main factors in the progression of diabetes. Since  $\beta$ -cells are not able to be regenerated, developing a strategy to protect  $\beta$ -cells before apoptosis is the key step to effectively prevent the progression of MetS.

**Methods:** Although glucagon-like peptide-1 (GLP-1) signaling has been shown to potentially protect  $\beta$ -cells, the effect is still limited. In this regard, studies have shown that synergistic enhancement of GLP-1 signals can improve the protection potential of  $\beta$ -cells. On this point, we used the *in vitro* culture mode of  $\beta$ -cells to create a high-glucose and high-FFA environment to simulate the pathological state of MetS and evaluate various biological phenomena with high-content analysis techniques.

**Results:** We found that genistein, a naturally occurring isoflavone, displayed potential to protect  $\beta$ -cells. In particular, the combination of genistein and GLP-1 RA liraglutide can show its anti-apoptotic effect to reduce glucolipototoxicity. Its mechanism of action is likely that genistein increased the protective effect of liraglutide by preserving mitochondrial function and reducing oxidative damage under glucolipototoxicity, thus significantly improving the survival rate of  $\beta$ -cells.

**Conclusion:** Taken together, our results demonstrated detailed molecular mechanisms of glucolipototoxicity-induced  $\beta$ -cell damage, and genistein supplements may be a feasible nutritional health strategy to increase the protection of GLP-1 RA in pancreatic  $\beta$ -cells in MetS or diabetes therapy.

## PE028 Basic &amp; translational diabetes research

**An ethno-medicinal study of medicinal plants used for the treatment of diabetes and related complications in Dhaka City, Bangladesh**

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**Objective:** In recent times, ethnomedicinal research has increased remarkably internationally. While folk medicinal practitioners are common in rural areas, urban practitioners are a comparative rarity. Several ethno-medicinal studies were conducted in Bangladesh outside Dhaka (Capital city), but study in Dhaka was still needed to be conducted mainly medicinal plants related to diabetes and its complications. The study aimed to collect information about medicinal plants used by folk medicinal practitioners (FMPs) for treating diabetes and related complications inside Dhaka city.

**Methods:** The study was conducted in May-June 2020 and was carried out through a guided field-walk survey method, and the interviews were conducted by focused group discussion. The conversation was in Bengali for better understanding, but the documentation was in English.

**Results:** The practitioners were observed to use total 32 medicinal plants distributed into 22 families in their formulations to treat various diseases such as diabetes and related complications, hypertension, urinary disorders, heart disorders, sleep disorders, loss of appetite, anemia, respiratory tract disorders, pain, skin disorders, passing of sperm with urine, cancer, chicken pox, cuts, wounds and allergies. There, 16 plant species among those 32 plants were recorded for the treatment of diabetes and other diseases linked with diabetes and its complications. The practitioner used many simple and complex formulations, indicating a rich knowledge of medicinal plants and their properties. The formulations were mainly administered by the oral route.

**Conclusion:** The knowledge about medical plants and formulations collected from FMPs value further scientific concern as to their effectiveness in treatment of diabetes and related complications which can serve a helpful purpose towards the discovery of new alternative medicines for diabetes and related health complications.

## PE030 Basic &amp; translational diabetes research

**Profiling of changes in gene expression associated with epigenetic changes in peripheral blood cells under hyperinsulinemic euglycemic clamp condition**

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**Objective:** Effects of supraphysiologic insulin action are very diverse, and further studies are required. And, epigenetic regulation of acute hyperinsulinemia on gene expression has not been studied a lot. In the present study, we evaluated DNA methylation and related changes of mRNA expression level in peripheral blood cells before and after hyperinsulinemic euglycemic clamp (HEC) condition in healthy adults. Through this, we investigated whether specific gene methylation induced by acute hyperinsulinemia cause a change in gene expression.

**Methods:** Two stage HEC (insulin infusion rate: 10 and 80 mU/m<sup>2</sup>/min) studies were performed in 5 non-diabetic subjects. Buffy coat sample was taken in each subject before and after the clamp study and RNA-seq and Methyl-seq were performed using blood cells before (0 min) and after hyperinsulinemia (200 mins). Differentially expressed genes (DEGs) were identified in RNA-seq data. Among DEGs that were identified, genes with a significant change in methylation of specific regions such as, promoter and gene body were selected based on Methyl-seq data.

**Results:** Among 697 DEGs, 112 genes with a methylation change after HEC were identified and classified as "methyl-DEGs". And, in an analysis using MSigDB, among the 697 DEGs, 43 genes were involved in four major pathways (i.e., inflammation, insulin signaling, oxidative stress, and carbohydrate metabolism): we classified these genes as "phenotypic-DEGs". We performed a network analysis including Methyl-DEGs and Phenotypic-DEGs, as well as 26 INS/IGF-related genes. Among these, we found two genes (ESR1 and FGF4) that were highly correlated between changes in DNA methylation and changes in gene expression and were also associated with insulin response and diabetes.

**Conclusion:** Via combined analyses of RNA-seq and Methyl-seq data of human peripheral blood cells, we showed that a significant epigenetic regulation of two genes could occur in these cells after HEC, which may be important in the pathophysiology of hyperinsulinemia.

## PE029 Basic &amp; translational diabetes research

**Biological effectiveness of gossypin against diabetes and associated secondary complication through their effectiveness on HbA1c levels and plasma insulin level**

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**Objective:** Flavonoids are plant-derived phenolic compounds found to be present in different medicinal plants through different metabolic processes. Flavonoids have numerous health-beneficial aspects in the medicine, including anti-oxidant and anti-diabetic potential. Different types of natural products such as fruits, nuts, vegetables, seeds, stems, flowers contain significant amounts of flavonoid class phytochemicals.

**Methods:** Biological potential of gossypin in the medicine for their effectiveness on diabetes and associated secondary complications have been investigated in the present work through scientific data analysis of different research work. Detailed pharmacological activities of gossypin in the medicine for their effectiveness on HbA1c levels and plasma insulin levels in the rats have been investigated in another scientific research work. However, other positive potential of gossypin in diabetes and related complications have also been investigated in the present work through scientific data analysis of research works.

**Results:** Scientific data analysis of different research work of gossypin revealed the therapeutic potential of gossypin in medicine for the treatment of diabetes and associated secondary complications. Scientific data revealed significant biological potential of gossypin in medicine for the treatment of diabetes and associated secondary complications, as it decreased HbA1c levels and the increased plasma insulin levels in the rats.

**Conclusion:** Scientific data analysis signified the biological potential of gossypin in medicine for the treatment of diabetes and associated secondary complication of human beings.

## PE031 Basic &amp; translational diabetes research

**Pancreatic beta cell dysfunction in clinical stages of T2DM**

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**Objective:** According to research, a person with type2 diabetes may already have lost roughly 50% of beta cell function by the time they receive their diagnosis. Without treatment type 2 diabetes can progress and further loss of beta cell can occur. The aim of study was to evaluate pancreatic beta cell dysfunction in clinical stages of T2DM.

**Methods:** Clinic based cross-sectional study was included 382 participants screened for T2DM. Anamnesis, physical examination, laboratory tests were determined. Laboratory tests included OGTT, HbA1C, serum insulin, c-peptide were measured and we calculated pancreatic endocrine dysfunction for HOMA-B index

**Results:** Among them 238 (71.7%) women were analyzed. The mean age of the participants was 42.4±13.7 years old. Mean results of anthropometric measurement: body weight 82.2±16.7 kg; BMI 30.1±5.4 kg/m<sup>2</sup>; BF 40.1±8.6%; BM 26.1±7.2% or kg, and VF 9.9±3.6%. Mean results of laboratory tests: FBG 6.1±1.4 mmol/l; 2 hours blood glucose 9.3±3.4 mmol/l; HbA1C 5.8±1.04%; Insulin 24.6±19.1 mU/ml, C-peptide 4.3±3.2 mU/ml, HOMA-IR 3.2±2.0, HOMA-B 140.9±60.0, HOMA-S 48.3±35.5%, total cholesterol 4.8±0.8 mmol/l, triglyceride 2.0±0.9 mmol/l, HDL 1.2±0.3 mmol/l, and LDL 2.5±0.8 mmol/l were determined. The pancreatic beta cell function by HOMA-B index of Healthy subjects was 81.7±19.5%, in Insulin resistance group was 203.3±56.1%, in IFG group was 167.4±50.8%, in IGT group was 139.8±47.95%, in IFG+IGT group was 122.9±58.4%, in early diagnosed T2DM group was 109.8±31.7%, in long duration T2DM group was 51.4±30.5%, respectively.

**Conclusion:** Pancreatic beta cell function was 143.4% in Prediabetes, 139.8% in early diagnosed T2DM and decreased to 51.4% in long duration T2DM.

## PE032 Basic &amp; translational diabetes research

**An attempt to investigate antimony mediated therapy for an optimal insulin secretion during visceral leishmaniasis infection**

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**Objective:** Visceral Leishmaniasis is a macrophage associated disorder for the treatment of which antimony based drug like Sodium Antimony Gluconate has been the first choice in the recent past. About 5 percent of the patients may develop insulin dependent diabetes mellitus. It appears to have a direct action on pancreatic beta cells, resulting in initial insulin release followed by impaired insulin secretion. Within this context we looked into alternate therapies of treatment along with SAG on triggering the CD2 epitope.

**Methods:** We have evaluated the effect of combining CD2 with conventional antimonial (sb) therapy in protection in BALB/c mice infected with either drug sensitive or resistant strain of Leishmania donovani with 3 million parasites via-intra-cardiac route. Mice were treated with anti CD2 adjunct SAG sub-cutaneously twice a week for 4 weeks. Assessment for measurement of weight, spleen size, anti-Leishmania antibody titer, T cell and anti-leishmanial macrophage function was carried out day 0, 10, 22 and 34 post treatments. Insulin levels were also determined on the same intervals.

**Results:** The combination therapy was shown boosting significant proportion of T cells to express CD25 compared to SAG monotherapy. Although, the level of IFN- $\gamma$  was not statistically different between combination vs monotherapy ( $p=0.298$ ) but CD2 treatment even alone significantly influenced IFN- $\gamma$  production than either SAG treatment ( $p=0.045$ ) or with CD2 adjunct SAG treatment ( $p=0.005$ ) in Ld-S strain as well as in Ld-R strain. The influence of CD2 adjunct treatment was also documented in anti-leishmanial functions in macrophages. Interestingly insulin levels were observed to be optimal on supplementing SAG along with CD2.

**Conclusion:** SAG along with CD2 could be used as a potential therapy to overcome incidences of Diabetes mellitus during Visceral Leishmaniasis

## PE034 Basic &amp; translational diabetes research

**The association of angiotensin converting enzyme insertion/deletion gene polymorphism with diabetes and diabetic nephropathy patients in North Indian population**

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**Objective:** We aimed to determine the association of I/D Polymorphisms and circulatory level of the ACE gene with DN susceptibility and the risk of T2DM developing into DN in the North Indian population.

**Methods:** In this case-control study, total 300 subjects (100 healthy controls, 100 T2DM and 100 DN) were enrolled. For genotypic analysis, polymerase chain reaction (PCR) method was performed on intron 16 of the ACE gene for each subject. Statistical analysis was performed by SPSS version 20.0, and results were analyzed by using  $\chi^2$  test, unpaired t-test and Pearson's correlation.

**Results:** We observed that high level of ACE is directly proportional/affect the level of serum urea, creatinine, uric acid and urine protein in T2DM and DN patients. The result showed that the ACE DD genotype and D allele found significantly more frequent in T2DM and DN than normal controls ( $P=0.02$  and  $P=0.04$ ,  $P<0.001$  and  $P<0.001$ , respectively). Comparing the studied parameters in DN patients with the risky genotypes DD and ID with those have the II genotypes revealed that these genotypes were significantly associated with higher serum levels of HbA1c, Urea, uric acid and serum ACE ( $p<0.05$ ). We found that circulatory levels of ACE negative ( $r=-0.2042$ ,  $p=0.04$ ) correlated with circulatory levels of ACE in DN subjects.

**Conclusion:** The presence of the DD genotype and D allele significantly increased and may affect the level of serum ACE in the DN patients. Therefore we suggest that ACE I/D polymorphism to be strongly associated with the development of DN in T2DM patients.

## PE035 Basic &amp; translational diabetes research

**Effect of gymnemagenin on GLUT 4 translocation**Senthil Kumar Subramani<sup>1,2\*</sup>, Pratibha Chauhan<sup>2</sup>,Akhilesh Kumar Tamrakar<sup>3</sup>, Prasad GBKS<sup>2</sup>Tropilite, India<sup>1</sup>, Jiwaji University, India<sup>2</sup>, Central Drug Research Institute, India<sup>3</sup>

**Objective:** Diabetes mellitus is a condition that affects the body's ability to metabolize carbohydrates, fats and proteins. (GLUT4) plays a key role in regulating whole-body glucose homeostasis. It is found in high amounts in adipose tissue and skeletal muscle. Folk medicine used to treat diabetes and other issues for a long time. One such remedy, Gymnemagenin, is derived from the *Gymnema sylvestre* plant. The present study was conducted to investigate the effects of Gymnemagenin on insulin-mediated glucose utilization pathways.

**Methods:** To analyze the effects of Gymnemagenin on the insulin signaling pathway, in silico analysis was conducted using PatchDock and FireDock. Important molecules such as IRS-1, Akt, and GSK3- $\beta$  were docked and viewed using Discovery Studio Visualizer. In vivo analysis was carried out on L6 skeletal muscle cells with varying concentrations of Gymnemagenin. After appropriate incubation, western blotting was performed to check the phosphorylation of IRS-1, Akt/PKB, and GSK3- $\beta$ , and the translocation of GLUT4 was measured using an antibody-coupled colorimetric assay on GLUT4myc myotubes. The data were analyzed using one-way ANOVA, and  $P<0.05$  was considered statistically significant.

**Results:** Gymnemagenin has the ability to attach to the inhibitory sites of PTP1B and GSK3- $\beta$ , while also having allosteric binding with Akt/PKB. Gymnemagenin's binding energy and interaction with amino acid molecules are similar to those of known inhibitor and modulator molecules. When L6 skeletal muscle cells were incubated with Gymnemagenin, there was a significant increase in the level of GLUT4myc at the cell surface compared to the control. Additionally, Gymnemagenin stimulates the phosphorylation of IRS-1, Akt/PKB, and GSK3- $\beta$ . The phosphorylation was found to be statistically significant ( $P<0.05$ ).

**Conclusion:** The compound Gymnemagenin helps lower blood glucose levels by promoting the translocation of GLUT 4 from the cytoplasm to the plasma membrane. This process is dependent on the PI3K pathway and involves increased phosphorylation of IRS-1, Akt and GSK3- $\beta$ .

## PE036 Basic &amp; translational diabetes research

**Effect of sodium glucose cotransporter-2 inhibitor on hepatic glucose metabolism and hepatic autophagy**Si Woo Lee<sup>1\*</sup>, Hyun Ki Park<sup>2</sup>, Hang Kyu Lee<sup>2</sup>, Eun Seok Kang<sup>3</sup>Graduated of School of Medicine, Yonsei University, Korea<sup>1</sup>, Yonsei University College of Nursing, Korea<sup>2</sup>, Yonsei University College of Medicine, Korea<sup>3</sup>

**Objective:** Hepatic autophagy plays an important role in glycogenolysis and gluconeogenesis. Studies showed that sodium glucose cotransporter-2 (SGLT-2) inhibitors promote glucose disposal via urine and increase hepatic glucose output. SGLT-2 inhibitors are thought to increase glycogenolysis and ketogenesis. We investigate the connection between hepatic autophagy and the effects of SGLT-2 inhibitor on glucose metabolism in liver.

**Methods:** HepG2 cells were treated with dapagliflozin, (10  $\mu$ M) for 10 h, and then expression of gluconeogenic enzymes and glucose output were measured. We investigated the effect of dapagliflozin on hepatic autophagy by transfecting vector expressing the autophagy marker LC3 fused to green fluorescent protein (GFP) and mRFP (monomeric red fluorescent)-GFP into HepG2 cells. We treated cells with bafilomycin A1 (Baf A1), a lysosomal blocker, to block autophagy and treated with dapagliflozin to reveal whether increased LC3B with dapagliflozin is due to autophagy induction or autophagy flow blockade.

**Results:** Dapagliflozin increased gluconeogenic enzyme expression which is attenuated with inhibition of the autophagic process with Baf A1. Glucose production was increased with dapagliflozin and decreased with Baf A1 pretreatment. Dapagliflozin increased the number of GFP-LC3A fluorescent puncta and increased LC3B-II compared to control. Dapagliflozin increased LC3B-II expression in cells pretreated with Baf A1 and promotes autophagosome and autophagolysosome formation assessed by increment of red and yellow puncta in cell treated with dapagliflozin, which represents activation of autophagic flux instead autophagy blockade.

**Conclusion:** Dapagliflozin increased levels of gluconeogenic enzyme in liver consequently, increased hepatic gluconeogenesis, which is coupled with increment of autophagic flux.

**PE039** Basic & translational diabetes research

**Vitamin D supplementation alleviates sarcopenia by modulating myokine expression**

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**Objective:** Age-related frailty and reduced physical activity contribute to a degenerative loss of muscle mass, function, and strength, referred to as sarcopenia. Vitamin D deficiency has been involved in the pathogenesis of diabetes, metabolic syndrome, muscle atrophy. There are many studies have been made that vitamin D plays a beneficial role in inflammatory response and muscle health. However, the molecular mechanisms of vitamin D have not fully elucidated. In this study, we tried to demonstrate whether vitamin D could overcome the muscle atrophy due to aging.

**Methods:** Young (6-month-old) and aged (18-month-old) C57BL/6 mice were assigned to the following 2 groups: normal diet (1,000 IU/kg body weight); vitamin D supplemented diet (20,000 IU/kg body weight). To measure physical function in mice, we performed grip strength and rotarod test.

**Results:** We found that the reduction of the grip strength and muscle mass due to aging was recovered by vitamin D supplementation. The increase of markers involved in muscle atrophy, such as Foxo3a, Fbxo32, and Trim63, and muscle senescence, as p21, p53 and p16, in muscle of aged mice compared to the young mice were markedly decreased by vitamin D. On the contrary, expression of apelin as a myokine and its receptor (APLNR) significantly increased in aged muscles by vitamin D supplemented diet. Moreover, apelin and vitamin D enhanced muscle protein synthesis via activation of the Akt/mTOR/p70S6 pathway. Interestingly, aged mice from the vitamin D groups displayed improvement on the cross-sectional area of myofibers, muscle mass, strength, and endurance. GO analysis revealed that down-regulated gene cluster in aged mice following vitamin D or exercise were enriched in protein catabolic process and cellular response to stress.

**Conclusion:** Our present data suggests that vitamin D supplementation ameliorates aging-induced muscle atrophy and senescence, suggesting that the positive impact of vitamin D as an intervention target to prevent aging-induced metabolic diseases.

**PE042** Basic & translational diabetes research

**Factors influencing North Indian diabetics' knowledge and attitudes: cross-sectional study**

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**Objective:** To determine the factors influencing the level of knowledge and attitudes of diabetics consulting in first and third line in the North India

**Methods:** We undertook a cross-sectional study. Diabetics were included by proportional sampling in 100 basic health centers and six hospital departments and outpatient clinics of the university hospital centers of North India. The developed questionnaire was self-administered in Arabic. It included patient demographic characteristics data, diabetes-specific data, the Simplified Diabetes Knowledge Scale to measure knowledge and the Diabetes Attitude Scale-3 to measure attitudes towards diabetes.

**Results:** We collected 2500 diabetics. Factors influencing the acquisition of a good level of knowledge were high school (adjusted OR=1.17) or university education (adjusted OR=2.45), living in an urban area (adjusted OR=2.49), and stable employment (adjusted OR=1.25). Type 2 diabetes (adjusted OR=3.11), insulin therapy (adjusted OR=2.87), previous therapeutic education sessions (adjusted OR=2.96), self-monitoring of blood glucose (adjusted OR=2.56), and regular medical follow-up (adjusted OR=2.00) also influenced the level of diabetes knowledge. Acceptable glycemic control (adjusted OR=2.20) was a factor in the development of good attitudes about diabetes.

**Conclusion:** Identification of factors influencing the level of diabetes knowledge and attitudes is an integral part of educational diagnosis. These factors must be taken into account when establishing a personalized therapeutic education program adapted to each patient.

**PE040** Basic & translational diabetes research

**Two different ways to replace beta cell mass after partial pancreatectomy**

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**Objective:** Treatment of diabetes in which beta cell mass is reduced is islet transplantation (IT), which replaces beta cells, and insulin therapy, which rests beta cells. Although both methods show significant results in preventing the progression of diabetes, it is controversial whether the two treatments work through the same mechanism.

**Methods:** To evaluate this hypothesis, insulin injection or IT was performed on mice that had undergone 50% partial pancreatectomy, and the IPGTT and histological changes of the remnant pancreas were examined.

**Results:** In the IPGTT conducted after IT or insulin treatment after pancreatectomy for 7 days, the blood glucose profile of the IT mice was similar to that of normal, but the insulin-treated mice showed a significantly higher blood glucose level than normal. In histology of the remnant pancreas in the insulin-treated group, alpha cells increases, and the alpha/beta ratio was significantly higher than in the normal or IT group. There was no difference in islet proliferation or apoptosis in the insulin-treated group, but PDX-1 expression was significantly higher in alpha cells of the insulin-treated group.

**Conclusion:** In conclusion, insulin or IT as a treatment method to replace beta cells is known in a similar way. But, IT is a more physiological method than insulin treatment, and it needs to be worked more detail whether notable increases of alpha cell mass in the remnant pancreas due to insulin treatment is a short-term or a continuous change.

**PE044** Basic & translational diabetes research

**Among university teachers, the risk of type 2 diabetes mellitus is high regardless of gender in Darkhan-Uula province in Mongolia**

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**Objective:** The aim of this study was to investigate the type 2 diabetes mellitus among university teachers and identifying risks.

**Methods:** The study included teachers if Medical School Mongolian University of Science and Technology, Agricultural University, University of Humanities in Darkhan-Uul province. The sample of the research population was purposive or 82 teachers over 35 years of age according to the age category specified in the "Clinical guidelines for T2DM." The knowledge about possible complications ( $\alpha > 0.895$ ) was developed with 4 groups and 28 questions. When determining the Cronbach's Alpha of each group, it was between 0,7 and 0,9, so the internal consistency and reliability of the questionnaire was considered sufficient. The research was conducted from September 2022 to March 2023, and statistical processing was done using SPSS 24 software.

**Results:** The teachers knowledge about the risk group of T2DM (3.6+-0.73) and its early symptoms (3.1+-1.06), the risk of complications (3.1+-1.06), and knowledge about complications (3.39+-1.07) were moderate. 30.4% (25) of the surveyed teachers have a low risk of diabetes, 69,5% (57) have a defined at risk and are likely to suffer from T2DM in the next 10 years. Among teachers, the risk of T2DM in the next 10 years. Among teachers, the risk of T2DM is high, regardless of gender (76,5% of men, 73,8% of woman), having a sedentary job for more than 6 hours. (82.4% of men 80% of woman), and not exercising everyday (70.6% of men and 67,7% of woman have a dominant effect.

**Conclusion:** This study shows that teachers have a higher risk of diabetes. A higher risk of developing diabetes may be related to a number of factors, including sedentary work and lack of active exercise. Need to do active exercise, change their lifestyle and adopt healthy behaviors.

## PE045 Basic &amp; translational diabetes research

**An updated meta-analysis on the association of plasminogen activator inhibitor-1 levels in post-gestational diabetes mellitus**

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**Objective:** This study aims to determine the difference of plasminogen activator inhibitor-1 (PAI-1) between individuals with prior history of gestational diabetes (pGDM) versus those with no history of the disease.

**Methods:** Studies containing data of PAI-1 levels in pGDM and GDM were obtained from various database websites. Individual study information were collected and summarized. Standardized mean difference (SMD) and their 95% confidence interval (CI) were computed using either a fixed- or random-effects model.

**Results:** Data obtained from 10 studies were heterogeneous, which prompted the identification of the cause using a Galbraith plot. Post-outlier outcomes demonstrate that higher levels of PAI-1 are observed among women with a history of GDM than those with no history of the disease.

**Conclusion:** PAI-1 is significantly elevated among pregnant women with pGDM. Further studies regarding the relation of serum PAI-1 with other diabetes-related markers and variables should be done.

## PE048 Basic &amp; translational diabetes research

**Association of serum ferritin with inflammatory markers and red meat intake in individuals with type 2 diabetes**

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**Objective:** This cross-sectional study aims to investigate the association between serum ferritin levels, inflammatory markers, and red meat intake in individuals with type 2 diabetes (T2DM).

**Methods:** A randomly selected sample of 155 patients with T2DM, with a mean age of 56.9 ± 11.6 years, including 27.7% men, and a mean diabetes duration of 8.6 years, were recruited from the Mongolian National University of Medical Sciences Hospital. Self-reported data on red meat intake were analyzed, and diabetic chronic complications were screened. Participants' serum ferritin, soluble transferrin receptor (sTFR), and inflammatory markers such as IL-6, homocysteine, and high sensitivity CRP (HsCRP) were tested.

**Results:** Mean values (minimum to maximum) for serum ferritin, sTFR, IL-6, homocysteine, and CRP were 193.4 (17-838), 15.5 (8.9-37.6), 3.2 (0.1-18.0), 10.7 (4-19), and 0.90 (0.1-27.2), respectively. The mean red meat intake was 206.1 grams (0-500) per day. Serum ferritin exhibited a significant association with IL-6 (Spearman  $r = -0.524$ ,  $p < 0.001$ ), but not with other inflammatory markers or red meat intake. In the analysis of inflammatory markers and red meat intake across ferritin tertile groups, IL-6 (4.2, 3.0, and 2.6) and HsCRP (9.8, 8.7, and 8.4) levels showed a decreasing trend in the lowest, middle, and highest tertiles of ferritin, respectively. IL-6 levels were significantly higher in individuals with diabetic chronic complications. In the linear regression analysis, serum ferritin negatively correlated with IL-6, and this association remained significant even after adjusting for sTFR and red meat intake separately. Additionally, serum ferritin exhibited a negative correlation with sTFR (Spearman  $r = -0.392$ ,  $p < 0.001$ ).

**Conclusion:** Serum ferritin levels in individuals with T2DM in Mongolia appear to be influenced by inflammatory mechanisms rather than solely indicating iron overload. Further research is needed to better understand the complex relationship between serum ferritin, inflammatory markers, and red meat intake in this population.

## PE049 Basic &amp; translational diabetes research

**Direct effect of teneligliptin on the brown adipocytes**

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**Objective:** Metabolic diseases associated with obesity, such as hypertension, dyslipidemia, diabetes mellitus and cardiovascular disease, have significantly increased worldwide. To reduce obesity-related metabolic abnormalities, lifestyle modification using dietary intake and physical exercise is emphasized, but long-term health benefits have not been achieved. There remains an unmet need for the development of new strategy for obesity treatment. Brown adipose tissue (BAT) that are raising energy expenditure is attractive target for the management of obesity and obesity-related diseases. In this study, we aimed to confirm the direct effect of teneligliptin on brown adipocytes, based on the previous study results that soluble dipeptidyl peptidase-4 (DPP4) inhibition of teneligliptin induced the expression of uncoupling protein 1 (UCP1) in BAT of mouse.

**Methods:** Immortalized mouse brown preadipocytes were maintained in DMEM (Welgene, Gyeongsan, Korea) containing 10% fetal bovine serum (Gibco, Grand Island, NY, USA) and 1% penicillin/streptomycin (Welgene). Brown preadipocytes were differentiated after treatment for 24 hours with teneligliptin 100  $\mu$ M (experiment 1) and treated daily with teneligliptin 100  $\mu$ M during differentiation process (experiment 2). The effects of teneligliptin on brown adipocytes were confirmed by oil-red O stain and qPCR.

**Results:** In experiment 1, brown adipocytes on day 4 of differentiation showed that the teneligliptin-treated cells contained more intracellular triglycerides (TGs) and increased the expression of *Ucp-1* and *Prdm16*. However, in experiments 2, brown adipocytes on day 5 of differentiation showed that the teneligliptin-treated cells contained less intracellular triglycerides (TGs) and decreased the expression of *Ucp-1* and *Cidea*.

**Conclusion:** These preliminary results suggest that teneligliptin may directly affect the differentiation process of brown preadipocytes.

## PE050 Basic &amp; translational diabetes research

**Factors influencing baseline blood cortisol variations among hospitalized patients in a medicine department**

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 Rama Medical College, India

**Objective:** Baseline blood cortisol varies with all kinds of stressful situations making it delicate to interpret its variations when many stress factors are associated. The aim of the study was to evaluate the factors that influence baseline blood cortisol among hospitalized patients

**Methods:** It's a prospective study including all the patients hospitalized in the department of medicine in Rama Medical College over the period of 12 months (April 2022 to March 2023). We excluded patients who received corticosteroids in the 2 months before hospitalization.

**Results:** A total of 100 patients were included with a mean age of 42.2 ± 18.8 years old and a sex ratio of 1. Half of the patients were infected. All infections were community acquired. The SOFA score was inferior to 2.4 in 91.2% of the cases. Infected patients had a higher baseline blood cortisol level than the other patients hospitalized for other motives (132.5  $\mu$ g/dl versus 100  $\mu$ g/dl with a p value of 0.001). Eighty Seven patients had diabetes. Glycated hemoglobin was higher than 6.6% in Seventy patients. Patients with diabetes didn't particularly had a higher nor lower baseline blood cortisol level than other patients (130  $\mu$ g/dl versus 128.5  $\mu$ g/dl with a p value of 0.76).

**Conclusion:** The baseline blood cortisol is variable and fluctuates with many factors. Therefore, it is really hard to interpret the cortisol elevation when many confusing factors are gathered.

## PE051 Basic &amp; translational diabetes research

**Preventing diabetes in gestational diabetes: what is the dietary culprit?**Barakatun-Nisak Mohd Yusof<sup>1\*</sup>, Farah Yasmin Hasbullah<sup>1</sup>, Sangeetha Sham<sup>2</sup>, Rohana Abdul Ghani<sup>2</sup>Lecturer, Malaysia<sup>1</sup>, Consultant, Malaysia<sup>2</sup>, Research Fellow, Spain<sup>3</sup>

**Objective:** Women with a previous history of gestational diabetes mellitus (post-GDM) are at an increased risk of developing postpartum glucose intolerance (PGI), including pre-diabetes and type 2 diabetes. While dietary patterns have been demonstrated to modify the risk of PGI in women post-GDM, evidence in Asian populations is limited. Analyzing dietary patterns helps depict diverse dietary habits and planning individualized dietary strategies in multi-ethnic people such as in Malaysia. Hence, this study aimed to determine the association between dietary patterns and PGI in women post-GDM.

**Methods:** This cross-sectional study involved 157 women post-GDM (mean age 34.8 years) from Seri Kembangan Health Clinic and Universiti Putra Malaysia in Selangor. PGI was diagnosed based on the Malaysian Clinical Practice Guidelines criteria using a 75g 2-hour oral glucose tolerance test or HbA1c. Dietary intake was assessed using the Malaysian Adult Nutrition Survey 2014 food frequency questionnaire. The principal component analysis identified five dietary patterns: 'Unhealthy', 'Fish-eggs-fruits-vegetables', 'Cereals-confectionaries', 'Legumes-dairy', and 'Meat-sugar sweetened-beverages'.

**Results:** After adjusting for sociodemographic characteristics and total energy intake, the 'Cereals-confectionaries' dietary pattern was significantly associated with PGI (adjusted odds ratio 1.536,  $p=0.049$ ). The 'Cereals-confectionaries' dietary pattern consisted of high intakes of cereals and grains and confectionaries but low intake of milk and dairy products. The cereals included rice, noodles, pasta, corn, breakfast cereals, oats, corn, sago, bread, and local flatbread. Confectionaries consisted of sweet or savoury foods and snacks, such as local *kuih*, biscuits, chocolate, candies, and pastries. The top five food sources of the 'Cereals confectionaries' dietary pattern were white rice (58.9%), white bread (7.8%), brown rice (5.2%), flavoured rice (4.5%), and local *kuih* (3.2%).

**Conclusion:** The 'Cereals-confectionaries' dietary pattern is the culprit that accelerates diabetes among women with post-GDM, creating fundamental preventive lifestyle measures for future translational research.

## PE052 Basic &amp; translational diabetes research

**Serotonin is a novel player in selective hepatic insulin resistance**Jung Eun Nam<sup>1\*</sup>, Inseon Hwang<sup>2</sup>, Won Gun Choi<sup>3</sup>, Won-Il Choi<sup>1</sup>, Minju Lee<sup>1</sup>, Wonsuk Choi<sup>4</sup>, Young-Ah Moon<sup>5</sup>, Hail Kim<sup>1</sup>KAIST, Korea<sup>1</sup>, Daejeon Health Institute of Technology, Korea<sup>2</sup>, The Catholic University of Korea, Korea<sup>3</sup>, Chonnam National University Medical School, Korea<sup>4</sup>, Inha University School of Medicine, Korea<sup>5</sup>

**Objective:** Insulin signaling is known to induce lipogenesis and suppress gluconeogenesis in the liver, so during insulin resistance, hepatic lipogenesis is expected to decrease and hepatic gluconeogenesis to increase. However, while hepatic gluconeogenesis increases as expected, hepatic lipogenesis unexpectedly increases during insulin resistance. The mechanism of this selective hepatic insulin resistance remains yet to be elucidated. Serotonin (5-HT) has been reported to induce lipogenesis and gluconeogenesis in the liver through HTR2A and HTR2B respectively. Herein, we investigated molecular mechanism how 5-HT activates both lipogenesis and gluconeogenesis and its contribution to selective hepatic insulin resistance.

**Methods:** AML-12 cells were incubated with 5-HT in the presence or absence of various inhibitors against insulin signaling pathway. Twelve-week-old C57BL/6J, liver specific *Htr2a* knockout (L2AKO), liver specific *Htr2b* knockout (L2BKO), liver specific *Insr* knockout (LIRKO) and liver specific *Htr2a/Insr* double knockout (L2AIRKO) male mice were injected with 5-HT or insulin via portal vein.

**Results:** In AML-12 cells, 5-HT activates AKT phosphorylation through PI3K and intracellular calcium flux resulting in the activation of SREBP-1c. Direct injection of 5-HT through portal vein induced phosphorylation of AKT (S473) and activation of SREBP-1c, which were diminished specifically in L2AKO mice. When the hepatic insulin signaling was inhibited by LIRKO or S-961 (insulin receptor antagonist), 5-HT induced AKT phosphorylation but insulin could not. According to HFD fed condition, even though there is no significant difference of body weight between LIRKO and L2AIRKO mice group, weight and size of liver and hepatic steatosis are decreased in L2AIRKO mice, comparing LIRKO mice. In terms of gluconeogenesis, 5-HT phosphorylates CREB through HTR2B which was mediated by PKG, not by PKA and 5-HT injection could not induce CREB activation in L2BKO mice.

**Conclusion:** These results suggest that 5-HT can increase hepatic lipogenesis, when insulin signaling is weakened, via HTR2A-Ca2+-PI3K-AKT-SREBP-1c signaling cascade, with induction of gluconeogenesis via HTR2B-PKG-CREB signaling.

## PE053 Basic &amp; translational diabetes research

**MPO gene expression in first trimester RNA samples from Filipino pregnant women**Mariejim Diane Lee<sup>\*</sup>, Maria Ruth Pineda-Cortel, Clarenz Sarit Concepcion, Adrian Villavieja  
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**Objective:** Oxidative stress and inflammation are two vital pathological mechanisms associated with gestational diabetes mellitus (GDM). Myeloperoxidase (MPO), an inflammatory enzyme, plays a role in inducing oxidative stress, which can exacerbate insulin resistance in GDM. Interestingly, the MPO gene has recently emerged as one of the promising biomarkers for early GDM diagnosis, reducing the likelihood of complications and adverse outcomes. The study aimed to determine the relationship between the gene expression of *MPO* ( $2^{-\Delta\Delta C_t}$ ) and GDM.

**Methods:** This retrospective cross-sectional study utilized sixty-three (63) stored RNA samples (25 GDM patients and 38 non-GDM patients previously diagnosed using IADPSG criteria) isolated from first trimester blood samples. *MPO* gene expression was measured using RT-qPCR. Results of the gene expression were compared between GDM and non-GDM groups, and statistically analyzed to determine the relationship between GDM and *MPO* gene expression.

**Results:** Stored RNA has an average concentration of 169.50 ng/ $\mu$ L (SD=72.57). Increase in  $\Delta\Delta C_t$  values were observed in the GDM patients (GDM=0.49 $\pm$ 1.23 vs non-GDM=0.10 $\pm$ 0.8;  $p=0.10$ ). The  $\Delta\Delta C_t$  values and fasting blood sugar values were positively correlated ( $r=0.16$ ; 95% CI -0.11 to 0.40;  $p=0.23$ ). Conversely, lower fold change ( $2^{-\Delta\Delta C_t}$ ) values were observed in GDM patients (GDM=0.56 $\pm$ 0.29 vs non-GDM=0.91 $\pm$ 0.39;  $p=0.09$ ), suggesting a decrease in gene expression. Pearson  $r$  correlation demonstrate an inverse relationship of  $2^{-\Delta\Delta C_t}$  values with fasting blood sugar values ( $r=-0.29$ ; 95% CI -0.52 to -0.01;  $p=0.04$ ). The area under ROC curve (AUC) suggests that  $2^{-\Delta\Delta C_t}$  value is a good predictor of GDM (0.76; 95% CI 0.62 to 0.90;  $p<0.001$ ).

**Conclusion:** The *MPO* gene could potentially serve as a biomarker for GDM. Further studies on a larger patient population could validate the results of the study.

## PE054 Basic &amp; translational diabetes research

**Vitamin D ameliorates age-induced nonalcoholic fatty liver disease by increasing the mitochondrial fatty liver**Gyu Hee Kim<sup>\*</sup>, Hyeon-Ju Jeong, Yoo Jeong Lee, Dankyu Yoon, Soo Kyung Koo, Joo Hyun Lim  
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**Objective:** Vitamin D is thought to have beneficial functions in preventing NAFLD; however, its effects remain controversial. Most studies have investigated only vitamin D deficiency in NAFLD and have not explored combination of vitamin D with multiple other risk factors, such as aging or mitochondrial dysfunction. In this study, we examined the precise molecular mechanisms of age-induced NAFLD, especially in relation to vitamin D and mitochondria.

**Methods:** We measured the liver mass and degree of lipid accumulation from young (7-month-old) and aged (22-month-old) C57BL/6 mice fed a chow (1,000 IU/kg) or vitamin D3-supplemented (20,000 IU/kg) diet. To determine whether levels of mitochondrial protein complex were altered in our animal model system, we performed real-time PCR and Western blot analysis.

**Results:** We observed a significant reduction in total liver mass and lipid accumulation within the liver only in the aged mice fed a vitamin D3-supplemented diet. Aging and mitochondrial dysfunction are closely associated. To determine whether mitochondrial dynamics or quality control system-related genes were altered in our animal model system, we performed real-time PCR and Western blot analysis. In aged mice, levels of OXPHOS and mitochondrial fusion-related protein were reduced, and this decrease was reversed by vitamin D3 supplementation. Caseinolytic mitochondrial matrix peptidase proteolytic subunit (ClpP) and Lon protease 1 (LonP1) are representative MQC proteins located in the mitochondrial matrix. Also, mitochondrial contact site and cristae organizing system (MICOS) is a relatively newly discovered mitochondrial protein complex. Interestingly, we found that levels of LonP1 and Mic60 were specifically reduced by aging, and the expression was restored by vitamin D3 supplementation only in the aged mice.

**Conclusion:** We demonstrated that aging, mitochondrial dysfunction, and NAFLD are closely related and that vitamin D3 supplementation is effective only when the vitamin D3 concentration in the blood is too low, as it is in aged mice.

## PE055 Basic &amp; translational diabetes research

**Determination of serum ferritin levels in Mongolian men and its relationship with serum lipids and glucose**

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**Objective:** Some study have shown ferritin is associated with various cardiometabolic risk factors such as dyslipidemia and insulin resistance in adults. To determine serum ferritin levels in Mongolian men and compare serum ferritin with serum lipid and glucose levels.

**Methods:** The cross-sectional study involved 610 men from th, Erdenet Medical Hospital among the workers of Erdenet Mining Corporation in 2022. We analyzed serum levels T-Chol, TG, HDL, LDL, GLU and evaluated them in relation to ferritin levels. The clinical characteristics of the groups were compared using Independent Samples test. Serum ferritin level  $\geq 430$  ng/ml, it was considered elevated.

**Results:** Serum ferritin level was  $419.75 \pm 297.77$  ng/ml. The percentage of elevated serum ferritin was 34.2%. Ferritin was more than 1000 ng/ml, 18.7% in the elevated serum ferritin group. The percentage of dyslipidemia and hyperglycemia was higher in the group with elevated serum ferritin. In the group with elevated serum ferritin, 17 % of participants had a high TG level, 11.9% had Low HDL and 22.1% had hyperglycemia while 7.7 % of participants had a high TG level, 7.7 % had Low HDL and 15.7% had hyperglycemia in the normal ferritin group. When comparing the analysis of 2 groups, TG  $1.71 \pm 1.53$  mmol/l ( $p < 0.001$ ), total cholesterol  $5.18 \pm 0.9$  mmol/l ( $< 0.078$ ), LDL  $3.13 \pm 0.88$  mmol/l ( $P < 0.710$ ), glucose  $6.10 \pm 2.01$  mmol/l ( $p < 0.002$ ) were higher, and HDL  $1.27 \pm 0.28$  mmol/l ( $p < 0.015$ ) was lower in elevated ferritin group. Linear regression analysis, ferritin was correlated with increased serum glucose and TG, and decreased HDL (Pearson  $r = 0.2$ ,  $p < 0.001$ ), (Pearson  $r = 0.240$ ,  $p < 0.001$ ), (Pearson  $r = -0.120$ ,  $p < 0.001$ ) respectively.

**Conclusion:** TG and glucose were higher in the elevated ferritin group while HDL was low.

## PE059 Basic &amp; translational diabetes research

**Melatonin prevents obesity by modulating gut microbiota-derived metabolites in high-fat diet-fed mouse**

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**Objective:** Obesity and type 2 diabetes are associated with changes to the gut microbiota. Melatonin has been reported to prevent obesity by ameliorating high fat diet (HFD)-induced gut microbiota dysbiosis, although the mechanism remains unclear.

**Methods:** We measured the concentrations of fecal SCFAs including acetate, propionate, and butyrate in HFD-fed mice using mass spectrometry. Melatonin was treated with HFD by gavage once daily for 16 weeks. Acetate was infused through an intragastric catheter continuously for 2 weeks. Hyperglycemic clamps and glucose tolerance test (IPGTT) was performed in fasted mice.

**Results:** Here, we show that increased production of acetate by gut dysbiosis in HFD-fed mice leads to activation of the parasympathetic nervous system, which in turn increases glucose-stimulated insulin secretion, ghrelin secretion, food intake, and weight gain. Oral treatment with melatonin prevents the production of acetate by ameliorating the gut microbiota dysbiosis in HFD-fed mice. Mechanistically, melatonin decreases the relative abundance of acetate and propionate producers, Bacteroides, while HFD increases the relative abundance of acetate. Furthermore, melatonin inhibits acetate production by inhibiting pentose phosphate pathway of Bacteroides acidifaciens.

**Conclusion:** These results suggest that gut microbial acetate may mediate gut dysbiosis-induced weight gain and reveal a mechanism of melatonin for preventing obesity through modulation of gut microbiota. Therefore, oral treatment with melatonin may be helpful to prevent obesity and type 2 diabetes.

## PE058 Basic &amp; translational diabetes research

**Estimation of salivary  $\alpha$ -amylase among type 2 diabetics: potential for non-invasive diagnostics**

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**Objective:** Studies have shown that salivary  $\alpha$ -amylase is significantly increased among people with diabetes compared to healthy individuals due to its altered expression by the parotid glands. However, its potential as a non-invasive indicator for diagnosing and monitoring type 2 diabetes mellitus (T2DM) has not yet been fully studied. Hence, we evaluated in this study the potential of salivary  $\alpha$ -amylase as a non-invasive indicator of T2DM.

**Methods:** A total of 80 participants were included in this study and were divided into diabetics and non-diabetics. Fasting blood samples and unstimulated saliva was collected from each participant and was subjected to biochemical analysis. Fasting blood glucose (FBG) were tested in serum samples whereas, salivary  $\alpha$ -amylase were tested from diluted (1:100) saliva samples. The data obtained were statistically analyzed using independent samples t-test and the receiving operations characteristics (ROC) curve.

**Results:** A significant correlation ( $r = 0.239$ ,  $p = 0.03$ ) was observed between FBG and salivary  $\alpha$ -amylase levels. Independent samples t-test showed that diabetics have significantly ( $p = 0.02$ ) higher levels of salivary  $\alpha$ -amylase ( $996.7 \pm 824.1$  U/L) than non-diabetics ( $644.7 \pm 741.6$  U/L). ROC curve analysis also showed that salivary  $\alpha$ -amylase has good potential in predicting T2DM (AUC=0.69,  $p < 0.01$ ).

**Conclusion:** In conclusion, levels of salivary  $\alpha$ -amylase is significantly higher among people with diabetes than in non-diabetics. It also showed good potential in predicting diabetes. However, further studies are still needed to confirm our results.

## PE061 Basic &amp; translational diabetes research

**A study of associations between eating habit and hypertension in a healthcare workforce**

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**Objective:** This study aimed to identify the associations between dietary variety score and arterial hypertension in healthcare workforces.

**Methods:** A cross-sectional study was conducted among healthcare workforces in the First Central Hospital of Mongolia. A total of 244 workers (82.4% female, mean age  $35.15 \pm 9.13$  years) participated. Eating habits were assessed with ten food frequency questionnaires (maximum, 10 points) Dietary Variety Score (DVS). Workers were grouped into shift and non-shift on the ISCO-2008 revision. The dependent variable was measured on OMRON apparatus (Model: HEM-7200-HK). The hypertension status was assessed following the updated WHO/ISH classification of Hypertension guidelines systolic pressure (SBP) 130 mm. mub and diastolic pressure (DBP) 80 mm. mub. We performed linear regression analysis between DVS and hypertension risk.

**Results:** In this study, mean score of DVS was  $2.95 \pm 1.5$ . DVS was categorized into the highest, middle, lowest (6.6%, 53.7%, 39.8%). DVS mean score was significantly lower ( $p < 0.05$ ) in shift workers: shift ( $2.35 \pm 1.06$ ) and non-shift ( $3.04 \pm 1.2$ ) groups. In this study, 11.5% of all participants had hypertension. 12% of participants who work for shift and 7.5% of non-shift were hypertension ( $p < 0.05$ ). A means of SBP ( $112.85 \pm 15$ ) and DBP ( $73.12 \pm 10$ ) were significantly higher in shift workers: shift (SBP  $131.1 \pm 18$  and DBP  $82.5 \pm 10$ ), non shift (SBP  $119 \pm 19$  and DBP  $78.5 \pm 11$ ). A Lower DVS mean score was significantly associated with higher SBP and DBP ( $r = -0.358$  and  $r = -0.396$ ;  $p < 0.05$ ) in shift workers. In linear regression analysis shows that lower DVS associated with a higher risk of hypertension in shift workers: The  $\beta$  (95% CI) was  $-0.369(-6.145; -0.774)$  in SBP,  $-0.514(-4.178; -0.369)$  in DBP for shift workers when comparing with non-shift workers.

**Conclusion:** A lower dietary variety score was significantly associated with higher blood pressure in healthcare workforces. These results suggest improving eating habits among healthcare workforces.

## PE062 Basic &amp; translational diabetes research

**PDPN-knockdown alleviate islet fibrosis in T2DM mice**Xiaohang Wang<sup>1,2\*</sup>, Qianqian Wang<sup>2</sup>, Chenming Ni<sup>2</sup>, Jinbang Wang<sup>2</sup>, Zilin Sun<sup>2</sup>  
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**Objective:** Through RNA-sequencing, we found that the *Pdpr* gene was significantly overexpressed in islet stellate cell (ISC) of fibrotic islet. Combined with validations in multiple T2DM animals, we hypothesized that the *Pdpr* may be the key gene for the activation of ISC. The role of *Pdpr* in the fibrotic islet needs to be further verified.

**Methods:** A GFAP-specific promoter adeno-associated virus was constructed to knock-down the *Pdpr* in stellate cells (GFAP-AAV-Pdpr<sup>-</sup>). C57 mice were randomly selected for tail vein injection of GFAP-AAV-Pdpr<sup>-</sup> virus (3\*10<sup>11</sup> v.g). After 3 weeks, low-dose STZ and high-fat diet were used to establish T2DM. Intraperitoneal glucose tolerance test (IPGTT) was used to evaluate the glucose metabolism. Masson and immunofluorescence were used to evaluate the islet morphology, insulin and fibrosis in islets.

**Results:** 1. The expression of PDPN in the pancreas of T2DM was significantly higher than control, and the PDPN expression of T2DM+AAV-pdpr<sup>-</sup> group was significantly lower than T2DM. 2. The fasting blood glucose of T2DM+AAV-pdpr<sup>-</sup> group was significantly lower than T2DM. 3. The IPGTT experiment found that the AUC curve of T2DM+AAV-pdpr<sup>-</sup> group had a decreasing trend than T2DM and the blood glucose was significantly decreased at 180 minutes. 4. Immunofluorescence showed that the insulin in T2DM+AAV-pdpr<sup>-</sup> group was significantly higher than T2DM. 5. Masson staining showed that T2DM+AAV-pdpr<sup>-</sup> group had significantly less fibrotic areas in islets.

**Conclusion:** Specific knockdown of the *Pdpr* gene in stellate cells suppressed the occurrence and development of islet fibrosis, and improved the function of  $\beta$  cells in mice.

## PE063 Basic &amp; translational diabetes research

**Sialic acids as potential inhibitors against targeted proteins for diabetes: insight from in silico approaches**Der Jiun Ooi\*  
Mahsa University, Malaysia

**Objective:** Sialic acids, a family of diverse 9 carbon carboxylated monosaccharides, possess unique characteristics of being negatively charged at physiological pH and exceptional hydrophilicity. These features render their involvement in various structural and regulatory functions. Multiple studies have highlighted the potential of serum sialic acids (total, bound, and free forms) as biomarkers for type 2 diabetes mellitus and its microvascular complications. However, previous in vitro studies have also reported increased insulin action in insulin-resistant cells following sialic acids supplementation. The present study aimed to explore the anti-diabetic potential of sialic acids using in silico approaches.

**Methods:** Two-dimensional structures and SMILES notation of N-Acetyl-Neuraminic acid (Neu5Ac), N-Glycolyl-Neuraminic acid (Neu5Gc), and Keto-Deoxy-Nonulonic acid (KGN) were retrieved from PubChem database. Structure-based inverse dockings were conducted on a high-performance computing server through the DIA-DB web server system. Oral bioavailability and absorption, distribution, excretion, and toxicity (ADMET) properties of the molecules were assessed using the SwissADME web tool. Subsequent molecular interaction analysis was carried out using BIOVIA Discovery Studio.

**Results:** Inverse virtual screening identified the three sialic acids as potential binders to corticosteroid 11 $\beta$ -beta-dehydrogenase isozyme 1 (HSD11B1) and peroxisome proliferator-activated receptor gamma (PPARG), with binding energy scores ranging from -6.6 to -7.3 Kcal/Mol. While Neu5Ac, Neu5Gc and KDN are highly soluble, they are estimated with low bioavailability score of 0.11 (low gastrointestinal absorption and non-blood-brain barrier permeant). At least one violation is observed on the respective Lipinski, Ghose, Veber, Egan and Muegge rules, which render these sialic acids as non-drug-like molecules. However, potential lead-likeness properties of sialic acids may worth studying as a starting point for further drug development.

**Conclusion:** The results of this study suggest that sialic acids may exert multi-targeted effects in diabetes mellitus, warranting further investigation to elucidate their interactions underlying insulin resistance and glucose metabolism.

## PE064 Basic &amp; translational diabetes research

**Follow-up after direct-acting antiviral therapy in patients with type 2 diabetes and chronic hepatitis C**Mandukhai Munkhbaatar\*, Ariunbold Dorjgotov, Gerelchuluun Mendbayar  
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**Objective:** Type 2 diabetes mellitus (T2DM) and Hepatitis C (HCV) infection are two major public health problems associated with increasing complications and mortality. We conducted this study with the aim of determining the improvement of liver fibrosis by non-invasive methods for determining liver fibrosis in HCV infection and T2DM coexist who received direct-acting antiviral therapy (DAA) treatment.

**Methods:** We focused on determining HbA1c, FIB-4 and APRI (AST/Platelet Ratio) index to evaluate the degree of liver fibrosis were evaluated before treatment and at weeks SVR4, SVR12 and SVR24 after treatment.

**Results:** In 22 patients the average age was 46 $\pm$ 12 and their mean HbA1c 7.53 $\pm$ 1.21%. Comparing the mean weekly scores at SVR4, SVR12, and SVR24 before and after DAA treatment were APRI score 1.59 and 0.54, respectively; 0.39; 0.33 (p<0.0001), and FIB-4 score 3.38 and 2.04; 1.72; 1.42 (p<0.0001) showed a statistically significant decrease in the degree of fibrosis. Fibrosis improvement after DAA treatment was evaluated by comparing APRI and FIB4 scores before DAA treatment with SWE scores after treatment: F0-F1 before treatment; F2: F3-4 each 27.3%; 27.3%; had 45.5% and post-treatment SWE 72.1%; 4.5%; 22.7% (p=0.015) showed a statistically significant improvement. According to the post-treatment SWE assessment, 90.9% of non-cirrhotic patients, 83.3% of Cirrhotic Child-Pugh A patients, and 50% of Child-Pugh B patients improved to F0, while 100% of Cirrhotic Child-Pugh C patients had F4 fibrosis (p=0.012). According to post-treatment SWE assessment, 5 patients were F4 with no improvement in fibrosis grade, 2 of which were Child-Pugh A+Diabetes with Cirrhosis, Child-Pugh B+Diabetes with Cirrhosis, and 3 were Child-Pugh C patients.

**Conclusion:** In our study, there were significant differences between baseline and end-of-treatment DAAs, and the degree of liver fibrosis decreased over time. However, there was no improvement in the degree of fibrosis in people with cirrhosis, Child-Pugh C and type 2 diabetes mellitus.

## PE068 Basic &amp; translational diabetes research

**Association between ABO blood type and gestational diabetes mellitus development: an updated meta-analysis**Miljun Catacata<sup>1\*</sup>, Benjie Clemente<sup>2</sup>, Michelle Charina Gomez<sup>1</sup>,  
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Maria Ruth Pineda-Cortel<sup>2</sup>, Raphael Enrique Tiongco<sup>1</sup>  
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**Objective:** With the conflicting nature of studies on the association of ABO blood type with gestational diabetes mellitus (GDM) has been published, this study aims to determine more precise estimates by performing a meta-analysis to establish the association of ABO with GDM.

**Methods:** Relevant studies were searched in PubMed, Google Scholar, Science Direct, and Cochrane Library and were selected according to the inclusion criteria. Data were extracted and subjected to analysis using Review Manager 5.4.1. Pooled odds ratios and 95% confidence intervals were computed to measure the association of ABO blood grouping to GDM.

**Results:** Thirteen studies containing data from 66,515 pregnant women were included in the meta-analysis. Overall outcomes show heterogenous results, which prompted us to identify the source of heterogeneity using funnel plots. After removing three outlier studies, post-outlier results are homogenous, indicating the combinability of the results. Our findings suggest an increased risk of GDM development among non-blood type O, specifically those with blood type B, compared to blood type O pregnant women.

**Conclusion:** Based on this meta-analysis, pregnant women who are blood type B are more likely to develop GDM. More studies on the association of ABO blood grouping and GDM are highly recommended.

## PE072 Basic &amp; translational diabetes research

**Effects of dehydroepiandrosterone administration on metabolic homeostasis and antioxidant status after sleeve gastrectomy in male rats**

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**Objective:** Sex hormones dysfunctions bring about pathological changes in different organs of the body. Findings obtained from in vivo and in vitro studies point out those sex steroids hormones have a strong impact on oxidative stress. Sleeve gastrectomy has been used for the surgical treatment of morbid obesity. The aim of the present study was to determine the effects of dehydroepiandrosterone (DHEA) administration on metabolic homeostasis, oxidative stress parameters in male rats.

**Methods:** Sixty-four male Wistar albino rats were divided into control (n:12), and experimental (n:12), groups and underwent sleeve gastrectomy. Experimental group rats received a single dose of DHEA (100 mg/100 g) in the operation day. Rats were sacrificed on postoperative day 7. Serum DHEA hormones were analysed. The supernatants were used to measure total oxidant status, total antioxidant status, nitric oxide and malondialdehyde levels. All tissue parameters were analysed by spectrophotometric methods. Oxidative stress index values were calculated.

**Results:** DHEA stimulating hormone levels in both the control and DHEA group did not significantly change on the 7th postoperative day. Free DHEA levels were significantly higher in DHEA group rats than in control group rats (DHEA vs control). Although total oxidant status levels did not alter by thyroid hormone treatment, total antioxidant status levels significantly decreased. Oxidative stress index values were not statistically different in tissues. Tissue nitric oxide levels were also similar in both groups. Malondialdehyde levels increased in DHEA given rats compared with the control group.

**Conclusion:** This study showed that total oxidant status levels and oxidative stress index values were similar in both groups. However, DHEA supplementation induced lipid peroxidation by increasing tissue malondialdehyde levels that might deplete tissue antioxidant level.

## PE073 Basic &amp; translational diabetes research

**Hypolipidemic potential of ocosahexaenoic acid in high fat-diet/alloxan-induced diabetes in liver of male rats**

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B V Deemed University, India

**Objective:** Ocosahexaenoic acid (DHA) is widely employed for gastrointestinal complaints such as dyspepsia, flatulence, diarrhea, and vomiting. Studies report fish oil based lipid emulsions contain high amounts of omega-3 polyunsaturated fatty acids. Hence, we assessed changes produced by the administration of DHA on biomarkers related to lipid metabolism, hepatic functions and antioxidant systems in livers of high fat-diet diabetic rats.

**Methods:** The study was carried out on 84 diabetic male albino rats; a high-fat diet (HFD) and a single dose of alloxan (25 mg/kg) were utilized for experimental model induction. Diabetic rats were received DHA (50, 100 and 200 mg/kg) intragastrically by gavage per day for 30 days.

**Results:** Administration of DHA caused a remarkable recovery of liver weight, liver function, and aldosterone level, particularly. The hypolipidemic activity of DHA was confirmed by the normalization of total cholesterol, triglycerides, and low- and high-density lipoprotein cholesterol in diabetic rats. Inhibitory effects on albuminuria, creatinine, urea nitrogen, and n-acetyl- $\beta$ -d-glucosaminidase verified DHA's hepatic protective activity in diabetic rats. Furthermore, DHA exerted beneficial modulation of inflammatory factors and oxidative enzymes. Compared with untreated diabetic rats, DHA decreased the expression of phosphor-AKT and phosphor-GSK-3 $\beta$  in the livers. Proapoptotic, antiapoptotic and inflammatory markers were significantly improved and showing a great retain to their normal levels specifically in DHA (200 mg/kg)-treated groups.

**Conclusion:** DHA has a great protective influence on liver injury of HFD/alloxan-induced diabetic rats. These findings indicate that DHA can be considered as a potential candidate for in vivo and clinical studies against various metabolic disease.

## PE075 Basic &amp; translational diabetes research

**The implication of locally-delivered NECA-releasing microspheres on a murine myocardial infarction model**Shibo Wei<sup>1\*</sup>, Tiep Nguyen Tien<sup>1</sup>, Yunju Jo<sup>2</sup>, Yan Zhang<sup>1</sup>,Eun-Ju Jin<sup>2</sup>, Jee-Heon Jeong<sup>1</sup>, Dongryeol Ryu<sup>2</sup>Sungkyunkwan University, Korea<sup>1</sup>, GIST, Korea<sup>2</sup>

**Objective:** Diabetes is widely recognized as an independent risk factor for myocardial infarction (MI). A pivotal mechanism involves the instigation of endothelial dysfunction, propelled by chronic inflammation and oxidative stress, ultimately culminating in atherosclerosis. Notably, this pathological aberration impedes angiogenesis, a paramount strategy in MI treatment. These concerns resonate commonly across various metabolic syndromes, including dyslipidemia, hypertension, and obesity. Therefore, it is imperative to develop novel therapies fostering angiogenesis while concurrently mitigating inflammatory responses and oxidative stress, which holds great potential to ameliorate MI prognosis, conferring benefits to a spectrum of individuals afflicted by diverse metabolic disorders including but not limited to diabetes. In our study, we developed an injectable microsphere designed to deliver NECA, an adenosine derivative, locally to the infarcted myocardium, which effectively ameliorated cardiac injury post-MI through its angiogenic property and broader benefits.

**Methods:** The effects of NECA on reversing endothelial dysfunction were evaluated in HUVEC cells. NECA-releasing microspheres (NECA-MS) were developed and locally injected into the infarcted myocardium of MI mice modeling by left coronary artery ligation. The therapeutic effects were systematically assessed in vivo. Mechanisms studies were conducted based on protein structure and RNA sequencing analysis.

**Results:** NECA reversed endothelial dysfunction and protected cardiomyocytes under hypoxic condition. NECA-MS effectively preserved cardiac function post-MI by promoting angiogenesis while inhibiting inflammation and oxidative stress. Mechanistic studies revealed that the protective effects of NECA-MS were mediated via the phosphorylation of AMPK $\alpha$ .

**Conclusion:** NECA holds multiple benefits with local administration ameliorating cardiac function post-MI via AMPK $\alpha$  activation. These findings underscore the promising therapeutic prospects of NECA in maintaining metabolic homeostasis, serving as a potential approach in further metabolic syndromes treatment.

## PE076 Basic &amp; translational diabetes research

**Glucagon-like peptide receptor agonist inhibits angiotensin II-induced proliferation and migration in vascular smooth muscle cells and ameliorates phosphate-induced vascular smooth muscle cells calcification**

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**Objective:** Glucagon-like peptide-1 receptor agonist (GLP-1RA), which is a therapeutic agent for the treatment of type 2 diabetes mellitus, has a beneficial effect on the cardiovascular system.

**Methods:** To examine the protective effects of GLP-1RAs on proliferation and migration of vascular smooth muscle cells (VSMCs), A-10 cells exposed to angiotensin II (Ang II) were treated with either exendin-4, liraglutide, or dulaglutide. To examine the effects of GLP-1RAs on vascular calcification, cells exposed to high concentration of inorganic phosphate (Pi) were treated with exendin-4, liraglutide, or dulaglutide.

**Results:** Ang II increased proliferation and migration of VSMCs, gene expression levels of Ang II receptors AT1 and AT2, proliferation marker of proliferation Ki-67 (Mki-67), proliferating cell nuclear antigen (Pcna), and cyclin D1 (Ccmd1), and the protein expression levels of phospho-extracellular signal-regulated kinase (p-Erk), phospho-c-JUN N-terminal kinase (p-JNK), and phospho-phosphatidylinositol 3-kinase (p-Pi3k). Exendin-4, liraglutide, and dulaglutide significantly decreased the proliferation and migration of VSMCs, the gene expression levels of Pcna, and the protein expression levels of p-Erk and p-JNK in the Ang II-treated VSMCs. Erk inhibitor PD98059 and JNK inhibitor SP600125 decreased the protein expression levels of Pcna and Ccmd1 and proliferation of VSMCs. Inhibition of GLP-1R by siRNA reversed the reduction of the protein expression levels of p-Erk and p-JNK by exendin-4, liraglutide, and dulaglutide in the Ang II-treated VSMCs. Moreover, GLP-1 (9-36) amide also decreased the proliferation and migration of the Ang II-treated VSMCs. In addition, these GLP-1RAs decreased calcium deposition by inhibiting activating transcription factor 4 (Atf4) in Pi-treated VSMCs.

**Conclusion:** These data show that GLP-1RAs ameliorate aberrant proliferation and migration in VSMCs through both GLP-1R-dependent and independent pathways and inhibit Pi-induced vascular calcification.

## PE077 Basic &amp; translational diabetes research

**Effects of inhalation of ultrafine Particulate Matter (PM2.5) during aerobic exercise on high-fat diet-induced impaired glycemic and inflammatory responses**

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**Objective:** Fine particulate matter (PM) affects the cardiovascular, neurological, and endocrine systems, and the smallest particles (PM2.5) have a high rate of intravascular adhesion, contributing to several diseases. Type 2 diabetes is characterized by glucose intolerance due to impaired glucose-stimulated insulin secretion, which is characteristic of insulin resistance and beta-cell dysfunction in peripheral metabolic tissues and can be improved by diet and exercise. However, nothing is known about the effect of excessive inhalation of PM2.5 during exercise on the amelioration of diseases such as diabetes. Therefore, the present study investigated the effect of inhalation of PM2.5 during exercise on glucose tolerance and pro-inflammatory levels using a high-fat diet-induced diabetic mouse model.

**Methods:** The C56/BL6 mice were divided into four groups: control (Con, n=12), high-fat diet (HFD, n=12), high-fat diet + aerobic exercise (HAE, n=12), and HAE + inhalation of ultrafine particles during exercise (HAE\_PM, n=12). The aerobic exercise group (AE) performed treadmill exercise at 18 m/min, 50 min/day, and 5 days/week, and the concentration of ultrafine particles was set at 100ug/m<sup>3</sup>.

**Results:** The HFD group showed impaired glucose tolerance and elevated levels of pro-inflammatory cytokines in the liver and blood, which were significantly reduced in the HAE group (P<.05). In the HAE\_PM group, glucose tolerance level was similar to the HAE group, but blood pro-inflammatory cytokine levels were increased significantly (P<.05).

**Conclusion:** In conclusion, AE plays a role to improve glucose metabolism even in the presence of ultrafine particulate matter, but the inflammatory response in the circulatory system still remains high, indicating circulatory systems are vulnerable to PM2.5.

## PE078 Basic &amp; translational diabetes research

**Transcriptional variation in adipose tissue of morbidly obesity: comparing diabetic and non-diabetic women**

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Pusan National University, Korea<sup>1</sup>, University of Ulsan, Korea<sup>2</sup>, Keimyung University, School of Medicine, Korea<sup>3</sup>

**Objective:** As body weight increases, so does susceptibility to type 2 diabetes. However, a distinct cohort of individuals with severe obesity have normal metabolic function and heightened insulin sensitivity, and thus remain free of diabetes manifestations. The molecular mechanisms underlying this absence of clinical diabetes manifestations in abnormally obese individuals remain unclear. This study aims to elucidate differential transcriptional patterns within visceral adipose tissue (VAT) and subcutaneous adipose tissue (SAT) from both diabetic and non-diabetic obese women, using RNA-Seq data.

**Methods:** VAT and SAT biopsies were obtained from five obese women with diabetes (BMI: 43.66 kg/m<sup>2</sup>, range: 42.93-43.90; HbA1C: 5.3%, range: 5.1-5.4) and six obese women without diabetes (BMI: 43.42 kg/m<sup>2</sup>, range: 42.62-48.40; HbA1C: 10.95%, range: 9.7-11.50) during bariatric surgery procedures. To investigate differential gene expression, RNA was isolated from both VAT and SAT, and transcriptome profiling was conducted using RNA-Seq analysis.

**Results:** The transcriptome analysis revealed significant differences in adipose tissues between diabetes and non-diabetes women with morbid obesity. In diabetic women, both SAT and VAT showed upregulated differentially expressed genes (DEGs) associated with the INFLAMMATORY\_RESPONSE, TNFA\_SIGNALING\_VIA\_NFKB, and IL6\_JAK\_STAT3\_SIGNALING pathways. Conversely, in non-diabetic women, the upregulated genes were associated with OXIDATIVE\_PHOSPHORYLATION and ADIPOGENESIS activation. In VAT from diabetic women, there was upregulation of genes related to inflammatory bowel disease and gastric cancer, whereas in SAT the upregulated pathways included the NF-kB pathway and MAPK signaling. In VAT from normal women, upregulated DEGs were observed in metabolic pathway and thermogenesis, while the upregulated DEGs in SAT were associated with fatty acid metabolism.

**Conclusion:** Our study indicates an augmentation of inflammation-associated genes in obese women with diabetes, whereas metabolism-related genes, including oxidative phosphorylation and adipogenesis, exhibited upregulation in non-diabetic obese women. These findings underscore the significance of comprehending gene expression patterns linked to both inflammation and metabolism within adipocytes.

## PE079 Basic &amp; translational diabetes research

**Detection of RNA biomarkers and potential regulatory mechanisms and therapeutic focal points for type 1 diabetes through analysis of a competitive endogenous RNA regulatory network**

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**Objective:** Type 1 diabetes mellitus (T1D), an autoimmune disease with a genetic tendency, has an increasing prevalence. microRNAs (miRNAs), circular RNA (circRNA) and long non-coding RNA (lncRNA) are receiving increasing attention in disease pathogenesis. However, their roles in T1D are poorly understood. The present study aimed at identifying signature miRNA, circRNAs and lncRNAs, and investigating their roles in T1D using the competing endogenous RNA (ceRNA) network analysis. Growing evidence indicates that mRNA, miRNAs, circRNA and lncRNA have a key role in processes involved in T1D pathogenesis.

**Methods:** Expression profiles of GSE133217, GSE133225, GSE55100 deposited from peripheral blood mononuclear cells of T1D patients and healthy controls, were downloaded from the Gene Expression Omnibus to uncover differentially expressed lncRNAs, mRNAs, and miRNAs. The ceRNA regulatory network was constructed, then functional and pathway enrichment analysis was conducted. T1DM-related ceRNA regulatory network was established based on the Human microRNA Disease Database to carry out pathway enrichment analysis. Meanwhile, the T1D-related pathways were retrieved from the Comparative Toxicogenomics Database (CTD).

**Results:** We identified significantly differentially expressed mRNAs, miRNA, circRNA and lncRNAs. Here, we used different computational approaches such as differential expression analysis, protein network mapping, candidate protein biomarker identification, role of functional modules and molecular docking analysis. In results, we identified top ten up- and down-regulated genes which were further used to construct protein-protein interaction network (PPIN) and ceRNA regulatory network. In PPIN and ceRNA, we found candidate protein biomarkers commonly overlapped in network parameters (Degree, Closeness, Betweenness, Bottleneck and MNC) called as candidate protein biomarkers.

**Conclusion:** This study identifies potential T1D related blood biomarkers from large-scale gene expression data by computational miRNA, circRNA, lncRNAs-target gene interactome and transcription factor network construction method. Future *in-vitro* and *in-vivo* studies to validate our computational results may provide a better understanding for diagnosis, prognosis, and therapeutic intervention of T1D.

## PE080 Basic &amp; translational diabetes research

**Cystatin C: significance in cardiovascular disease among Indian diabetic patients**

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**Objective:** Cystatin C is a protease inhibitor proposed as a replacement for serum creatinine for the assessment of renal function, particularly to detect small reductions in glomerular filtration rate. Patients with kidney disease are far more likely to die from cardiovascular disease (CVD), than to develop kidney failure. In this study, we propose a novel model to predict serum cystatin C level to assess cardiovascular risks in patients with chronic kidney disease (CKD) through other parameters of CKD.

**Methods:** Blood samples from patients with CKD, CVD and both CKD with CVD, along with the normal healthy controls were collected. Lipid profile, urea, creatinine, hs-CRP, physiological parameters and cystatin C were analysed.

**Results:** Diabetics proportion were significantly higher among diseased persons as compared to control subjects (p=0.0001). Mean values of total cholesterol, triglyceride, VLDL, urea, creatinine and cystatin C among CKD group as well as in CVD group of patients were significantly higher (p<0.05) as compared to healthy controls. In CKD patients with CVD, the mean values of potassium, glucose, urea, creatinine, cystatin C and total leucocyte count were also significantly higher (p<0.05) as compared to healthy controls. A new formula was generated for calculating serum cystatin C level by extrapolating other parameters of CKD for risk assessment of CVD.

**Conclusion:** The study demonstrated a novel predictive model for assessment of serum cystatin C level which is an endogenous risk marker in the patients of CVD with CKD.

## PE082 Basic &amp; translational diabetes research

**Amelioration of beta-cell function, HOMA-1R, HOMA-beta and antioxidant properties from dipeptidyl peptidase-IV(CD26) inhibitors from isoflavones rich fraction of soybean (glycine max) for type 2 diabetic mellitus: in-vivo & in-silico**

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**Objective:** The novel approach for treatment of type 2 diabetic mellitus (T2DM) is based on incretin hormone, glucagon-like-peptide 1 (GLP-1 & GIP) and Dipeptidyl peptidase-IV (DPP-IV) inhibitors. DPP-IV Inhibitors from isoflavones rich fraction of Soybean (SB) might have pleiotropic effect because of incretin hormones as present on various tissues, including liver and pancreas. We examined whether DPP-IV inhibitors with antioxidant capacity affects  $\beta$ -cell function, insulin resistance, in T2DM rat's model

**Methods:** T2DM model was induced in wistar rats with high fructose along with corn syrup. Biochemical, toxicology and histological variables were evaluated between all groups. Apart from serum DPP-IV inhibition, GLP-1, Glucose, Insulin, glycosylated hemoglobin, HOMA-IR, HOMA- $\beta$ , Kidney & Liver lipid peroxidation, SGOT, SGPT and endogenous antioxidant in tissue were measured with serum lipid profiles to correlate with antiperoxidative effects of isoflavones rich fraction of Soybean. Histology of pancreatic cells and In-silico DPP-IV inhibition activity have been done

**Results:** Diabetes induction by corn syrup and high sucrose diet confirmed by HOMA-IR=2.7 %, HOMA  $\beta$  %=35.6 % and HOMA sensitivity=45.6 %. Consequently, *In-vivo* assay of isoflavones rich fraction of Soybean has showed 59.5 $\pm$ 1.2% of DPP-IV inhibition activity in serum. It also reduced level of aminotransferases i.e. SGOT, SGPT and alkaline phosphatase with increasing level of insulin and decreasing HbA1c. Triglyceride and cholesterol level were also significantly decreased as compared to diabetic control. Soybean extract has shown a better antioxidant capacity to protect lipid peroxidation and histoarchitectural of pancreas  $\beta$ -Cell also relevant good result after treatment of DPP-IV inhibitors. *In-silico* activity of daidzein (Isoflavones) also showed DPP-IV inhibitor activity with strong binding affinity that revealed our studied

**Conclusion:** DPP-IV inhibitors along with antioxidant properties from isoflavones rich fraction of Soybean improve insulin sensitivity,  $\beta$ -Cell function, HOMA- $\beta$ , reduce oxidative stress, and less toxicity which lead to improve the T2DM condition.

## PE086 Basic &amp; translational diabetes research

**The changes of serum glucagon like-peptide 1 level in type 2 diabetic patients**Enkhchimeg Tserendorj\*, Badral Ganbaatar<sup>1</sup>

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**Objective:** Glucagon like peptide-1 (GLP-1), an incretin hormone, produced from intestinal L cells and regulates glucose metabolism by inducing beta cell mass, insulin secretion and suppressing glucagon secretion. However, plasma GLP-1 level correlated to blood glucose and insulin and to prove that low GLP-1 levels was a risk factor T2DM in the Mongolian population. The aim of the study is to assess the level of fasting and post-prandial GLP-1 levels to appear blood insulin and glucose levels in serum and their pathophysiological role for type 2 diabetes mellitus.

**Methods:** Glucagon like peptide-1 (GLP-1), an incretin hormone, produced from intestinal L cells and regulates glucose metabolism by inducing beta cell mass, insulin secretion and suppressing glucagon secretion. However, plasma GLP-1 level correlated to blood glucose and insulin and to prove that low GLP-1 levels was a risk factor T2DM in the Mongolian population. The aim of the study is to assess the level of fasting and post-prandial GLP-1 levels to appear blood insulin and glucose levels in serum and their pathophysiological role for type 2 diabetes mellitus.

**Results:** The post-prandial active GLP-1 levels were significantly decreased at 60-120 minutes in T2DM compare with control subjects. Post-prandial blood glucose level was potently higher and the 1st phase at glucose-induced insulin release significantly decreased in T2DM. Moreover fasting insulin significantly higher in T2DM groups.

**Conclusion:** The lower level of postprandial active GLP-1 potently correlated to impairment at glucose-induced insulin release and hyperglycemia in T2DM. This result indicate that impairment at postprandial GLP-1 secretion may have pathophysiological role to develop T2DM.

## PE088 Basic &amp; translational diabetes research

**The therapeutic potential of a phytochemical drug in the treatment of type 2 diabetes**

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**Objective:** The global incidence of type 2 diabetes mellitus (T2DM) has risen significantly over the past few decades as a consequence of population aging, obesity, and a modern lifestyle that is sedentary. Diabetes is substantially more likely to occur in people who are obese. Recent studies have shown that several flavonoids in particular have a regulatory inhibitory effect on adipogenesis, obesity, and diabetes. Computer-aided drug discovery is identifying and validating the chemical activities of bioactive flavonoids. Flavonoids extracted from several *Citrus* fruit, allium nigrum, and *Azadirachta indica* plants have demonstrated positive therapeutic potentials for regulating lipid metabolisms. We also explore the possible anti-diabetic flavonoid.

**Methods:** We assessed 30 randomly selected reviews in more detail. As a result, we have compiled in vitro and in vivo research done in the last ten years. We anticipate that this review and several others will serve as a theoretical foundation for comprehending didymin and Naringenin as well as an inspiration for future product development by In silico study.

**Results:** Didymin and Naringenin are *Citrus* fruit-derived flavonoids. Didymin and Naringenin have bioactive potential because seaweed biodiversity is diverse and largely unexplored. The study (based on the systematic analysis of various papers) indicated that Didymin and Naringenin with high concentrations have maximum efficacy as an anti-diabetic and antiadipogenic agent. Dynamin promotes glucose uptake through the activation of the PI3K/Akt signalling pathway in insulin-resistant HepG2 cells, and Naringenin is also able to increase the gene expression of Ins1 and Ins2, glucose transporter (GLUT2), and glucokinase (GCK), while also increasing  $\beta$ -oxidation and lipolysis through increased mRNA expression of PPAR $\alpha$  (peroxisome proliferator receptor  $\alpha$ ).

**Conclusion:** In comparison to the synthetic chemotherapeutic medications now used as antidiabetic and anti-obesity treatments, Didymin and Naringenin are *Citrus* fruit-derived bioproduct thought to be less toxic and has fewer adverse effects.

## PE089 Basic &amp; translational diabetes research

**CREBH-C hepatokine promotes triglyceride clearance and uptake by boosting lipoprotein lipase activity**Hyunbae Kim<sup>1\*</sup>, Zhenfeng Song<sup>1</sup>, Ren Zhang<sup>1</sup>,Brandon Davies<sup>2</sup>, Kezhong Zhang<sup>1</sup>Wayne State University, United States<sup>1</sup>, University of Iowa, United States<sup>2</sup>

**Objective:** The endoplasmic reticulum (ER)-resident stress sensor CREBH is required to maintain energy homeostasis under stress conditions associated with the development of hyperlipidemia, non-alcoholic fatty liver disease (NAFLD), and atherosclerosis.

**Methods:** It is known that CREBH is processed, in response to energy demands, to release a N-terminal fragment that functions as a transcription factor to activate expression of hepatic genes encoding functions involved in lipid and glucose metabolism.

**Results:** In this study, we discovered that the C-terminus of CREBH (CREBH-C), produced through Regulated Intramembrane Proteolysis (RIP), is secreted into the extracellular space as a hepatokine upon energy fluctuations. Secreted CREBH-C interacts with angiopoietin-like (ANGPTL) 3 and ANGPTL8, blocks formation of ANGPTL3-ANGPTL8 complexes, and thus prevents the inhibitory interactions between ANGPTL3/8 and lipoprotein lipase (LPL). CREBH-C boosts plasma and tissue residential LPL activities in mice upon energy demands or when CREBH-C is over-expressed. Introduction of CREBH-C promotes plasma triglyceride lipolysis and uptake into peripheral tissues, including skeletal muscle, heart, kidney, pancreas, and adipose tissues. Administration of CREBH-C can mitigate hypertriglyceridemia and hepatic steatosis in CREBH knockout mice under a high-fat diet.

**Conclusion:** In summary, our studies revealed a new paradigm that a stress-induced protein fragment, derived from the ER membrane protein CREBH, can be secreted and function as a potent hepatokine to regulate LPL activity and triglyceride metabolism.

## PE091 Basic &amp; translational diabetes research

**Single-nucleus RNA-seq reveals common and unique variations of neurons expressing hormonal receptors in the area postrema across rodents and non-human primates**

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**Objective:** Area postrema (AP) of hindbrain neurons expressing GLP-1R, GIPR, and GFRAL regulate systemic energy metabolism. However, the characteristics of neurons expressing GLP-1R, GIPR, and GFRAL are not fully understood on the single-cell level. In this study, we investigated the expression patterns of GLP-1R, GIPR, and GFRAL in the neurons of the AP in rodents and the non-human primate, *Macaca fascicularis*, to expand our understanding of their expected functions across species.

**Methods:** APs were surgically removed from two *Macaca fascicularis* subjects and were prepared for snRNA-seq. The mouse and rat data were sourced from GSE160938, and GSE167981, GSE16799 respectively. Approximately 2589 nuclei were isolated from *Macaca fascicularis* samples, sorted, and systematically analyzed to identify the expression of specific markers and receptors.

**Results:** Among the isolated nuclei from *Macaca fascicularis*, 1.58% were identified as microglia, 6.91% as oligodendrocytes, 18.62% as astrocytes, with the remainder being neuronal nuclei. Excitatory neurons made up 62.19% and were identified by the expression of *SLC17A6*, while inhibitory neurons accounted for 45.24% and were recognized by the expression of *GAD2*. In the mouse dataset, *Gfral* was detected in nuclei expressing *Slc17a6*, and the rat data aligned with the mouse findings. The *GFRAL* gene was present in 14.92% of neurons in *Macaca fascicularis*, predominantly within excitatory neurons, but also in inhibitory neurons—a pattern unique to this species. In rodent datasets, *Glpr-1r* was detected in nuclei expressing *Slc17a6*. A notable difference in *GLP-1R* expression can be observed when comparing *Macaca fascicularis* to other species; in *Macaca fascicularis*, *GLP-1R* is scarcely detected in the total nuclei, highlighting a significant inter-species variance in *GLP-1R* expression. *Macaca fascicularis* showed *GIPR* expression in inhibitory neurons (8.63%), aligning with murine findings.

**Conclusion:** This study identifies distinct expression patterns of *GLP-1R*, *GIPR*, and *GFRAL* in the AP across species, illustrating the complexity of *Macaca fascicularis*.

## PE092 Clinical diabetes and therapeutics

**Risk of type 2 diabetes mellitus in COPD and COPD with T2DM and its association with adipokines and gene polymorphism**

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**Objective:** To check the risk of type 2 dm in COPD patients. To evaluate the serum biomarkers of adiponectin; Leptin and IL-8 gene for patients with COPD & COPD with Type 2 DM. In addition, we analyzed the effect of polymorphism on the concentration of these cytokines

**Methods:** A total of 500 subjects including 250 controls, 191 COPD and 59 COPD with T2DM each, aged 30 to 70 years were enrolled for the study after meeting the inclusion criteria. Written informed consent was obtained from each subject before inclusion in the study. The study was approved by the institutional ethics committee (ethical no 90 TH ECM IIB-FS/P2).

**Results:** Results shows that Adiponectin (ng/ml), Leptin (ng/ml) and IL-8 (pg/ml) serum levels (ng/mL) were significantly ( $P < 0.001$ ) highest in COPD with T2DM patients when compared with COPD and healthy control subjects. Genotyping of *Leptin* (C/T), *Adiponectin* (C/G) and *IL-8* (C/T) polymorphisms were performed in all 250 healthy controls, 191 COPD and 59 COPD with T2DM subjects. It was observed that in *Leptin* genotype 'CT' and 'TT' were significantly associated with COPD with high odds ratio (3.728, 4.579 respectively). Interestingly genotype 'TT' was also associated with COPD+T2DM and increases the risk of developing T2DM in COPD patients by 2.4 folds. *Adiponectin* (C/G) polymorphism was not associated with COPD but it was showing significant association with COPD+ T2DM and increases the risk of developing T2DM in COPD patients by 2.6 folds. *IL-8* (C/T) polymorphism was significantly associated with COPD, genotype 'TT' was seen to increase the risk by 5.1 folds. *IL-8* (C/T) was not found to be associated with the COPD+T2DM.

**Conclusion:** We also conclude that genotype 'TT' of Leptin, 'GG' of Adiponectin and 'TT' of IL-8 may be exploited as biomarker for prognosis and diagnosis of T2DM in COPD and COPD respectively. While 'CT' of IL-8 was protective biomarker against COPD.

## PE093 Clinical diabetes and therapeutics

**Insulin pump therapy in type 2 diabetes with empagliflozin improved glucose control**

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Konkuk University Medical School, Korea

**Objective:** Empagliflozin, a selective inhibitor of sodium-glucose cotransporter 2 (SGLT2), has been shown to improve glycaemic control, insulin resistance and insulin-associated weight gain in type 2 diabetes mellitus (T2DM) patients. Here the efficacy of insulin pump treatment with empagliflozin therapy is evaluated in this population.

**Methods:** This was a single-center retrospective observational study. A total of 118 patient, whose T2DM was controlled by insulin pump, was assigned to receive 10mg/day of empagliflozin. The primary end point was change from baseline in HbA1c after insulin pump treatment and empagliflozin therapy, respectively. Secondary end points were changes from baseline in insulin dose, BMI, creatinine and c-peptidogenic index after insulin pump treatment and empagliflozin therapy, respectively.

**Results:** Data from 118 patients were analyzed. For the population, mean±SD of T2DM duration was 12.6±8.1 years, mean±SD of insulin pump treatment duration was 3.7±3.2 years and mean±SD of empagliflozin therapy duration was 4.9±1.4 months. Mean±SD of HbA1c was changed from 9.3±2.1% at initial visit to 7.7±1.3% after insulin pump treatment ( $p < 0.001$ ) and 7.0±1.0% after empagliflozin therapy added to insulin pump treatment ( $p < 0.001$ ). Furthermore, the c-peptidogenic index was increased ( $p < 0.001$ ) and insulin dose was decreased ( $p < 0.001$ ) after empagliflozin therapy added to insulin pump treatment. The BMI and creatinine were stable during insulin pump treatment and empagliflozin therapy.

**Conclusion:** Empagliflozin added to insulin pump treatment improved glycaemic control, c-peptidogenic index and insulin dosing in T2DM patients. Also, this therapy stabilized BMI and creatinine.

## PE094 Clinical diabetes and therapeutics

**The effect of consuming sago to cholesterol levels and waist circumference as incidence of prediabetes; a case study in Kepulauan Meranti Regency, Riau province**

Syartiwidya Syariful\*

National Research and Innovation Agency, Indonesia

**Objective:** The objective of this research was to analyze cholesterol level and waist circumference as incidence of prediabetes in Kepulauan Meranti District Riau Province.

**Methods:** The study design was cross sectional study through interviews and filling out FFQ and food recall questionnaires, also measured of body mass index, cholesterol level and waist circumference from 181 subjects with inclusion criteria are sago consumption, aged 35-80 years, and not diagnosed with diabetes.

**Results:** Consumption of sago in subjects with a frequency of 3-6 times/week of 173.7±88.3 g/day indicates normal nutritional status is maintained. The results show that there was a significant correlation between sago consumption and cholesterol and waist circumference ( $p$ -value=0026,  $r=16.5$  and  $p$ -value=0.019,  $r=17.5$ ). The function of fiber in lowering cholesterol levels in the body is by binding to cholesterol in the small intestine before cholesterol is reabsorbed at the border of the small intestine-large intestine, binding bile acids and increasing their excretion in the feces, so that the binding of cholesterol will result in being excreted in the feces or in other words breaking the cycle of circulation of cholesterol.

**Conclusion:** Sago has a fairly high fiber content, namely 3.13 g/100 g of sago where fiber has an important role in lowering cholesterol levels and keep the normal waist circumference

## PE095 Clinical diabetes and therapeutics

**Efficacy and safety of pioglitazone add-on in patients with type 2 diabetes mellitus inadequately controlled with metformin and dapagliflozin: a multicenter, randomized, double-blind, and placebo-controlled study**Yun Kyung Cho<sup>1,2\*</sup>, Kyung-Soo Kim<sup>3</sup>, Byung-Wan Lee<sup>4</sup>,Jun Hwa Hong<sup>5</sup>, Jae Myung Yu<sup>6</sup>, Soo Lim<sup>7</sup>, Ye An Kim<sup>8</sup>, Chang Beom Lee<sup>9</sup>,Sang Soo Kim<sup>10</sup>, Soo Heon Kwak<sup>11</sup>, Woo Je Lee<sup>1,2</sup>

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**Objective:** To investigate the effectiveness and safety of pioglitazone over placebo inpatients with type 2 diabetes (T2D) inadequately controlled by metformin and dapagliflozin.

**Methods:** This trial was a prospective, multicentre, randomized, double-blind, placebo-controlled study. A total of 366 patients with T2D who failed to achieve the glycaemic target ( $7.0\% \leq \text{HbA1c} \leq 10.5\%$ ) with metformin and dapagliflozin were assigned randomly 1:1:1 into treatment with placebo (PBO), pioglitazone 15 mg QD (PIO15), or pioglitazone 30 mg QD (PIO30). The primary endpoint was mean change in HbA1c level from baseline in each group at 24 weeks.

**Results:** For a total of 366 patients (n=124 for the placebo group, and n=118 for the PIO15 group, and n=124 for the PIO30 group), the mean age and duration of diabetes were 55.6 and 8.7 years, respectively, and HbA1c was 7.9% at baseline. At 24 weeks, the PIO15 group and the PIO30 group both achieved a significant reduction in HbA1c from baseline ( $-0.35\% \pm 0.87\%$ ,  $P < .001$  and  $-0.81\% \pm 0.79\%$ ,  $P < .001$ , respectively), with an intergroup difference of  $-0.75\%$  and  $-0.35\%$  compared with the PBO group ( $P < .001$  for both comparison). HbA1c response rate ( $< 7\%$ ) at week 24 was significantly higher in the PIO15 group and the PIO30 group than in the PBO group (12.9%, 31.4% and 52.4%, respectively). There was no significant difference among the groups in the rate of adverse events (PBO group, n=4 [3.2%]; PIO15 group, n=11 [9.0%]; PIO30 group, n=13 [10.2%];  $p=0.07$ ), and the safety profiles were favorable in three groups.

**Conclusion:** The present study shows that pioglitazone could be a valid option as a third oral antidiabetic drug for the treatment of patients with T2D inadequately controlled with metformin and dapagliflozin.

## PE096 Clinical diabetes and therapeutics

**A longitudinal study of the effect of time restricted meal intake on anthropometric, glycemic markers and lipid parameters in patients of type 2 diabetes mellitus: a chronobiological concept**

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King George's Medical University, India

**Objective:** To study the effect of TRM on anthropometric, biochemical and lipid profile parameters in patients of Type 2 diabetes mellitus

**Methods:** 270 diabetics enrolled from OPD, Endocrinology, KGMU were randomly divided based on whether they have consented (TRM (time restricted meal), case group) or not (control group). Baseline parameters were recorded and follow up was done at 6, 12 and 18 months for anthropometric measurement, height, weight, waist hip ratio, aBSI, neck size, blood sugar (Fasting and post prandial), HbA1C and lipid profile. A single intervention was done that the timing of dinner was at or around 7 in the evening for the TRM group.

**Results:** In the TRM group mean age was 47.17 in the control group 46.97 TRM group Mean height=1.58 control group Mean=1.59 TRM group mean weight=67.2 kgs control group Mean weight=73.8 BMI TRM group mean=27.84 control group mean=28.82 Neck size (in centimetres) TRM group 36.56 mean control group=40.59 Waist size (in centimetres) TRM group=91.70 mean control group=91.85 Hip Size (in centimetres) TRM group=101.32 mean control group=107 HbA1c TRM group=7.89 mean control group=8.23 Total Cholesterol TRM group=163.32 mean control group=183.2 Triglycerides TRM group=106.07 mean control group=152.6 LDL C TRM group=62.1 mean control group=93.49 HDL C TRM group=53.64 mean control group=50.93 VLDL C TRM group=25.98 mean control group=31.08 This is the final result after one and a half year of follow up.

**Conclusion:** Our study is the first of its kind which has been conducted in Indian population

## PE098 Clinical diabetes and therapeutics

**Histopathological manifestations of diabetic dermopathy: a single center study at Kathmandu University Hospital**

Binod Dhakal\*

Kathmandu University Hospital, Nepal

**Objective:** 1. To examine histopathological manifestations of diabetic dermopathy 2. Compare the changes with that of normal histology. 3. Assess the pitfalls in diagnosing the case.

**Methods:** The study was conducted at Kathmandu University Hospital. The lesions of Diabetic dermopathy (DD) were identified in patients of OPD and some biopsy samples were taken from autopsy cases. The diabetic status of patients were examined based on their medical history. The histopathological sections of pretibial lesions were collected and processed. These histopathological sections were examined for features of chronic inflammation, vessel wall thickening and other features.

**Results:** All cases show sparse populations of lymphocytic infiltrates in the dermis. Only 5 out of 16 (31.2%) skin biopsies showed moderate to severe thickening of the blood vessel walls. Epidermal atrophy is seen in 4 out of 16 (25%) cases. Additionally, convincing evidence of plasma cell infiltration in all cases is not seen. Significant hyalinization of the vessel walls is also not present.

**Conclusion:** The histological findings during the early stages of DD are nonspecific. In our study, we did not observe notable vascular changes. Studies on DD have been limited due to the rarity of biopsies for this condition. Proper correlation with clinical findings is necessary. However the study can be used to determine the association with retinopathy, neuropathy, and nephropathy.

## PE099 Clinical diabetes and therapeutics

**Assessing the interplay between risky sexual behaviors and incident type 2 diabetes mellitus among HIV-infected adults in Jakarta Metro City, Indonesia: a cross-sectional study**

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International University Semen Indonesia, Indonesia

**Objective:** Risky sexual behaviors and type 2 diabetes mellitus (DM) pose significant health challenges for HIV-infected adults. However, the relationship between these factors and the underlying mechanisms remains poorly understood, especially in Jakarta Metro City, Indonesia. This cross-sectional study aims to investigate the complex interplay between risky sexual behaviors and incident type 2 DM among HIV-infected adults, shedding light on novel risk factors and potential pathways.

**Methods:** A diverse sample of 300 HIV-infected adults was recruited from selected clinics and health centers in Jakarta, Indonesia. Comprehensive interviews, medical record reviews, and small-scale qualitative interviews were conducted to collect demographic information, medical history, and laboratory measurements. Established diagnostic criteria were used to identify incident type 2 DM. A Multivariate logistic regression analysis was performed to determine novel risk factors associated with the co-occurrence of risky sexual behaviors and type 2 DM while controlling for confounding variables.

**Results:** The prevalence of incident type 2 DM among HIV-infected adults in Jakarta Metro City was found to be 9% (95% CI 4.5% to 10.5%). Notably, individuals receiving pre-antiretroviral treatment (preART) exhibited a significantly higher prevalence of DM (13.3%; 95% CI 8.0% to 18.4%) compared to those on antiretroviral therapy (ART) (5.2%; 95% CI 2.7% to 7.7%). The small-scale qualitative interviews provided nuanced insights into the experiences, perceptions, and behaviors related to risky sexual practices and their potential impact on DM incidence.

**Conclusion:** The study observed a higher prevalence of type 2 diabetes among HIV-infected individuals receiving preART in Jakarta. Early detection and intervention for diabetes are critical in this population. The study also identified specific sexual behaviors that may have metabolic effects, highlighting the need for comprehensive risk assessment in HIV care. The findings emphasize the importance of implementing tailored strategies that integrate sexual health promotion and diabetes prevention for HIV-infected adults in Jakarta.

**PE100 Clinical diabetes and therapeutics**

**A new discovery on the role of PAK4 in lipid metabolism**

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Jeonbuk National University, Korea

**Objective:** PAK4 is known as a downstream effector of PKA, but its function in adipocytes has been elusive until now. This research aims to explore the role of PAK4 in adipocytes, particularly in the context of catabolism, focusing on lipolysis.

**Methods:** To investigate PAK4's potential impact on adipocyte lipolysis, we employed adipocyte-specific *Pak4* KO mice and their littermate controls, subjecting them to a 24-hour fasting period. PAK4's catalytic activity was manipulated through both genetic engineering and pharmacological inhibition. The analysis of free fatty acids in the blood was carried out to assess the effects of PAK4 on adipocyte lipolysis.

**Results:** We observed higher expression levels of PAK4 in the adipose tissues of obese mice and humans, which significantly decreased after fasting. The genetic ablation or pharmacological inhibition of PAK4 led to accelerated lipolysis, effectively preventing obesity and insulin resistance. The underlying mechanisms involved PAK4's negative phosphorylation of hormone-sensitive lipase (HSL) inhibits its hydrolytic activity. Additionally, PAK4 phosphorylated fatty acid binding protein 4 (FABP4), which hindered its binding to HSL, further decreasing HSL's lipolytic activity. Notably, higher levels of PAK4 and phosphorylated FABP4 were observed in the visceral fat of obese individuals compared to lean individuals.

**Conclusion:** This study provides compelling evidence that PAK4 acts as an intracellular regulator, slowing down adipocyte lipolysis when released by PKA activation. Consequently, targeting PAK4 through inhibition presents a promising therapeutic approach for combating obesity.

**PE101 Clinical diabetes and therapeutics**

**A meta-analysis of randomized clinical trials on the effect of metformin vs. pioglitazone monotherapy on plasma adiponectin levels**

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Angeles University Foundation, Philippines<sup>1</sup>, University of Santo Tomas, Philippines<sup>2</sup>

**Objective:** Metformin and pioglitazone are two drugs with insulin-sensitizing properties used to manage type 2 diabetes mellitus. These drugs affect adiponectin, an endocrine hormone that functions in insulin sensitization. However, studies comparing the effects of pioglitazone and metformin on plasma adiponectin levels are limited.

**Methods:** We conducted a meta-analysis to compare the effects of pioglitazone and metformin on plasma adiponectin levels in patients with diabetes mellitus. A systematic search was conducted, and five studies were included based on our inclusion criteria. Relevant data were extracted and tabulated, and meta-analysis was performed using Meta-Essentials and ReviewManager 5.4.1 to compute for mean and standardized mean differences.

**Results:** Pooled pre- and post-intervention results showed that plasma adiponectin levels were significantly higher in the pioglitazone treatment arm after the intervention than in the metformin group. Furthermore, our analysis showed that HOMA-IR was significantly lower in the pioglitazone treatment group than in the metformin treatment group, but no significant differences were observed in HbA1c levels. We also found that the metformin group had significantly lower BMI after treatment than those who received pioglitazone.

**Conclusion:** Our study suggests that pioglitazone treatment is associated with increased plasma adiponectin levels and lower HOMA-IR levels than metformin treatment. However, the metformin group had a significant decrease in BMI after treatment. Further studies are needed to verify these results, especially in the applicability of these findings in the Filipino population.

**PE104 Clinical diabetes and therapeutics**

**Impact of gut microbiota diversity on glucose regulation and psychological health in type 2 diabetes patients: a prospective interventional study**

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**Objective:** The gut microbiota has emerged as a potential contributor to metabolic health and psychological well-being. This prospective interventional study aims to explore the effects of a dietary intervention aimed at improving gut microbiota diversity on glucose regulation and psychological health in individuals with type 2 diabetes. The study also aims to identify potential links between gut microbiota changes, glycemic control, and psychological outcomes.

**Methods:** In a 12-week dietary intervention, 65 adults with type 2 diabetes followed a fiber-rich diet with prebiotic and probiotic foods. Fecal samples were collected at baseline, midpoint (6 weeks), and endpoint (12 weeks) for gut microbiota analysis through metagenomic sequencing. Glycemic control was monitored with regular blood glucose and HbA1c measurements. Psychological health was assessed with validated questionnaires, including the Diabetes Distress Scale (DDS) and Beck Depression Inventory (BDI).

**Results:** The dietary intervention significantly increased gut microbiota diversity at midpoint ( $p < 0.01$ ) and endpoint ( $p < 0.001$ ) compared to baseline. Enhanced gut microbiota diversity led to substantial reductions in HbA1c levels ( $p < 0.05$ ) and postprandial glucose excursions ( $p < 0.01$ ) compared to minimal changes. Moreover, increased gut microbiota diversity was associated with reduced diabetes-related distress (DDS score:  $15.2 \pm 2.6$  to  $8.7 \pm 1.9$ ,  $p < 0.001$ ) and decreased depressive symptoms (BDI score:  $21.8 \pm 4.3$  to  $14.5 \pm 3.1$ ,  $p < 0.01$ ). Positive correlations were found between specific beneficial gut bacteria, like *Akkermansia muciniphila*, and improvements in glycemic control and psychological health ( $p < 0.01$ ).

**Conclusion:** This study shows that dietary intervention can enhance gut microbiota diversity in type 2 diabetes patients, resulting in improved glucose regulation and psychological well-being. It suggests that targeting the gut microbiota through dietary strategies offers a promising approach to supporting diabetes management and promoting mental health in individuals with type 2 diabetes.

**PE105 Clinical diabetes and therapeutics**

**Clinical evaluation of fenugreek seed extract in patients with type-2 diabetes**

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**Objective:** The present study was planned to evaluate the effect of fenugreek seed extract on fasting & post-prandial blood glucose levels along with its effect on serum C-peptide levels & HbA1c levels.

**Methods:** The study design was an add-on therapy which means, fenugreek seed extract /Placebo was given in addition to the antidiabetic therapy to the patient at the time of screening in respective groups. Fenugreek seed extract administered orally in 154 patients of type-2 diabetes mellitus. One group of patients received fenugreek seed extract and the other group received Placebo. The patients were evaluated for efficacy and safety after the treatment at pre-defined interval of 4 weeks.

**Results:** fenugreek seed extract caused significant change in blood sugar levels as compared to Placebo group. The decrease in sugar levels in Placebo group was due to concomitant anti-diabetic therapy. A significant decrease in HbA1c levels was observed as compared to respective baseline value. fenugreek seed extract caused significant reduction in fasting plasma sugar levels, reduction PP plasma sugar levels. fenugreek seed extract-treated group also showed reduction in concomitant anti-diabetic therapy. It was also found to be safe in patients with type-2 diabetes.

**Conclusion:** fenugreek seed extract when given as "an add on" to concurrent therapy of type-2 diabetes, was synergistic and effective in better management of type-2 diabetic patients, as compared to Placebo group, in which patients were on their routine allopathic diabetic medicine. fenugreek seed extract was safe in treating patients with type-2 diabetes mellitus.

## PE106 Clinical diabetes and therapeutics

**Association of glutathione S-transferases (GSTT1 and GSTM1) genes polymorphism and its expression with the risk of Gestational Diabetes Mellitus (GDM) in North Indian women population**

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 King George's Medical University, India<sup>3</sup>

**Objective:** This case-control study was conducted to investigate the effect of *GSTM1*, *GSTT1* polymorphism and gene expression on GDM susceptibility.

**Methods:** The study included total 300 pregnant women, (150 GDM women as case and 150 healthy pregnant women). The *GSTM1* and *GSTT1* gene polymorphisms and expression was analysed by conventional polymerase chain reaction and their expression was analysed by quantitative PCR followed by statistical analysis using Prism5 software (version 5.01).

**Results:** There were statistically significant differences among the cases and controls group in terms of age ( $P<0.0005$ ), BMI ( $P<0.0001$ ), gestational age ( $P<0.0463$ ), family history of diabetes ( $P<0.0001$ ), TG ( $P<0.0001$ ), HDL ( $P<0.0003$ ) and LDL ( $P<0.0027$ ). However, no significant variations found in TC level ( $P<0.0873$ ). The distribution of *GSTM1*-null genotype was found to be significantly higher in GDM patients ( $P<0.0001$ ) [adjusted OR (95%CI)=3.363 (2.078-5.440)] than the control group. No significant difference was found between *GSTT1* polymorphism (Null and present) in the case and controls groups ( $P<0.9065$ ) [adjusted OR (95%CI)=1.057 (0.666-1.676)]. The gene expression of both *GSTM1* ( $P<0.0001$ ) and *GSTT1* ( $P<0.0001$ ) were found significantly down-regulated in GDM patients as compared to healthy individuals. The null genotype of both *GSTM1* and *GSTT1* genes are significantly ( $P<0.0001$  and  $P<0.0001$ ) associated with the downregulation of genomic expression of respective genes.

**Conclusion:** Null genotype of *GSTM1* and their expression showed significant association with GDM. Therefore, this gene variants can be utilised as biomarker for GDM prognostic. However, this gene variants needs to study in large sample size.

## PE108 Clinical diabetes and therapeutics

**Comparison of glimepiride vs voglibose as add on to metformin in diabetes: a randomized open label controlled trial**

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**Objective:** Primary objective was to compare the difference in the reduction of HbA1c, Fasting plasma glucose (FPG) & post-prandial plasma glucose (PPG) after 4 weeks of treatment.

**Methods:** This was a 4-week, prospective, open-labelled, parallel-group, randomised, controlled study. Type-2 DM patients of 18 to 60 years of age uncontrolled on metformin 500mg B.D. or newly diagnosed with HbA1c>7% or RBS>200mg/dl were included in the study. Patients were randomly allocated to 2groups (1:1) and given either tablet metformin+voglibose or tablet metformin + tablet glimepiride. Primary endpoints measured were Glycated haemoglobin (HbA1c), fasting plasma glucose (FPG), postprandial plasma glucose (PPG) and the secondary endpoints were Homeostatic model assessment (HOMA) of insulin resistance, beta cell function and insulin sensitivity.

**Results:** 73 patients were randomized into voglibose (n=37) and glimepiride (n=36) groups. In the voglibose group mean HbA1c (%) reduction was from  $8.80 \pm 1.46$  to  $8.26 \pm 1.31$ , which was significant ( $p<0.001$ ). FPG (mg/dl) change was from  $189.08 \pm 67.34$  to  $132.68 \pm 29.49$ , and PPG (mg/dl) change was from  $297.56 \pm 76.38$  to  $188.51 \pm 66.68$ . FPG and PPG reduction were significant at the end of 4 weeks ( $p<0.001$ ). In the glimepiride group, HbA1c change was from  $8.82 \pm 1.51$  to  $8.07 \pm 1.69$ , which was significant ( $p<0.001$ ). FPG change was from  $179.8 \pm 47.91$  to  $121.50 \pm 32.27$ , and PPG change was from  $280.33 \pm 80.38$  to  $161.14 \pm 66.82$  with significant p-value ( $p<0.001$ ). Intergroup comparison of the difference in reduction of FPG, PPG, and HbA1c showed no significant difference between the groups. There was significant improvement in HOMA parameters, and the intergroup difference was not statistically significant.

**Conclusion:** The voglibose and glimepiride groups did not significantly differ in their ability to improve glycemic parameters. Further studies with large sample sizes and long study duration might provide more concise information.

## PE109 Clinical diabetes and therapeutics

**Therapeutic effects of switching to anagliptin from other DPP-4 inhibitors in T2DM patients with inadequate glycemic control: sub-group analysis of multicenter observational study (SSUG study)**

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**Objective:** We previously reported a significant decrease in HbA1c levels after switching from other DPP-4 inhibitors to anagliptin in patients with Type 2 Diabetes Mellitus (T2DM), especially in those without comorbidities. In this study, we aimed to assess the difference in HbA1c-lowering effect by significant comorbidities, such as hypertension and dyslipidemia, following a switch to anagliptin.

**Methods:** This is a subgroup analysis of SSUG study, a multicenter, open-label, single-arm, prospective observational study conducted in South Korea. The study enrolled 1,119 T2DM patients who had been treated with DPP-4 inhibitors other than anagliptin. Once all patients switched to anagliptin, HbA1c levels were measured at weeks 12 and 24. We compared the change in HbA1c levels in the group without comorbidities with the groups with comorbidities classified as follows: hypertension only, dyslipidemia only, both hypertension and dyslipidemia, and others.

**Results:** There was no difference in the HbA1c reduction between the group without comorbidities and the hypertension-only group (-0.65% and -0.85% vs. -0.48% and -0.56% from baseline to weeks 12 and 24, respectively;  $p>0.0125$  after Bonferroni-correction). However, the reduction in HbA1c in the groups with dyslipidemia only, both hypertension and dyslipidemia, and others were significantly less than that observed in the group without comorbidities ( $p<0.01$ ). The proportion of patients achieving HbA1c $\leq$ 7% increased from 7% at baseline to 44% at week 24 in the hypertension-only group, comparable to the group without comorbidities (from 9% to 65%).

**Conclusion:** T2DM patients without comorbidities and with hypertension only experienced the most substantial reductions in HbA1c after switching to anagliptin. In this large-scale observational study, various clinical characteristics including blood pressure were not collected. Given previous reports that anagliptin reduced diastolic blood pressure in patients with T2DM, further studies are needed to investigate the effects of anagliptin on cardiovascular risk factors beyond HbA1c.

## PE110 Clinical diabetes and therapeutics

**The road less taken: a scoping review of the utilisation of hand assessments in individuals with diabetes mellitus**

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**Objective:** Diabetic peripheral neuropathy (DPN) is one of the most prevalent chronic complications of diabetes mellitus (DM), known to cause significant results in disability and impaired quality of life. The DPN of the foot has been extensively studied in diabetes care. Nevertheless, the DPN of hand has been the road less taken in research and clinical practice. To address this gap, a scoping review was conducted to identify all available standardized hand assessments used, developed, or tested in individuals with DM.

**Methods:** This scoping review was reported in alignment with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR). A meticulous search was conducted across five prominent databases: Cochrane, Scopus, ProQuest, MEDLINE, and Web of Science (WoS).

**Results:** Of the 294 articles initially identified, 21 studies were included and analysed thematically after removing duplicates. These assessments, predominantly focused on body function and structure such as grip and pinch strength while the rest are measuring the activity and participation domain. Most of the hand assessments were performance-based measurements; however, self-reported measurement offers advantages such as ease of use, efficiency, accessibility, and minimal resource requirements. It is recommended to employ both types of assessments to obtain a comprehensive understanding of hand conditions in individuals with DM. While there are validated hand assessments were identified, only the Duröz Hand Index (DHI) has been validated as a reliable tool specifically for evaluating hand function in individuals with DM.

**Conclusion:** This review highlights the need to evaluate the measurement properties of the other identified instruments for individuals with DM and calls for the development of better hand assessment tools specifically designed for the DM population. This scoping review was forging a new path, by discovering diabetes care through the utilisation of hand assessments.

## PE111 Clinical diabetes and therapeutics

**Examining the impact of Artificial Light At Night (ALAN) on sleep quality and duration in patients with metabolic syndrome: a comparative study on light pollution as a zeitgeber**

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King George's Medical University, India

**Objective:** 1. To study the effect blue light/mobile exposure has on quality and duration of sleep in patients of metabolic syndrome using DREEM 2 headband. 2. To study the effect blue light/mobile exposure has on quality and duration of sleep in patients of metabolic syndrome using questionnaires. 3. To study the effect blue light/mobile exposure has on quality and duration of sleep in patients of metabolic syndrome using PSQI scoring (Pittsburgh Sleep Quality Index (PSQI)) of each patient

**Methods:** We studied the effect of ALAN on 180 patients of metabolic syndrome using like 1) PSQI Pittsburgh Sleep Quality Index 2) Questionnaires on phone usage based on frequency of phone use, time slot of phone usage, position of mobile phone while going to sleep, immediacy of response to phone when it rings while the patient is sleeping/ going to sleep, length of usage of mobile phones on weekdays. 3. Sleep quality was studied using DREEM 2 (a headband that measures EEG while asleep).

**Results:** PSQI score was best in patients who used smartphones for 2 or <2 hours per day as compared to patients using mobile phones for >2 hours and the control group. Sleep quality and duration was better in the patients who used smartphones for 2 or <2 hours per day, the second best sleep quality and duration was seen in patients not using the smartphone/ keypad phones.

**Conclusion:** This is the first study in Indian patients using DREEM 2 and the results show promise.

## PE114 Clinical diabetes and therapeutics

**The impact of meal timing on sleep quality, duration, and hormonal parameters in patients with type 2 diabetes mellitus**

Shiv Srivastav\*, Narsingh Verma, Smriti Rastogi  
King George's Medical University, India

**Objective:** To know the effect of Time restricted meal intake quality and duration of sleep and hormonal parameters

**Methods:** Total 80 subjects (40 early dinner group (dinner at or before 7 pm)+ 40 late night eaters) were enrolled in the study and their anthropometric, biochemical and hormonal levels of Insulin, Leptin and Cortisol were assessed. Sleep study was completed on 20 patients in the case group and 20 patients in the control group using DREEM 2 headband and application for 7 days for each patient.

**Results:** Study participants were aged between 50±4 years. At baseline, insulin was 26.3 ± 13.39 µIU/mL, leptin was 48.69±18.25 ng/mL and cortisol was 117.3 ± 19.52 ng/mL in late night diabetic eaters while at baseline insulin was 20.4±23.97 µIU/mL, leptin was 35.6±27.7ng/mL and cortisol was 90.67±15.21 ng/mL in early dinner diabetic group. At follow up insulin was 29.5±32.86 ng/mL leptin 50.62±33.46 ng/mL and cortisol 126.47±6.55 ng/mL in the late night eater group and in the early night eater group insulin was 19.6±17.14 ng/mL, leptin 32.31±13.44 ng/mL and cortisol 86.06±9.03 ng/mL. BMI was 28.71 ± 7.16 in late night diabetic eaters and 24.22± 3.55 in early dinner group. Fasting level was 167.94±65.58 mg/dL in TRM group and 188.7± 69.00 in the late night eater group(Ref. value-60-100 mg/dL) and post prandial level was 220.09±81.86 mg/dL in TRM group and 243.5±56.55 in the late night eater group. (Ref. value- 70-140 mg/dL)

**Conclusion:** Only study to be undertaken using DREEM 2 and hormonal parameters in Indian patients.

## PE113 Clinical diabetes and therapeutics

**A prospective study to evaluate the effectiveness of walking in women with gestational diabetes mellitus**

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**Objective:** Diabetes mellitus in pregnancy is a major public health concern. It is important to avoid medicines in pregnant women as no anti-diabetic medicine is considered safe in pregnancy. This study was aimed to evaluate the effectiveness of walking as physical exercise in controlling blood sugar in pregnant women with gestational diabetes mellitus (GDM).

**Methods:** This was a prospective, interventional study carried out in the obstetrics and gynaecology department in a tertiary care hospital for a duration of two years. The diagnosis of GDM was confirmed by oral glucose tolerance test. Pregnant women were prescribed light intensity walking for minimum 8000 steps/day. The steps were counted using fitness trackers. Follow-up OGTT tests were done every month after starting diet and walking till the end of pregnancy. HbA1c values were also checked at baseline and at the last follow-up. The results were analysed using appropriate statistical tests and P<0.05 was considered significant.

**Results:** Total 104 pregnant women with newly diagnosed GDM were included in the study. The average age was 29±4.6 years. There was a significant correlation between number of daily steps walked and energy expenditure (P=0.014). Significant correlation was found between the pre- and post- intervention glucose levels on OGTT test (P=0.02). The glucose levels reached within normal limits in 68 out of 104 women (65.38%). The correlation between HbA1c and walking was not statistically significant.

**Conclusion:** It can be concluded that light intensity walking can be an effective means of controlling blood sugar levels in pregnant women with diabetes mellitus. Further research combining it with diet and other forms of physical exercise can be conducted to design a regimen effective for majority of women.

## PE115 Clinical diabetes and therapeutics

**Resveratrol: a potent phytochemical drug in prevention and therapy of diabetes**

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**Objective:** Diabetes mellitus (DM) is one of the most researched diseases and one of the most common conditions in the world. It is usually linked to serious clinical sequelae such as diabetic cardiomyopathy, nephropathy, retinopathy, neuropathy, etc. novel monomer molecules from herbal medicine are the subject of ongoing scientific investigation into potential novel medications to combat diabetes and its consequences. A polyphenol phytoalexin called resveratrol has antiplatelet, estrogenic, and anti-inflammatory activities among other biochemical and physiological effects.

**Methods:** A model of diabetic mice was used to study the effect of resveratrol. All modeled mice were housed individually and 10 mice in each group, and 10 mice of the same age were selected as controls. Resveratrol was intraperitoneally injected with 10, 20, and 30 mg/kg, respectively. Both the control and model groups were intraperitoneally injected with an equal volume of physiological saline once a day. After 21 days of treatment blood is collected from each mic and biochemical parameters were studied.

**Results:** Resveratrol treatment of mice leads to activation of AMPK, resveratrol inhibits the expression of nicotinamide adenine dinucleotide phosphate oxidase 4 (NOX4) in renal tubular epithelial cells, alleviating diabetic nephropathy and lowering blood glucose levels. The low dose of resveratrol treatment significantly reduced blood glucose levels.

**Conclusion:** Resveratrol is a natural plant extract with a variety of pharmacological activity and low toxicity, wide source, low cost, and potential therapeutic agent for Diabetes mellitus.

## PE116 Clinical diabetes and therapeutics

**Sodium-glucose transporter-2 as a therapeutic target for the prevention and treatment of diabetes**

Shiv Kumar Yadav\*

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**Objective:** Millions of individuals worldwide suffer from diabetes, a chronic disease. The International Diabetes Federation (IDF) projects that by 2045, the illness will afflict 783 million people worldwide. India is the epicenter of diabetes. There is an urgent need for the discovery of a specific drug to suppress the blood glucose level. Quercetin is the main flavonoid and is predominantly present in foods like onions, cabbage, cauliflower, apples, almonds, tea, berries, and many others. It indicates a variety of biological processes, such as anti-inflammatory, anti-carcinogenic, and antiviral properties, and also has anti-diabetic properties.

**Methods:** A model of diabetic mice was used to study the effect of quercetin-3-O-glucoside (Q3G). All modeled mice were housed individually and 10 mice in each group, and 10 mice of the same age were selected as controls. Quercetin-3-O-glucoside was intraperitoneally injected with 1, 5, and 10 mg/kg, respectively. Both the control and model groups were intraperitoneally injected with an equal volume of physiological saline once a day. After 21 days of treatment blood is collected from each mouse and biochemical and histopathological parameters were studied.

**Results:** The biochemical analysis result shows the low blood glucose level in the blood as well as in the intestine. Quercetin-3-O-glucoside inhibits glucose uptake by sodium-glucose transporter-2 in a specific and competitive manner. Q3G also inhibited Na<sup>+</sup>-independent glucose uptake. Furthermore, Q3G seems to be transported by SGLT1. Thus, at least part of the intestinal Q3G absorption could occur via this route.

**Conclusion:** Diabetes drugs targeting the sodium-glucose co-transporter 2 are recognized as useful in treating blood sugar levels in diabetic patients. Our result also the potential therapeutic effect of Q3G in diabetes by reducing glucose uptake.

## PE117 Clinical diabetes and therapeutics

**Association of Diabetes Mellitus (DM) - type 2 in patients with Primary Open Angle Glaucoma (POAG)**Sunita Timilsina<sup>1</sup>\*, Dakki Sherpa<sup>2</sup>Bhim Hospital, Ministry of Health, Province, Nepal<sup>1</sup>, Nepal Eye Hospital, Nepal<sup>2</sup>

**Objective:** To investigate whether diabetes mellitus (DM) (type 2) is a risk factor for Primary open angle glaucoma (POAG) and to examine relationship between intraocular pressure (IOP) and diabetes in Nepalese population.

**Methods:** This hospital-based, cross-sectional descriptive study was conducted for a period of 18 months from April 2020 to September 2021 in glaucoma clinic of Nepal eye hospital. Diagnosed cases of POAG were evaluated through means of intraocular pressure (IOP) and severity of visual field changes for association with DM.

**Results:** A total of 74 patients above 40 years of age were enrolled in the study. Among 145 eyes of 74 patients, majority were of the age group 40-49 years, comprising of 35.1% and minority were of age group 70 and above. Male comprised of 56.8%, followed by female comprising 43.2%. Diabetes was present in 7.4% of the patients. There was no association found between IOP and DM (p value 0.097). We also couldn't elicit the relation between the severity of visual field changes and DM (p value 0.172, 95% CI: -2.33 -0.65).

**Conclusion:** There is no evidence from this study that supports relationship between diabetes and POAG through an association of IOP and visual field changes. The relationship of diabetes and POAG still remains a debated topic. A larger prospective comparative study might be needed for understanding this correlation.

## PE118 Clinical diabetes and therapeutics

**Antibiotics use of hospitalized diabetic patients**

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**Objective:** Infection and antibiotics use are more common among diabetic patients. The aim of study was to evaluate antibiotics usage among the hospitalized diabetic patients.

**Methods:** Cross sectional study was included 201 (47 males 53 females) diabetic patients, aged 22-79 and admitted to hospital. Body composition (body mass index, body fat, body muscle, body age and visceral fat), Blood glucose and HbA1C were measured. Antibiotics use data was collected from the hospital medical record.

**Results:** A total of 100 hospitalized diabetic patients out of 201 used antibiotics. Diabetic patients mean age was 57.4 ± 11.2 years old, body weight 77.2 ± 15.8 kg, height 165.4 ± 9.0 cm, BMI 27.9 ± 5.2 kg/m<sup>2</sup>, body fat (BF) 33.7 ± 8.4%, muscle (BM) 44.5 ± 10.2%, body age 67.8 ± 14.9 years old, visceral fat (VF) 10.7 ± 4.1%, metabolic rate 1316 ± 263.7 kcal, waist circumference 99.2 ± 13, FBG 12.0 ± 3.6 mmol/l, HbA1C 10.5 ± 2.8%, Insulin 14.1 ± 9.1 µU/ml and C-peptide 2.7 ± 1.5 ng/ml. Among hospitalized and antibiotics used diabetic patients urinary tract infection, soft tissue infection, foot ulcer and ketoacidosis was 50%, 28%, 18% and 4%, respectively. Cephalosporin and glycopeptides consumption was 73% and 27%, respectively.

**Conclusion:** 1 of 2 hospitalized diabetic patients was infected and used antibiotics. Urinary tract infections and cephalosporin use are more frequent among diabetic patients with infection.

## PE119 Clinical diabetes and therapeutics

**The association between glucagon-like peptide-1 receptor based therapies and the incidence of asthma or chronic obstructive pulmonary disease in patients with type 2 diabetes and/or obesity: a meta-analysis**

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**Objective:** Recent studies have indicated potential anti-inflammatory effects of glucagon-like peptide-1 receptor agonists (GLP-1RAs) in both acute and chronic pulmonary disease. Diabetes and obesity are risk factors for an accelerated decline in lung function indicators, which might exacerbate the development of asthma or chronic obstructive pulmonary disease (COPD). Therefore, we conducted a meta-analysis to evaluate the association between the use of GLP-1RAs and the incidence of asthma or COPD in patients with T2DM and/or obesity.

**Methods:** Electronic databases were systematically searched from the inception to July 2023. Randomized controlled trials of GLP-1RAs, as well as dual and triple receptor agonist/antagonists with reports of asthma or COPD events were included. The outcomes were computed as risk ratios (RR) and 95% confidence intervals (CIs).

**Results:** In all, 46 RCTs with 87,278 participants were included. There were 40 studies involving 83,796 participants with reports of asthma events while 19 studies with 72,557 participants were included in the analysis of COPD. Compared with non-GLP-1RA users, there was a trend of reduced risk of developing asthma (RR=0.91, 95%CI 0.67-1.24) or COPD (RR=0.92, 95%CI 0.75-1.11) in patients treated with GLP-1RAs, but the results did not reach a statistically significant difference. Further Subgroup analysis indicated that the use of light-molecular-weight GLP-1RAs might be associated with a reduced risk of asthma when compared with non-users (RR=0.66, 95%CI 0.43-0.99, P=0.045). Meta-regression analyses suggested that GLP-1RA-mediated reductions in HbA1c and body weight were not associated with the risk of asthma or COPD.

**Conclusion:** In general, compared with non-users, a trend of modest reduction in the risk of asthma and COPD was indicated in the patient with GLP-1RAs treatments, but the statistical significance was not reached. More investigations are warranted to further evaluate the association between GLP-1RAs and the risk of asthma or COPD.

## PE120 Clinical diabetes and therapeutics

**Anti-diabetic agents and the risks of cognitive disorder in patients with type 2 diabetes: a systematic review and network meta-analysis**Zonglin Li\*, Chu Lin, Fang Lv, Wenjia Yang, Linong Ji, Xiaoling Cai  
Peking University People's Hospital, China

**Objective:** To evaluate the association between anti-diabetic agents and the risks of cognitive disorder in patients with type 2 diabetes (T2D).

**Methods:** Literature retrieval was conducted in PubMed, Medline, Embase, the Cochrane Central Register of Controlled Trials and Clinicaltrials.gov between January 1995 and July 2023. Randomized controlled trials (RCTs) and observational studies in patients with T2D, which intercompared anti-diabetic agents or compared them with placebo, and reported the incidence of cognitive disorder were included. Regular and network meta-analyses incorporating these studies were subsequently implemented. Results generated from RCTs or observational studies were computed as the odds ratio (OR) or hazard ratio (HR) with 95% confidence interval (CI), respectively.

**Results:** A total of 42 RCTs (with 212551 participants) and 26 observational studies (with 1466782 participants) were included. In both regular and network meta-analysis of RCTs, the risks of cognitive disorder were all comparable among anti-diabetic agents and placebo. In regular meta-analysis of observational studies, compared with non-users, patients treated with metformin (HR=0.79, 95% CI, 0.67, 0.91), thiazolidinediones (TZD) (HR=0.78, 95% CI, 0.67, 0.90), dipeptidyl peptidase-4 inhibitor (DPP-4i) (HR=0.78, 95% CI, 0.63, 0.93), sodium-dependent glucose transporters-2 inhibitor (SGLT-2i) (HR=0.57, 95% CI 0.32, 0.83) were associated with a significantly decreased risk of cognitive disorder, while those received insulin (HR=1.19, 95% CI, 1.01, 1.37) rendered an increased risk of cognitive disorder. Moreover, in network meta-analysis of observational studies, metformin was found associated with decreased risks of cognitive disorder in patients with T2D compared with sulfonylureas (HR=0.50, 95% CI, 0.35, 0.72) and glinides (HR=0.32, 95% CI, 0.11, 0.91).

**Conclusion:** Compared with non-users, metformin, TZD, DPP-4i and SGLT-2i treatment may potentially reduce the risks of cognitive disorder in patients with T2D, while insulin treatment was associated with elevated incidence of cognitive disorder. More researches verifying these findings and further exploring the underlying mechanisms are required.

## PE121 Clinical diabetes and therapeutics

**The association between the eGFR slope and cardio-renal prognosis in patients with renoprotective treatments: a systematic review and meta-analysis**Shuzhen Bai\*, Chu Lin, Han Wu, Ruoyang Jiao, Suiyuan Hu, Wenjia Yang, Linong Ji, Xiaoling Cai  
Peking University People's Hospital, China

**Objective:** To explore the associations between estimated glomerular filtration rate (eGFR) slope and the cardio-renal prognosis in patients with renoprotective drugs.

**Methods:** PubMed, Medline, Embase, and the Cochrane databases were searched from inception to April 2023. Event-driven randomized controlled trials (RCTs) investigating renoprotective drugs and reporting eGFR slopes in patients with atherosclerotic cardiovascular disease, heart failure, type 2 diabetes, or chronic kidney disease were included. Weighted mean differences (WMDs), Risk ratios (RRs), and their 95% confidence intervals (CIs) were calculated using random effects model meta-analyses. Subgroup analyses and meta-regression analyses were also performed.

**Results:** In all, 25 RCTs with 179,893 participants were included. The preservation of eGFR was observed in patients with renoprotective drugs, with a comparator-adjusted total eGFR slope of 0.51 ml/min per 1.73 m<sup>2</sup>/year (95%CI, 0.31 to 0.70). It was indicated that the eGFR preservation reflected by the positive comparator-adjusted total eGFR slope was associated with a reduced risk of composite renal outcome ( $b=-0.097$ , 95%CI, -0.178 to -0.016,  $P=0.022$ ), but was not associated with the risks of major adverse cardiovascular events (MACE) or all-cause mortality. In patients with SGLT2i, MRA, or RAASi treatments, the placebo-adjusted acute eGFR slope was -0.59 ml/min per 1.73 m<sup>2</sup> per week (95%CI, -0.74 to -0.43), which was marginally associated with a reduced risk of composite renal outcome ( $b=0.290$ , 95%CI, 0.000 to 0.581,  $P=0.050$ ), but was not associated with the risks of MACE or all-cause mortality.

**Conclusion:** The eGFR preservation reflected by the positive comparator-adjusted total eGFR slope was associated with a reduced risk of composite renal outcome in patients receiving renoprotective agents. Greater acute decline in eGFR during the initiation of the treatment might confer a trend of fewer renal events in patients receiving SGLT2i, MRA, or RAASi.

## PE122 Clinical diabetes and therapeutics

**Behavioral risk factors and prevalence of Type 2 Diabetes Mellitus (T2DM) and Cardiovascular Diseases (CVD) among teachers in selected schools in Quezon city Philippines**Kim Leonard Dela Luna<sup>1\*</sup>, Reynaldo Jr. Magpantay<sup>2</sup>, Lyka Lagunero<sup>3</sup>, John Mark Margate<sup>3</sup>, Sheena Polinar<sup>3</sup>, Jervin Edward Tayag<sup>3</sup>College of Public Health, University of The Philippines Manila, Philippines<sup>1</sup>, College of Human Ecology, Philippines<sup>2</sup>, Polytechnic University of The Philippines, Philippines<sup>3</sup>

**Objective:** Sedentary lifestyle, long working hours, and poor dietary intake are predisposing factors leading to T2DM and CVD. Research findings shown that professionals working in the academe were at risk to develop non-communicable diseases (NCDs) because of their frequent exposure to sedentary lifestyle, poor dietary practices, stress, and long working hours. Thus, this study aims to characterize different behavioral risk factors and estimate the prevalence of T2DM and CVD among schoolteachers in selected schools in Quezon City, Philippines.

**Methods:** A total of 278 schoolteachers in Quezon City, Philippines participated in this cross-sectional survey. Frequencies and proportions were reported to describe the behavioral risk factors and prevalence of T2DM and CVD among the respondents. STATAv15 was used to analyze and interpret the data. Lastly, Ethical Clearance was secured prior to the conduct of this study and Informed Consent Forms were administered before data collection.

**Results:** It was observed that only 1 in every 10 teachers (14.4%) were physically active while the remaining majority (85.6%) were having sedentary lifestyle. In terms of alcohol consumption, half (50%) of the participants were current drinkers of alcohol, however, tobacco use was observed to be low among study participants at 2.5%. Tobacco use was primarily observed among male schoolteachers. Meanwhile, it was observed that majority of the respondents reported inadequate intake of essential nutrients. Lastly, a third (33.7%) of the participants reported that they were diagnosed with CVD and 5.0% reported that they were diagnosed with T2DM.

**Conclusion:** Findings of the study suggests negative lifestyle factors and poor dietary intake among participants. Moreover, the existence of CVD and T2DM among schoolteachers were also evident. Hence, nutrition interventions targeting behavioral risk factors should be prioritized to reduce the burden of different NCDs and its complication among schoolteachers. This can be done by modifying environments which are suitable for behavioral change.

## PE124 Clinical diabetes and therapeutics

**Identifying candidate variants associated with dependence on sulfonylureas using UK biobank**Sunah Yang<sup>1\*</sup>, Jaewon Choi<sup>1</sup>, Hyunah Kim<sup>1</sup>, Soohoon Kwak<sup>1</sup>, Kwangsoo Kim<sup>1,2</sup>, Hyeseung Jung<sup>1</sup>Seoul National University Hospital, Korea<sup>1</sup>, Seoul National University, Korea<sup>2</sup>

**Objective:** Sulfonylurea (SU) is indispensable to some patients for optimal glycemic control. In our previous study, we searched for single nucleotide variants (SNV) associated with the patients who showed remarkable sensitivity to SU, and isolated 96 rare SNV by whole exome sequencing and gene-based analysis. Among 70 genes harboring the variants, a gene was identified to contain 6 candidate SNV. Therefore, this gene was examined to validate if related with sensitivity to SU using another population.

**Methods:** In addition to the SNV identified previously, further candidates were filtered in the gene using the dbNSFP for missense mutations with a high probability of functional changes. In the UK biobank, we extracted patients with type 2 diabetes with eGFR higher than 45 ml/min/1.73m<sup>2</sup>. Patients having one of the candidate variants were designated as a case, and were compared to the others (a control) in the clinical characteristics and anti-diabetic medicine.

**Results:** We enrolled 18,806 patients with an average age and BMI of 60 years and 31.6 km<sup>2</sup>/m<sup>2</sup>. Men were 63%, and a median duration was 49 months. In total, 1,237 participants had 930 candidate variants in the gene. In patients with a short duration of diabetes, the case group demonstrated higher HbA1c levels and metformin use than the control group. Frequency of SU use was not different. However, in patients with a long duration of diabetes, the HbA1c and metformin use were comparable, while the rate of SU use was higher in the case compared to the control, indicating that according to the disease progression, trial-and-error induced prescription of SU and improved the glycemic control in the case group.

**Conclusion:** The functional variants in the candidate gene could have induced high responsiveness to SU. Funding: NRF (2022R1A2C2004570)

## PE125 Clinical diabetes and therapeutics

**Health-related quality of life and physical activity levels among select older adults with diabetes and hypertension in Angeles City, Philippines**

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**Objective:** Few studies have attempted to address the gap in knowledge on the association of physical activity (PA) with health-related quality of life (HRQoL) especially in older adults with diabetes and hypertension in the Philippines. Hence, in this research, we established the levels of PA and HRQoL and determined their relationship in the selected population.

**Methods:** With ethical approval, 160 older adults with diabetes mellitus (DM) and hypertension (HTN) aged 60 and above were recruited and asked to answer a structured interview guided questionnaire assessing their sociodemographic (SD) profile, levels of PA, and HRQoL. Data obtained were then consolidated and statistically analyzed.

**Results:** Our results show that among the constructs of HRQoL, role limitation due to physical health was found to be the lowest in the selected group. Higher levels were noted in emotional well-being and social functioning. In terms of HRQoL. In terms of PA, 76 out of 160 (63.33%) have a high level. Spearman's rank correlation showed no significant relationship between HRQoL and PA ( $r=-0.122$ ,  $p=0.12$ ). Kruskal-Wallis test was used to determine the difference of HRQoL and PA across the study group (DM vs. HTN vs. DM + HTN vs. Controls). Significant differences were observed for role limitation due to emotional problems (DM<HTN=DM + HTN=Control) and PA scores (DM + HTN<DM<Control<HTN).

**Conclusion:** Overall, our findings suggest that PA has no relationship with HRQoL in the selected population subset. However, despite these non-significant correlations, both PA and HRQoL are affected by the older adult's medical condition. Further longitudinal studies are still needed to verify further the effect of both DM and HTN on PA and HRQoL levels.

## PE126 Clinical diabetes and therapeutics

**Treatment patterns and beta cell reserve in patients with type 2 diabetes mellitus: a hospital-based study**

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**Objective:** This study aimed to investigate treatment patterns and beta cell reserve in patients diagnosed with type 2 diabetes mellitus (T2DM) who were admitted to the Central Hospital of Mongolian National University of Medical Sciences.

**Methods:** The study included 118 patients with T2DM, whose data were collected between November 2021 and December 2022. Patients with type 1 or other types of diabetes were excluded from the study. C-peptide levels were utilized to categorize patients into three groups: sufficient ( $>2$  ng/mL), borderline (0.5-2 ng/mL), and insufficient beta cell reserve ( $<0.5$  ng/mL).

**Results:** The study comprised 118 T2DM patients with a mean age of 56.7 years and an average diabetes duration of 9.7 years. Among all patients, 79% were given glucose lowering drugs and others (21%) were being treated with insulin. The majority of patients (80%) exhibited poor glycaemic control, indicated by HbA1c levels greater than 7.5%. The mean HbA1c was recorded at  $10.7 \pm 2.1\%$ , indicating a significant need for improved disease management. Regarding beta cell reserve, 81.4% of patients demonstrated sufficient levels, while 15.3% had borderline reserve, and 3.4% had insufficient reserve. Notably, a higher percentage of non-insulin users showed sufficient beta cell reserve (90.3%) compared to insulin users (69.6%). Among oral glycaemic drug users, 8.1% had borderline beta cell reserve, and 1.6% had insufficient reserve, highlighting the potential need for treatment adjustments. Among patients using a combination of insulin and oral glycaemic drugs, 12.5% had borderline beta cell reserve, and none exhibited insufficient reserve. Additionally, patients with good-to-moderate glycaemic control ( $HbA1c < 7.5$ ) showed no cases of insufficient beta cell reserve, whereas 4.0% of poorly controlled patients ( $HbA1c > 7.5$ ) displayed insufficient reserve despite insulin usage.

**Conclusion:** In conclusion, recognizing the impact of beta cell reserve on treatment response highlights the need for individualized and patient-centered approaches to managing T2DM.

## PE127 Clinical diabetes and therapeutics

**Deletion mutation in the glutathione s-transferase gene (GSTM1 and GSTT1) and their association with gestational diabetes development: a meta-analysis**

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**Objective:** The etiology of gestational diabetes mellitus (GDM) has not yet been fully explained. Several studies suggested an association between two deletion mutations (GSTM1 and GSTT1) of the GST, a gene that encodes for the enzyme glutathione s-transferase, and GDM susceptibility. However, limited studies are available, which prompted us to perform a meta-analysis to increase the power of existing studies.

**Methods:** Relevant studies were searched in PubMed, Google Scholar, ScienceDirect, and Cochrane Library and were selected according to the inclusion criteria set. Data were extracted and analyzed using Review Manager 5.4.1. Pooled odds ratios and 95% confidence intervals were computed to measure the association of the deletion polymorphism with the onset of GDM.

**Results:** A total of five studies involving 1633 participants (782 GDM and 851 non-GDM) were included in the meta-analysis. Overall analysis showed that pregnant women with the GSTM1 deletion mutation in the GST gene are more susceptible to GDM. In contrast, no significant association was observed for the GSTT1 deletion mutation.

**Conclusion:** Results of this meta-analysis suggest that pregnant women with the GSTM1 deletion mutation are more likely to develop GDM. However, further studies are needed to confirm our claims and to determine its applicability to the Filipino population.

## PE128 Clinical diabetes and therapeutics

**Therapeutic options of diabetic inpatients of endomed clinic**

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**Objective:** The incidence of diabetes mellitus (DM) in the Mongolia continues to grow rapidly. For many years the only therapeutic options for type 2 DM were sulfonylureas and insulin. The aims of this study were to evaluate therapeutic options of diabetic inpatients of Endomed clinic, Ulaanbaatar, Mongolia.

**Methods:** Cross sectional study was included 130 (71 males, 59 females) diabetic patients, aged 11-83 and admitted to hospital. Diabetic inpatients treatment data was collected from the hospital medical record.

**Results:** Hospitalized diabetic patients mean age was  $54.1 \pm 14.2$  years old, diabetes duration  $10.7 \pm 6.1$  years, body weight  $77.1 \pm 17.8$  kg, height  $164.1 \pm 10.1$  cm, waist circumference  $99.5 \pm 15.6$  cm, BMI  $28.7 \pm 5.9$  kg/m<sup>2</sup>, body fat (BF)  $34.06 \pm 9.7\%$ , body muscle (BM)  $47.1 \pm 9.6\%$ , body age  $56.5 \pm 16.0$  years old, visceral fat (VF)  $11.5 \pm 4.8\%$ , basal metabolic rate  $1364 \pm 293.3$  kcal, Total cholesterol  $5.0 \pm 1.3$  mmol/L, Triglycerid  $2.44 \pm 2.4$  mmol/L, HDL  $1.1 \pm 0.4$  mmol/L, LDL  $2.25 \pm 1.24$  mmol/L, HbA1C  $10.1 \pm 2.4\%$ , Insulin  $14.7 \pm 10.1$   $\mu$ IU/ml and C-peptide  $3.6 \pm 2.8$  ng/ml. Diabetic patients with Biguanides, DPP-4 inhibitors, Sulfonylureas, and SGLT2 inhibitors were 67.6% (88), 66.1% (86), 40.8% (53), and 12.3% (16), respectively. Diabetic patients using Rapid-acting, Long-acting, and Premixed insulin were 20% (26), 20.8% (27), and 21.5% (28), respectively. Diabetic patients using Statins, Fibrates, Antihypertensive, and Anticoagulant drugs were 75.3% (98), 32.3% (42), 79.2% (103), and 97.5% (127), respectively.

**Conclusion:** Among antiglycemic agents Biguanides, DPP-4 inhibitors, and Insulin were common for inpatients treatment.

## PE130 Clinical diabetes and therapeutics

**The impact of probiotics on clinical and metabolic outcomes in individuals diagnosed with type II diabetes**

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**Objective:** Our way of life and eating habits have drastically changed due to rapid economic growth and improved living standards, resulting in a rise in metabolic disorders such as Metabolic Syndrome and Type II Diabetes. Research has shown that probiotics have yielded positive results in treating several metabolic diseases. This study aimed to assess the effectiveness of probiotic supplements in managing Type II Diabetes.

**Methods:** A clinical trial was performed on 50 volunteers between the ages of 30 and 65, of any gender who attended the weekend Diabetic Clinic at Health Centre, Jiwaji University in India. Over three months, half of the participants were given a placebo while the other half were given a probiotic capsule. The therapeutic potential of both groups was monitored by tracking various biochemical markers including hematological parameters, fasting blood glucose, C-peptide, lipid, liver and kidney profile, as well as anthropometric data. SPSS 20 software was used to analyse the data using paired t-tests and student t-tests.

**Results:** Following a three-month probiotic supplement, there were remarkable decreases observed in the blood glucose and HbA1c levels. The group that underwent the probiotic treatment witnessed a noteworthy improvement in C-peptide levels when compared to the placebo group ( $P < 0.01$ ). Furthermore, Probiotic group witnessed significant reductions in their total cholesterol and triglyceride levels ( $P = 0.01$ ). The probiotic group demonstrating a significant difference compared to the placebo group in most biochemical and physiological parameters.

**Conclusion:** The addition of probiotics to the diet of individuals diagnosed with Type 2 Diabetes Mellitus (T2DM) resulted in notable improvements in all metabolic parameters. This finding suggests that probiotic supplementation could be a promising intervention for those with T2DM, potentially aiding in the management of this chronic condition.

## PE132 Clinical diabetes and therapeutics

**Status of body mass index, blood pressure and their determinants among the high school going adolescents: a cross sectional study in Pokhara, Western Nepal**

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**Objective:** Urbanization directly knockout the young adult to changes in their lifestyle, dietary habits and physical activity increasing the Body Mass Index (BMI) and thus the obesity which increases the risk for cardiovascular diseases. This study intended to find out the status of BMI, Blood Pressure (BP) and their determinants among the high school going adolescents of Pokhara, Nepal.

**Methods:** The total of parents' consented 360 adolescent students studying in classes XI and XII with mean age (15.25 ± 0.72 yrs.) were enrolled whose anthropometric variables and blood pressure were measured by WHO recommended tool and technique. Subjects were asked to fill the self-administered questionnaire.

**Results:** 45% males and 55% females have mean BMI of 21.16 ± 1.94. Mean height, weight and BMI of the male participants were found to be higher than the counterparts. 17.50% were overweight with mean body mass index of 26.92 ± 1.89 kg/m<sup>2</sup>. BMI was higher in nonvegetarian than vegetarians. Mean systolic and diastolic blood pressure (SBP and DBP) were 106 ± 2.25 mmHg and 72.86 ± 2.08 mmHg respectively. 12.30% were having elevated blood pressure with mean SBP 127.76 ± 3.00 and DBP as 85.86 ± 2.79. There was significant association of elevated blood pressure with gender, family history of hypertension and BMI ( $p < 0.05$ ). Males were 3 times more likely to have elevated blood pressure (AOR=3.048, CI=2.571-12.274) compared to females. Similarly, compared to thin and normally built students, overweight ones have more likelihood of having elevated blood pressure (AOR=2.25, CI=1.871-11.574)

**Conclusion:** Overweight and elevated blood pressure have been prevalent among high school going adolescents in urban setting of least and middle income country. This is really challenging and of public health significance. Regular screening of adolescents and motivation towards physical activity is essential for early detection and management of metabolic syndrome in coming days.

## PE133 Clinical diabetes and therapeutics

**Potential impact of add on omega 3 fatty acid supplementation on glycaemic profile in T2DM patients**

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**Objective:** Diabetes is the most prevalent disease which is preventable or treatable. Omega-3 fatty acid intake improves insulin sensitivity. The objective of the study was to study the effect of omega 3 fatty acid supplementation on glycaemic profile of type 2 diabetes patients.

**Methods:** In this study we have recruited 87 subjects from the outpatient department (OPD) of Family Medicine, KGMU. The fasting blood sugar (FBS), post prandial glucose (PPG), HbA1c and insulin levels were assessed at the time of patient recruitment, thereafter, administration of 10ml flaxseed oil/day (richest source of omega-3) was given to the subjects for 6 months. The FBS, PPG, HbA1c and insulin levels were then assessed after the 6-month intervention of flaxseed oil consumption.

**Results:** Study participants were aged between 48 ± 10 years. Among the subjects, 57% were males and 43% were females. At baseline FBS was 177.9 ± 74.8 mg/dL, PPG was 267.3 ± 102.6 mg/dL, HbA1c was 8.84 ± 3.2% and insulin level was 14.02 ± 5.1 µU/mL. Six months later after the administration of flaxseed oil, FBS was 162.09 ± 45.7 mg/dL, PPG was 253.7 ± 72.5 mg/dL, HbA1c was 7.98 ± 1.5% and insulin level was 17.98 ± 3.8 µU/mL.

**Conclusion:** A modest inverse association was found between omega 3 fatty acid supplementation and blood glucose levels. Therefore, omega 3 fatty acid supplementation in addition to conventional treatment of diabetic patients can be effective in diabetes management.

## PE134 Clinical diabetes and therapeutics

**P21-activated kinase 4 suppresses fatty acid -oxidation and ketogenesis by phosphorylating NCoR1**

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Jeonbuk National University, Korea

**Objective:** PPAR $\alpha$  corepressor NCoR1 is a key regulator of fatty acid  $\beta$ -oxidation and ketogenesis. However, its regulatory mechanism is largely unknown. This study investigated the effects of an oncogenic protein p21-activated kinase 4 (PAK4) on the transcriptional repressive function of NCoR1 and ketogenesis. PPAR $\alpha$  corepressor NCoR1 is a key regulator of fatty acid  $\beta$ -oxidation and ketogenesis. However, its regulatory mechanism is largely unknown. This study investigated the effects of an oncogenic protein p21-activated kinase 4 (PAK4) on the transcriptional repressive function of NCoR1 and ketogenesis.

**Methods:** Pak4 liver-specific knockout mice were used, and either PAK4 or NCoR1 was overexpressed in mice through adenoviral methods. Ketogenesis was studied by employing fasting, ketogenic-diet, or high-fat-diet feeding. The human relevance of the findings was validated in patients with non-alcoholic fatty liver disease (NAFLD) or hepatocellular carcinoma.

**Results:** The study revealed that hepatic PAK4 protein levels decreased significantly during fasting due to ubiquitination and proteasome degradation. Overexpression of PAK4 in mice suppressed ketogenesis, leading to increased hepatic fat accumulation, while genetic ablation or pharmacological inhibition of PAK4 had the opposite effect. It was discovered that PAK4 phosphorylates NCoR1 at T1619/T2124, facilitating its translocation towards the nucleus. Furthermore, impaired ketogenesis, elevated PAK4 protein levels, and increased NCoR1 phosphorylation were observed in liver tissues of high-fat-diet-fed mice, NAFLD patients, and hepatocellular carcinoma patients

**Conclusion:** The study demonstrated that PAK4 functions as an NCoR1 kinase and established a PAK4-NCoR1/PPAR $\alpha$  signaling pathway that plays a crucial role in regulating ketogenesis.

## PE135 Clinical diabetes and therapeutics

**Newly diagnosed type 2 diabetes mellitus and upper gastrointestinal disease of patients in Darkhan-Uul province, Mongolia**Mandukhai Munkhbaatar\*, Mendbayar Gerelchuluun  
Darkhan General Hospital, Mongolia

**Objective:** Type 2 diabetes and gastrointestinal disease is a developing country health issue with an increasing prevalence and disease burden.

**Methods:** 68 patients over 35 years of age, diagnosed early screening and divided into two groups type 2 diabetics and non-diabetics; each group consisting of 34 patient to analyze upper gastrointestinal disease in diabetic and non-diabetic patients to compare fasting glucose, BMI, GI endoscopy and H.pylori stool test in both groups.

**Results:** In our study 68 patients mean age  $43.8 \pm 1.05$ , fasting glucose  $11.80 \pm 4.06$  mmol/l. Mean BMI of  $25.25 \pm 0.37$  and  $24.5 \pm 0.3$  kg/m<sup>2</sup> respectively for diabetic and non-diabetic groups. Type 2 DM patients was significant compared to non-diabetic dyspeptic patients ( $p < 0.0001$ ). H.pylori stool test found in 64.1% of diabetic patients, 58.05% in non-diabetic participants ( $p < 0.05$ ).

**Conclusion:** *H. pylori* infection among diabetic patients was significantly higher than in non-diabetic patients. *H. pylori* infection is an important risk factor for gastric cancer, so additional efforts may be required to screen and eradicate *H. pylori* infection in high-risk populations.

## PE137 Clinical diabetes and therapeutics

**The metabolic storm after the standard meal in diabetes. can we do better?**Nur Maziah Hanum Osman<sup>1\*</sup>, Azrina Azlan<sup>1,2</sup>, Amin Ismail<sup>1,2</sup>,  
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Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Malaysia<sup>2</sup>,  
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**Objective:** Postprandial state plays an important role in the development of oxidative stress among Type 2 Diabetes Mellitus (T2DM). This research aims to study the global postprandial metabolomic following meal challenge test of conventional diabetes breakfast (CDB) vs modified diabetes breakfast (MDB) meals among Type 2 Diabetes (T2D).

**Methods:** Twenty patients participated in two meal challenge tests using a crossover study design. During the study, blood samples were collected at fasting (0-min), 60-min and 240-min after consuming either CDB (GI=66) or MDB (GI=42) meal. Blood samples were subjected to Nuclear Magnetic Resonance (NMR) spectroscopy using a non-targeted metabolomics approach. The acquired NMR data underwent further processing using Chemomx.

**Results:** A total of 13 metabolites were identified after consuming both meals with significant differences at 60-min involving glucose ( $p=0.022$ ), glutamine ( $p=0.04$ ), lactate ( $p=0.016$ ) and betaine ( $p=0.044$ ) after CDB vs MDB. All these metabolites regulating blood glucose level and inflammation via glycolysis, Cori cycle and glycine, serine and threonine metabolism pathway. Within CBD, thirteen metabolites being regulated with none metabolites preserved or protect patients from T2D related complication. Within MDB, eleven metabolites being regulated with one metabolite reduce the complications of T2D.

**Conclusion:** These discoveries provide valuable perspectives into the postprandial metabolic alterations resulting from the consumption of CDB versus MDB among patients with T2D.

## PE136 Clinical diabetes and therapeutics

**Factor associated with remission of type-2 diabetes mellitus after bariatric surgery in obese adults: 1 year follow-up of Korean**Mihae Seo<sup>1\*</sup>, Seunghee Yu<sup>1</sup>, Sang Hyun Kim<sup>1</sup>,  
Dong Won Byun<sup>2</sup>, Sang Joon Park<sup>2</sup>, Hye Jeong Kim<sup>2</sup>,  
Kyoil Suh<sup>2</sup>, Hyeong Kyu Park<sup>2</sup>, Soon Hyo Kwon<sup>1,2</sup>  
Soonchunhyang University Hospital, Gumi, Korea<sup>1</sup>,  
Soonchunhyang University Hospital, Seoul, Korea<sup>2</sup>

**Objective:** According to recent guidelines, it plays a crucial role in weight reduction for overweight and obese patients with T2DM due to its disease-modifying effects and remission of T2DM. This study aims to investigate the effects of factors associated with remission of T2DM and weight loss over 1 year follow-up period among Korean individuals.

**Methods:** In this retrospective study, we examined 257 participants who were scheduled to undergo bariatric surgery at Soonchunhyang University Seoul Hospital from March 2019 to April 2022, we collected demographic information or laboratory measurements at within 1month, 3month, 6month, 12months after surgery. The remission of T2DM were defined as being free of glucose lowering medication or as HbA1c <6.5% without medication.

**Results:** The participants with mean (standard deviation, SD) of age is 36.06(10.65)years and mean (SD) of body weight is 114.31 (24.54) kg. We divided preoperatively two groups : those without diabetes (mean age, 33.41 ± 9.25 years; mean BMI, 41.29 ± 8.40 kg/m<sup>2</sup>) and those with diabetes (mean age, 40.36 ± 11.40 years; mean duration of diabetes, 2.36 ± 4.46 years; mean BMI, 41.09 ± 7.91 kg/m<sup>2</sup>). The mean weight loss was 28.21 ± 9.13% of body weight at 1 year after bariatric surgery. The remission of T2DM at 1year was significantly associated with preoperative age, baseline HbA1c, baseline body weight, duration of T2DM, and baseline insulin use. Unadjusted odds ratios (OR) were as follows: 0.904 (95% CI 0.837-0.977) for age; 0.019 (95% CI 0.01-0.315) for HbA1c; 1.066 (95% CI 1.007-1.129) for body weight; 0.846 (95% CI 0.721-0.994) for duration of T2DM; and 0.047 (95% CI 0.004-0.523) for insulin use.

**Conclusion:** Our study demonstrated that patient who are younger, have a higher body weight, lower HbA1c, shorter duration of T2DM, and who are not on insulin therapy may be the best candidate to achieve a T2DM remission in Korean.

## PE139 Clinical diabetes and therapeutics

**Association of Cluster of Differentiation 36 (CD36): a fatty acid transporter gene variant rs1761667 (G>A) with Type 2 Diabetes Mellitus (T2DM) in North Indian population**Raza Ansari<sup>1\*</sup>, Kauser Usman<sup>2</sup>, Amrithes Chandra Shukla<sup>3</sup>Sri Jai Narain Misra Pg College, India<sup>1</sup>, King George's Medical University, India<sup>2</sup>,  
University of Lucknow, India<sup>3</sup>

**Objective:** The present study we evaluated CD36 polymorphism rs1761667 (G/A) as prognostic marker for obese T2DM cases and correlate with their clinical/biochemical parameters.

**Methods:** The total number of subjects included in the study was 475 comprising of T2DM cases (n=250), Obese T2DM cases (n=75) and age/sex matched controls (n=150). from north India were included in the study as per inclusion/exclusion criteria. Anthropometric details of study subjects were recorded and biochemical parameters were estimated in all controls and cases. Genotypic analysis of CD36 gene variant rs1761667(G/A) was performed using polymerase chain reaction-restriction fragment length polymorphism (PCR-RFLP). All statistical analysis was done using Prism(8.01) software.

**Results:** Systolic blood pressure (SBP) was significant in T2DM subjects. Fasting Plasma Glucose (FPG), Post Prandial Glucose (PPG), Total Cholesterol (TC), Low-Density Lipoprotein (LDL), and Very Low-Density Lipoprotein (VLDL) also showed significant association with obese T2DM cases. GA and AA genotypes showed significant association in obese T2DM cases. Genotype, GA showed significant association ( $P < 0.001$ ) with 2.77 folds risk of T2DM development. Genotype, AA was found significant ( $P = 0.008$ ) with 2.94 folds higher risk of T2DM in obesity while 9.33 folds significant risk of developing obesity in T2DM cases.

**Conclusion:** The risk of obesity in T2DM cases can be assessed by genotyping the CD36 genetic variant rs1761667 (G/A). However, raised FPG, PPG, TC, LDL, and VLDL showed poor prognosis in obese T2DM cases. CD36 gene variant can be proposed as prognostic biomarker for risk prediction of T2DM and obesity, while anthro-biochemical risk factors as preventive biomarker.

## PE140 Clinical diabetes and therapeutics

**Omega 3 plus vitamin D or vitamin E co-supplementation in women with gestational diabetes: a meta-analysis**Rao Nargis Jahan\*, Yasmin Sultana, Mohammad Azharuddin  
Jamia Hamdard, India

**Objective:** Limited research has been conducted on the combined impact of vitamin D or E and omega-3 fatty acids on metabolic status in GDM women, and the results have not been firmly established. With pooling the evidence, we therefore, aimed to perform a systematic literature review and meta-analysis using RCTs and observational studies to determine the combined effects of omega-3 and vitamin D or E on metabolic status and pregnancy outcomes in women with GDM.

**Methods:** A systematic search was conducted on MEDLINE, Cochrane Library, and Web of Science. The outcome measures were FPG, HOMA-IR, insulin, lipid profiles, oxidative stress and inflammatory biomarkers, and pregnancy outcomes. A meta-analysis was carried out using RevMan 5.3 software. The random effects model was used to compute the mean difference (MD)/odds ratio (OR) with 95% confidence intervals (CI).

**Results:** Results from meta-analysis, omega-3 fatty acids plus vitamin E or D supplementation significantly reduces FPG levels, HOMA-IR, and insulin. No significant impact was observed on lipid profile except triglycerides. In term of biomarker for oxidative stress and inflammation, omega-3 fatty acids plus vitamin E or D supplementation significantly reduces MDA (MD -0.87, 95% CI -1.26 to -0.47,  $p < 0.00001$ ) and significantly increased plasma TAC (MD 148.32, 95% CI 22.79 to 273.84,  $p = 0.02$ ), but no effect on GSH and NO. Significantly lower incidences of newborns' hyperbilirubinemia (OR 0.19, 95% CI 0.07 to 0.52,  $p = 0.001$ ), newborns' hospitalization (OR 0.21, 95% CI 0.08 to 0.56,  $p = 0.002$ ).

**Conclusion:** Current study revealed that administration of dietary supplements of omega-3 fatty acids in combination with vitamin E or D can be helpful in improving glycemic control, reducing triglycerides and showed significant reduction in MDA and increase in plasma TAC. These combined supplements may prevent the incidence of newborns' hyperbilirubinemia and hospitalization.

## PE141 Clinical diabetes and therapeutics

**Mobile health intervention on glycemic control and quality of life in type 1 diabetes mellitus: a meta-analytic synthesis**Md Azharuddin\*, Manju Sharma  
Pharmacology, Jamia Hamdard, India

**Objective:** Improved glycemic control and enhanced quality of life (QoL) are essential in reducing complications associated with type 1 diabetes mellitus (T1DM). With the advent of advanced technology, mobile apps offer unique opportunities for disease self-management. However, the effects of mobile health (mHealth) interventions on glycemic control and QoL in T1DM remain unclear. Thus, the aim of this study was to conduct a systematic literature review and meta-analysis of published studies on mHealth interventions to assess their impact on glycemic control and QoL.

**Methods:** A systematic search was performed on PubMed, Embase, and Cochrane Central Register of Controlled Trials to identify randomized controlled trials (RCTs). The outcome measure was glycemic control and QoL in population with T1DM. QoL shows better treatment and satisfaction. Subgroup analysis was performed on the basis of mobile application users and text-messaging/feedback systems. Estimated the pooled mean difference (MD) and 95% confidence intervals (CIs) using a weighted random-effect model.

**Results:** Overall, nine studies were included in the meta-analysis. The results from meta-analysis showed a significant reduction of mean HbA1c in intervention group compared to usual care. Subgroup analyses observed that mobile app intervention significantly reduced HbA1c levels by 0.27 percent, (Mean Difference, MD: -0.27; 95% CI: -0.49, -0.06;  $p < 0.05$ ; heterogeneity,  $I^2 = 59\%$ ). While text-messaging/feedback systems have shown no significant reduction in HbA1c levels (MD: -0.19; 95% CI: -0.68, 0.30). mHealth did not improve QoL.

**Conclusion:** The effectiveness of mHealth interventions for self-management and glycemic control improvement appears promising. Nonetheless, to validate the current findings, further randomized controlled trials (RCTs) and longitudinal studies are needed to be conducted on a global scale.

## PE142 Clinical diabetes and therapeutics

**Effect of saxagliptin as add-on therapy to metformin in type 2 diabetes mellitus**Rao Nargis Jahan\*, Yasmin Sultana, Mohammad Azharuddin  
Jamia Hamdard, India

**Objective:** This study aimed to systematically review and conduct a meta-analysis to evaluate the efficacy and safety of saxagliptin as an add-on therapy to metformin in patients with type 2 diabetes mellitus (T2DM), comparing outcomes with control groups (placebo/active treatment).

**Methods:** We conducted a systematic search on MEDLINE and CENTRAL to identify relevant randomized controlled trials (RCTs) involving patients with type 2 diabetes mellitus (T2DM). The primary outcome measures were the mean changes in HbA1c and fasting plasma glucose (FPG) levels from baseline. To estimate the pooled mean difference (MD) and odds ratio (OR) with a 95% confidence interval (CI) using a random effects model.

**Results:** Total 9 RCTs with 6497 participants included. From the included studies patient age, FPG, HbA1c, and duration of diabetes ranged from 50.1-72.60 years, 160.3-201.3 mg/dL, 7.6-9.5%, and 1.7-7.6 years respectively. The duration of trials ranged from 24-206 weeks. Results from the meta-analysis showed, that saxagliptin significantly reduced HbA1c levels (MD -0.43%, 95% CI -0.67 to -0.19) and FPG levels (MD -12.13%, 95% CI -20.42 to -3.84) compared to placebo. However, there were no significant changes were observed when compared to active treatment. Saxagliptin significantly decreased the incidences of hypoglycemia compared with control group (OR 0.11, 95% CI 0.06 to 0.19) as add-on therapy to metformin. A non-significant association was found between overall adverse events and saxagliptin compared to control group (OR 0.81, 95% CI 0.53 to 1.23).

**Conclusion:** Saxagliptin showed better glycemic control compared to placebo when used as an add-on therapy to metformin. Additionally, no significant detrimental effects or overall adverse events were observed with saxagliptin use. As a result, saxagliptin can be considered a possible option for add-on therapy to metformin in patients with inadequately controlled T2DM. However, to robust these results, further long-term follow-up RCTs and real-world studies are necessary.

## PE143 Clinical diabetes and therapeutics

**The association between Gamma-Glutamyl Transferase (GGT), High-Density Lipoprotein Cholesterol (HDL-C) and GGT/HDL-C Ratio with type 2 diabetes mellitus: a systematic review and meta-analysis**Made Lady Adelaida Purwanta\*,  
Anak Agung Istri Sri Kumala Dewi, Ketut Suryana  
Wangaya Hospital, Indonesia

**Objective:** Gamma-glutamyl transferase (GGT) and High-density lipoprotein cholesterol (HDL-C) are associated with NAFLD, and their roles in insulin resistance have recently been discovered, potentially linking NAFLD with T2DM. This meta-analysis aims to summarize recent findings on their significance in T2DM knowing their potential for early detection, risk stratification, and targeted intervention.

**Methods:** The last five years studies were searched in Pubmed, medRxiv, and Google Scholar based on PICO criteria and PRISMA 2020. Keywords included (gamma-glutamyl transferase OR GGT OR high-density lipoprotein OR HDL OR GGT/HDL-C Ratio) AND (diabetes mellitus). Included studies focused on populations without pre-existing liver disease, categorized into diabetic and non-diabetic groups across different country regions. Forest plot analysis pooled data for mean GGT, HDL-C levels, and/or GGT/HDL-C ratio. Quality assessment was done with the Newcastle-Ottawa Scale.

**Results:** Eight eligible studies involving 64,716 participants from East Asia, West Asia and Africa revealed that GGT levels were significantly higher in diabetic populations across all regions. Racial diversity contributed to variations of GGT levels between diabetic and non-diabetic populations, with the largest difference observed in West Asia (Mean difference (MD)=5.65; 95%CI 3.46-7.83;  $p < 0.00001$ ) and the smallest in Africa (MD=1.70; 95%CI -0.10-3.50;  $p = 0.06$ ). However, the overall HDL-C level showed no significant correlation with diabetes, except for East Asia where non-diabetic populations had higher HDL levels than diabetics (MD=-0.16; 95%CI -0.31-(-0.01);  $p = 0.04$ ). Furthermore, limited studies suggested a significant correlation between the GGT/HDL-C ratio and diabetes incidence. Higher GGT/HDL-C ratios (ratio  $> 10.610$ ) had a higher risk of diabetes compared to lower ratios (ratio  $< 10.610$ ) (Risk ratio (RR)=5.06; 95%CI 4.36-5.87;  $p < 0.00001$ ).

**Conclusion:** Basic laboratory markers like GGT level and GGT/HDL ratio could serve as a novel, comprehensive indicator for early detection and risk assessment of T2DM. Future research on the potential ratio, particularly aimed at predicting diabetes onset time in populations with metabolic-associated liver disease is required.

**PE144** Clinical diabetes and therapeutics

**TyG index is a simple and early predictor of type 2 diabetes in adults with normal glucose tolerance**

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Pusan National University School of Medicine, Korea

**Objective:** Insulin resistance even if being in the status of normal glucose tolerance (NGT) is increased before developing prediabetes and type 2 diabetes. Triglyceride-glucose index (TyG index), reflecting insulin resistance, is a simpler and more convenient calculator than oral glucose tolerance test (OGTT)-derived insulin sensitivity markers. We evaluated that the TyG index in the NGT status could be an early predictor of type 2 diabetes using a population-based prospective cohort study in Korea.

**Methods:** We examined 6113 adults of the NGT status except patients of prediabetes and diabetes in the Korean Genome and Epidemiology Study survey. This survey was conducted from 2001-2002 to 2019-2020 and the mean follow-up period was 13.37±/−5.36 years. We performed a cox proportional hazard ratio to assess the risk of developing type 2 diabetes across quartiles of TyG index (ln[fasting triglycerides (mg/dl) × fasting plasma glucose (mg/dl)/2]), and plotted a receiver operating characteristics (ROC) curve of the TyG index, the homeostatic model assessment of insulin resistance (HOMA-IR), and the composite (Matsuda) insulin sensitivity index (ISI) to compare their abilities in predicting type 2 diabetes.

**Results:** There were 1010 (16.5%) incident cases of type 2 diabetes during a total of 81762.4 person-years. The adjusted hazard ratio for type 2 diabetes increased in the highest quartile of the TyG index, reaching 3.78(95% CI, 3.091-4.630; p for trend<0.001), as compared with the bottom quartile even if adjusting for HOMA-IR and ISI value. The area under ROC curves for predicting type 2 diabetes was 0.643 (95%CI, 0.626-0.661) for the TyG index, which is higher than 0.561 (95%CI, 0.542-0.580) for HOMA-IR and 0.596 (95%CI, 0.577-0.614) for ISI (respectively, p<0.001).

**Conclusion:** Our data suggest that the TyG index is an early predictor of type 2 diabetes in adults with the NGT and is more predictable than OGTT-derived insulin sensitivity markers, such as HOMA-IR and ISI.

**PE145** Clinical diabetes and therapeutics

**No association between the GST gene GSTP1 genotypes and gestational diabetes mellitus: a meta-analysis of 1306 pregnant women**

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Angeles University Foundation, Philippines

**Objective:** The GSTP1 has been shown to contribute to the development of type 2 diabetes mellitus. However, limited studies are still available concerning its association with gestational diabetes mellitus (GDM). Hence, in this study, we determined the association of the GSTP1 genotypes (Ile/Ile, Ile/Val, and Val/Val) with the development of GDM.

**Methods:** Studies containing genotypic data of the GSTP1 polymorphism GDM and non-GDM pregnant women were retrieved from database websites namely PubMed, Google Scholar ScienceDirect, and Cochrane Library. Data were then extracted, collated, and analyzed to determine the pooled odds ratio (ORs) and 95% confidence intervals (CIs) using Review Manager 5.4.1.

**Results:** After a thorough review of the resulting studies, three studies were included in the meta-analysis involving 1306 pregnant women (613 GDM and 693 non-GDM). The allelic model shows homogenous outcomes with non-significant results (OR=1.15, p=0.10). The same homogenous and non-significant outcomes were observed for the co-dominant, dominant, and recessive genotypic models.

**Conclusion:** With the homogeneity of the pooled outcomes, our study shows that the GSTP1 genotypes are not associated with the development of GDM. Further studies may be conducted to verify the applicability of these findings, especially in different ethnic groups.

**PE146** Clinical diabetes and therapeutics

**Analyzing neopterin patterns in COVID-19 patients with coinciding diabetes mellitus: a retrospective study at saiful anwar general hospital, Malang, Indonesia**

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Universitas Brawijaya / Dr. Saiful Anwar General Hospital, Indonesia

**Objective:** The focus on COVID-19's intricate interplays grows as it becomes an endemic reality. Patients, particularly those who also have type 2 diabetes mellitus (T2DM) comorbidly, are at a particularly risky crossroads of susceptibility and death. Neopterin, an intriguing metabolite that immune cells, particularly macrophages and dendritic cells, have been whispering about, is a fascinating partner for immunological activation, a protagonist in the viral tale. A possible biomarker for immunological activation and inflammation is hidden among its complexities. Neopterin's function is still unknown as COVID-19 embeds itself. With COVID-19 patients who have T2DM, this study sets out to explore its potential as a mortality predictor.

**Methods:** COVID-19 patient samples with concomitant diabetes mellitus treated at the hospital were included in a prospective single-center study. Patients were divided into two groups: survival and non-survival. Clinical and laboratory data served as the basis for the diagnosis of COVID-19 and diabetes. Neopterin levels in patient serum were measured using an ELISA, and patients were monitored until they recovered or passed away.

**Results:** Results showed a 36.4% male population and an average age of 56.2±12.9 years. Neopterin levels showed no statistically significant difference between the survival and the non-survival group (p=0.851; 9.85±5.27 vs. 10.62±7.32 nmol/L).

**Conclusion:** Neopterin has the potential to be a predictive biomarker for the severity of COVID-19, but the absence of a significant difference in neopterin levels between patients who survived and those who did not with concurrent T2DM highlights the complexity of patient outcomes. Therefore, to develop a more holistic and relevant understanding of the elements impacting severity and mortality in this complicated setting, a thorough analysis of several variables is required.

**PE147** Clinical diabetes and therapeutics

**Impact of diabetes on COVID-19 susceptibility: a nationwide propensity score matching study**

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Kyung-Do Han<sup>4</sup>, Eun-Jung Rhee<sup>2</sup>, Won Young Lee<sup>2</sup>

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**Objective:** Previous studies have reported that patients with diabetes have poorer clinical outcomes when infected with COVID-19, but the susceptibility of diabetic patients to COVID-19 infection has not been extensively studied. In this study, we aimed to investigate the impact of diabetes on the COVID-19 infection using data from the National Health Insurance Service (NHIS) in Korea.

**Methods:** We analyzed NHIS data of individuals aged ≥30 years who underwent COVID-19 testing from December 2019 to April 2020. COVID-19 testing was performed using nasopharyngeal swabs or sputum samples through diagnostic kits or real-time polymerase chain reaction when individuals presented fever (≥37.5°C) or respiratory symptoms like cough or shortness of breath, or when physicians suspected COVID-19 infection. Patients with diabetes were defined as those prescribed antidiabetic drugs within a year before the COVID-19 test. Propensity score matching was used to compare individuals with and without diabetes in a 1:3 ratio.

**Results:** A total of 115,235 individuals tested for COVID-19. There were no significant differences in sex, age distribution, body mass index (BMI), and comorbidities between individuals with diabetes (n=6,462) and individuals without diabetes (n=19,386). However, fasting glucose levels were significantly higher in individuals with diabetes (132.2±51.6 vs. 97.0±14.3 mg/dL, P<0.0001). COVID-19 positive cases were significantly higher in individuals with diabetes compared to those without diabetes (268 (4.2%) vs. 630 (3.3%), P=0.0006). When performing logistic regression analysis with sex, age, BMI, smoking status, blood pressure, comorbidities, and Charlson Comorbidity Index score as covariates, diabetes was found to significantly increase the risk of COVID-19 test positive rate (odds ratio [confidence interval], 1.288 [1.114, 1.491]).

**Conclusion:** Diabetes increases the risk of COVID-19 infection. Considering the poorer clinical outcomes observed in diabetic patients with COVID-19, patients with diabetes should be more vigilant in preventing COVID-19 infection.

## PE148 Clinical diabetes and therapeutics

**Multicenter, randomized, double blind, three-arm parallel group study to evaluate efficacy and safety of alogliptin and pioglitazone combination therapy on glucose control in type 2 diabetes subjects who have inadequate control with metformin monotherapy in Korea: the PEAK trial (The practical evidence of antidiabetic combination therapy in Korea)**

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**Objective:** Evidence for the triple combination therapy (double add-on) after failure to metformin monotherapy in Type 2 diabetes mellitus (T2DM) is limited. This study investigates the effectiveness, longevity, and safety of utilizing a triple combination therapy involving metformin, alogliptin, and pioglitazone in managing T2DM patients with inadequately controlled with metformin monotherapy.

**Methods:** The Practical Evidence of Antidiabetic Combination Therapy in Korea (PEAK) trial was a multicenter, double-blinded, randomized control trial. Among 214 participants, 70 individuals were allocated for the alogliptin plus pioglitazone group (Alo+Pio), 75 for the alogliptin group (Alo), and 69 for the pioglitazone group (Pio). The primary outcome was the difference in glycosylated hemoglobin (HbA1c) levels across the three groups from baseline to the 24-weeks. Other metabolic parameters including insulin sensitivity (HOMA-IR),  $\beta$ -cell function (HOMA- $\beta$ ), lipid profiles were assessed as well. Safety analysis entailed the examination of adverse events.

**Results:** Over the course of 24 weeks of treatment, the Alo+Pio, Alo, and Pio groups decreased HbA1c by  $-1.38\%$  ( $\pm 0.08\%$ ),  $-1.03\%$  ( $\pm 0.08\%$ ), and  $-0.84\%$  ( $\pm 0.08\%$ ), respectively. HbA1c was significantly lower in the Alo+Pio group in comparison to the other groups ( $P=0.0063$ ,  $p<0.0001$ ), along with a higher proportion of patients achieving targeted HbA1c levels. Additionally, insulin sensitivity,  $\beta$ -cell function, lipid profiles, and other metabolic indicators were improved in the Alo+Pio group. Importantly, the triple combination therapy exhibited no severe adverse events.

**Conclusion:** Early initiation of triple combination therapy displayed superior efficacy without increasing noticeable side effects compared to the single add-on (dual) therapy. Thus, metformin, alogliptin, and pioglitazone combination therapy presents a valuable early treatment modality for T2DM patients with insufficient control under metformin monotherapy.

## PE149 Clinical diabetes and therapeutics

**Trends in prevalence of lean diabetes in Korea over 20 years**

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Chungnam National University Hospital, Korea<sup>3</sup>

**Objective:** Diabetes remains an important public health issue and the prevalence of diabetes is increasing globally. Despite obesity has been a well-known risk factor for type 2 diabetes, accumulating evidence show that type 2 diabetes in Asia occurs largely without obesity. And several recent studies suggest that lean diabetes subjects are more likely to develop diabetic complications. However, little is known about the prevalence of lean diabetes in Korea.

**Methods:** Lean diabetes was defined as type 2 diabetic subjects with BMI<23 kg/m<sup>2</sup>. Type 2 diabetes was defined as follows: (1) subjects who had been previously diagnosed by a doctor based on a self-report, (2) taking oral hypoglycemic agents or insulin, or (3) fasting plasma glucose (FPG) levels of  $\geq 126$  mg/dL and/or HbA1c levels of  $\geq 6.5\%$ . The age-standardized prevalence was estimated using the data from the 2<sup>nd</sup> to 9<sup>th</sup> Korea National Health and Nutrition Examination Survey (KNHANES). Among 136,853 subjects, we excluded participants aged <19 years (n=27,839) and pregnant or lactating women (n=846), suspected type 1 diabetes (n=12), and participants missing key information (n=12,943). Finally, total 95,213 subjects were analyzed in this study.

**Results:** The Age-standardized prevalence of type 2 diabetes without overweight or obesity were 9.8% in 2<sup>nd</sup> KNHANES (2001) and 13.3% in 9<sup>th</sup> KNHANES (2009-2021). The overall prevalence of lean diabetes showed a significant linear increased among adults aged  $\geq 19$  years from 2001 to 2021. The prevalence of lean diabetes was significantly increased by 35.7% over the 20-year period.

**Conclusion:** Type 2 diabetes significantly increased among lean subjects (BMI<23 kg/m<sup>2</sup>) from 9.8% to 13.3%, representing a 35.7% increase over 20 years in Korea.

## PE150 Clinical diabetes and therapeutics

**Distinct metabolic profiles of young-onset type 2 diabetes: single center, cross-sectional study**

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Ji Sung Yoon, Kyu Chang Won, Hyoung Woo Lee  
Yeungnam University Medical Center, Korea

**Objective:** The proportion of young-onset type 2 diabetes (YOD2) who are diagnosed under 40 years old is rapidly increasing globally including Korea. Early deterioration of insulin secretory capacity and higher risk of complications are more concerning compared to patients with elderly onset, but the pathophysiology and metabolic characteristics of YOD2 are not clearly understood yet. We explored the metabolic characteristics of YOD2 based on an oral glucose tolerance test (OGTT).

**Methods:** This study was a cross-sectional study conducted on patients who visited the Yeungnam University Hospital from 2020 to 2022. We included 177 patients with type 2 diabetes an 75g OGTT (0, 30 and 120 min). Patients were categorized into two groups by their age, 85 patients under age 40 were grouped as YOD2 and their demographic characteristics and compared OGTT findings between two groups.

**Results:** For YOD2, their mean BMI was significantly higher compared to older patients ( $29.26 \pm 6.7$  vs  $24.03 \pm 3.24$ ,  $p<0.001$ ). Fasting glucose ( $183.73 \pm 86.7$  vs  $163.21 \pm 64.3$  mg/dL  $p=0.001$ ), fasting insulin ( $18.54 \pm 16.7$  vs  $14.29 \pm 9.02$   $\mu$ U/ml  $p=0.001$ ), fasting C-peptide ( $3.94 \pm 2.84$  vs  $3.14 \pm 1.94$  ng/ml  $p=0.015$ ) and HOMA- $\beta$  were significantly higher in YOD2 group, whereas post-glucose loaded metabolic parameters such as glucose, insulin (30,120 min) and C-peptide (120min) did not show significant difference between groups. HOMA-IR did not show significant difference but tends to be higher in YOD2 group. Interestingly, peak glucose level at 30 min is more often in young onset diabetes (28% vs 13%).

**Conclusion:** There results suggest that YOD2 have distinct metabolic profiles compared to elder patients, such as higher insulin resistance with obese and compensatory insulin secretion failure.

## PE151 Clinical diabetes and therapeutics

**Effects of trigonella foenum graecum seed extract on oxidative stress and hepatic function in type 2 diabetic patients**

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B V Deemed University, India

**Objective:** Trigonella foenum-graecum (Fenugreek) is found to have many active bio molecules. It has a long history of use in folk medicine where, in India and South Asia use the plant to treat diabetes, various infections and kidney problems. The present study is designed to investigate the hepatoprotective and anti-diabetic effects of ethanolic extract of Trigonella foenum graecum seed (TSP) in a type 2 diabetes patients (T2D).

**Methods:** A total number of sixty-five subjects with T2D (age range: 45-65 years; M/F: 33/32) were enrolled. TSP was prepared in hot water and orally administered to type 2 diabetic patients with constipation. This treatment was thrice a week in 1st month, twice in a week in corresponding 2nd and 3rd months and once in a week from 4th to 6th months. The defensive enzyme, glutathione peroxidase, superoxide dismutase, catalase and fasting blood sugar, hemoglobin A1c, apolipoprotein B, apolipoprotein A-I, and malondialdehyde were measured in the red blood cells. The liver function test was performed by measuring hepatic enzymes (Aspartate amino transferase, alanine amino transferase) and lipid profile levels.

**Results:** TSP supplementation significantly reduced the levels of fasting blood sugar, serum hepatic enzymes, hemoglobin A1c, apolipoprotein B, apolipoprotein B/apolipoprotein A-I and malondialdehyde in TSP group in comparison to baseline, as well as control group, while it increased the level of apolipoprotein A-I ( $p<0.05$ ). The stools quality also changed to normal. The antioxidant enzymes decreased in red blood cells of diabetics by 20-30%, normalized after six months of treatment with TSP extract. There was also normalize hepatic enzymes activity with TSP treatment to diabetic patients.

**Conclusion:** TSP treatment to diabetic patients not only normalize the defense of red blood cells but also corrects skin infection, liver disorder and physiological disorder.

## PE152 Clinical diabetes and therapeutics

**Chronotherapeutic optimization of metformin administration for enhanced glycemic control and insulin sensitivity in type 2 diabetes patients: a randomized controlled trial**Sahnaz Vivinda Putri<sup>1\*</sup>, Firstriana Putriawati<sup>2</sup>, Aldella Ita Magdalena<sup>1,2</sup>International University Semen Indonesia, Indonesia<sup>1</sup>,  
Pratama Serawai Hospital, Indonesia<sup>2</sup>

**Objective:** This study aimed to explore the impact of personalized metformin administration timing, aligned with an individual's circadian rhythms, on glycemic control and metabolic parameters in patients with type 2 diabetes. Optimizing metformin dosing based on circadian rhythms has the potential to enhance treatment outcomes and mitigate side effects associated with the medication.

**Methods:** In this double-blind randomized controlled trial, 120 participants diagnosed with type 2 diabetes were enrolled. Participants were randomly allocated to either the control group (n=60) receiving standard metformin dosing or the experimental group (n=60) receiving metformin doses adjusted according to circadian rhythm analysis. The assessment of circadian rhythms included salivary melatonin levels and wrist-worn actigraphy. Both groups received comprehensive dietary counseling and tailored exercise recommendations. The primary endpoints encompassed fasting plasma glucose levels, HbA1c levels, and insulin resistance evaluated through the homeostatic model assessment for insulin resistance (HOMA-IR).

**Results:** The experimental group exhibited a remarkable 18 mg/dL reduction in fasting plasma glucose levels (95% CI: 14-22 mg/dL) in comparison to the control group. HbA1c levels demonstrated a significant mean reduction of 0.7% (95% CI: 0.5%-0.9%) in the experimental group. Noteworthy, the experimental cohort displayed a substantial 25% enhancement in insulin sensitivity, as indicated by a reduction in HOMA-IR (95% CI: 20%-30%), relative to the control group.

**Conclusion:** Customizing metformin timing based on a person's circadian rhythms improves diabetes control by reducing glucose levels, enhancing insulin sensitivity, and lowering fasting plasma glucose. This approach shows potential for optimizing metformin's effectiveness. Integrating circadian rhythm assessment into diabetes management could lead to personalized treatment plans. Continued research is needed to confirm the lasting benefits and feasibility of using circadian-based medication timing in routine diabetes care.

## PE153 Clinical diabetes and therapeutics

**Effects of calorie restriction diet on blood glucose regulator treatment for patients with post-gastric bypass**

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Shakuntla Hospital and Research Center, India

**Objective:** Background: Severe hypoglycemia characterized by neuroglycopenic symptoms is a recently described and relatively uncommon complication of gastric bypass surgery. It occurs several months to years after surgery and may be distinct from the more commonly encountered dumping syndrome that occurs early in the postoperative course and usually improves with time. Postprandial hypoglycemia is an infrequent but disabling complication of Roux-en-Y gastric bypass (RYGB) surgery. Dietary restriction (DR), often referred to as calorie restriction (CR), denotes limiting calorie intake by an individual. **Objectives:** To evaluate the daily life efficacy of a calorie-restricted dietary advice (CRD) of 5 meals per day with a 30 g carb maximum per meal in patients with documented post-RYGB hypoglycemia.

**Methods:** Frequency and severity of hypoglycemic events before and after CRD were assessed retrospectively in 38 patients with documented post-RYGB hypoglycemia, based on medical records and telephone questionnaires. Hypoglycemia was defined as a blood glucose level <3.0 mmol/L. Results are expressed as mean values ± standard error or median and range.

**Results:** CRD decreased the number of hypoglycemic events per month from a decline of 87% (P<.001). The lowest blood glucose measured during a hypoglycemic event increased significantly (P<.001). The number of patients who had required outside help in the treatment of hypoglycemia, significantly decreased (P<.001). In 11 patients the diet-induced reduction of hypoglycemia was insufficient and required the start of insulin suppressive therapy.

**Conclusion:** CRD decreased the number of hypoglycemic events per month from a decline of 87% (P<.001). The lowest blood glucose measured during a hypoglycemic event increased significantly (P<.001). The number of patients who had required outside help in the treatment of hypoglycemia, significantly decreased (P<.001). In 11 patients the diet-induced reduction of hypoglycemia was insufficient and required the start of insulin suppressive therapy.

## PE154 Clinical diabetes and therapeutics

**Study of pharmacological therapy on hydration status and glomerular filtration rate in post-menopausal women with chronic kidney disease**

Rohit Rajput\*, Anil Gaur

Shakuntla Hospital and Research Center, India

**Objective:** Premature menopause defined as secondary amenorrhea is common in women with kidney disease. Anemia, a common feature in chronic kidney disease (CKD), has multiple contributors to its pathogenesis. Various factors are involved in the pathogenesis of the CKD, including type of diet, genetic predisposition, colonic motility, absorption, social economic status, daily behaviors, and biological and pharmaceutical factors. Aim of current study was to investigate role of mechanoacoustic vibration therapy on hydration status and glomerular filtration rate (eGFR) in post-menopausal women with CKD.

**Methods:** We enrolled forty-six post-menopausal women patients with stage 3 to 5 CKD, allocated in the first group underwent a three-month personalized drug therapy and focused mechanoacoustic vibration (2 sessions per week, each lasting 15 minutes); women allocated in the second group underwent only three-month personalized drug therapy. Patients were evaluated performing kidney functions and eGFR, hydration status evaluation, and administration of Rome II criteria and kidney disease questionnaire (KDQ).

**Results:** Present results shown that treatment of post-menopausal women with mechanoacoustic vibration significantly improvement of eGFR, hydration status, erythropoietin levels and decrease abdominal pain, and better quality of life with increase appetite in treatment groups. There was an improvement of physical flexibility, and autonomic functions significantly improved which correlated with a reduction in the amount of medicine in treatment groups compare to control.

**Conclusion:** Hence, the combined treatment with focused mechano-acoustic vibration and pharmacological therapy has a beneficial effect on eGFR and kidney functions as well as on the muscle strength and quality of life in post-menopausal women with CKD.

## PE155 Clinical diabetes and therapeutics

**Amelioration of Insulin resistance after delivery is associated with reduced risk of postpartum type 2 diabetes in women with gestational diabetes mellitus**Heejun Son<sup>1\*</sup>, Joon Ho Moon<sup>2</sup>, Sung Hee Choi<sup>2</sup>,Nam H. Cho<sup>3</sup>, Hak Chul Jang<sup>2</sup>, Soo Heon Kwak<sup>4</sup>Seoul National University Hospital, Korea<sup>1</sup>, Seoul National University Bundang Hospital, Seoul National University College of Medicine, Korea<sup>2</sup>, Ajou University School of Medicine, Korea<sup>3</sup>, Seoul National University Hospital, Seoul National University College of Medicine, Korea<sup>4</sup>

**Objective:** Identifying risk factors for postpartum type 2 diabetes in women who had gestational diabetes mellitus (GDM) is essential for effective intervention to prevent type 2 diabetes. We investigated whether alterations in insulin sensitivity after delivery affects the risk of type 2 diabetes in women with GDM.

**Methods:** In a prospective cohort including subjects with GDM and gestational impaired glucose tolerance, 230 women who attended the follow-up visit at 2 months postpartum and annually thereafter were included for analysis. Changes in insulin sensitivity were calculated using Matsuda index at diagnostic oral glucose tolerance test for GDM and at 2 months postpartum which we defined as  $\Delta$ Matsuda index. The risk of postpartum type 2 diabetes was analyzed according to tertiles of  $\Delta$ Matsuda index using the Cox proportional hazard model.

**Results:** During 3.4 years of follow-up, 26 out of 230 subjects (11.3%) developed diabetes. The incidence of diabetes decreased as the tertile of  $\Delta$ Matsuda index increased (14.5%, 11.7%, and 7.8%). Subjects in the third tertile of  $\Delta$ Matsuda index showed lower risk of diabetes compared to the subjects in the first tertile (HR, 0.47; 95% CI, 0.18-1.23, P=0.122; HR, 0.23; 95% CI, 0.06-0.82, P=0.023) after adjusting for age, family history of diabetes, parity, gestational fasting glucose, and postpartum BMI.

**Conclusion:** Amelioration of insulin resistance lowers the risk of diabetes in Korean women with GDM. Although the assessment of insulin sensitivity is not standardized, changes in insulin sensitivity may be a useful predictor for future development of type 2 diabetes in women with GDM.

PE156 Clinical diabetes and therapeutics

**Risk factors of prediabetes among sago consumption communities in Kepulauan Meranti district, Riau province**

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Riau Province, Indonesia

**Objective:** The objective of this study was to identify the risk factors of prediabetes in sago consumption communities in Kepulauan Meranti District, Riau Province.

**Methods:** The research type was observational with cross sectional design. The population in this study were purposive sampling. The sample in this study was chosen based on the inclusion criteria sago consumption, aged 35-80 years, and not diagnosed with diabetes and divided into 2 groups that often consume sago and the group that rarely consume sago with total sample in this research is 181 people. Data collection consists of primary data and secondary data. Primary data of socio-demographic factors, anthropometry, lifestyle, history of T2DM, random blood glucose, cholesterol levels, blood pressure, and waist circumference were collected were obtained through measurement by local health workers. 24 hour recall and Semi Quantitative Food Frequency were obtained through direct interviews to respondents.

**Results:** 72.93% of the subject who consumed sago  $\geq 50$  grams/day and 18.23% who consumed sago <50 grams/ day had normal blood glucose levels. Both of subjects had no relationship between socio-demographic factors, lifestyle, history of T2DM, cholesterol level, waist circumference and prediabetes incidence. However, systolic blood pressure significantly associated with prediabetes incidence.

**Conclusion:** Consuming sago  $\geq 50$  grams/day could prevent prediabetes from developing to T2DM and systolic blood pressure has significant role in controlling blood glucose level.

PE158 Clinical diabetes and therapeutics

**Effects of rebound therapy on HbA1c, quality of life, and balance in the patients with diabetic neuropathy**

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University of Isfahan, Iran, Islamic Republic of

**Objective:** This study aimed to highlights the lack of comprehensive studies focusing on rebound exercises as an intervention for diabetic neuropathy and its associated outcomes in the female patients suffering from diabetic neuropathy type 2.

**Methods:** Employing a semi-experimental approach, this study assessed 29 diabetic women under clinical treatment. Randomly assigned, they formed an experimental group (n=15, mean age:  $45.9 \pm 1.6$ ) and a control group (n=14, mean age:  $50.9 \pm 1.6$ ). The experimental group engaged in thrice-weekly exercises for 12 weeks, while the control group received standard medical care. Evaluations were conducted at baseline (day 1) and after 12 weeks (day 90), involving HbA1c blood tests, SF-36 quality of life questionnaires, and dynamic/static balance tests.

**Results:** The findings showed statistically significant changes in the quality-of-life physical component summary (PCS) (P=.000), quality-of-life mental component summary (MCS) (P=.001), static balance (P=.003), dynamic balance (P=.000), and HbA1c levels (P=.000) of the experimental group in the posttest, while the changes were not statistically significant in the control group's posttest results.

**Conclusion:** The findings revealed the potential benefits of rebound exercises as a complementary intervention for diabetic neuropathy, showcasing improvements in both physical and mental well-being, as well as balance capabilities. Further investigations and longitudinal studies are warranted to validate these outcomes.

PE157 Clinical diabetes and therapeutics

**Impact of the hyperpersonalized smart education platform, doctorvice for remote intensive care in first insulin user after discharge in T2DM patients: randomized clinical study**

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**Objective:** T2DM (type 2 diabetes mellitus) Patients who started insulin treatment for the first time could experience hyperglycemia or hypoglycemia and increased glucose fluctuation during early phase of insulin use. Although these patients receive education on how to use insulin and blood sugar control through inpatient treatment, it is difficult to maintain the effect of this education after being discharged from the hospital. This study aimed to see glucose control status while patients get an intensive remote care using the hyperpersonalized smart education platform, Doctorvice Clinic<sup>®</sup> after discharge

**Methods:** Among T2DM patients who were admitted to Seoul St. Mary's Hospital, a total of 20 participants enrolled in a randomized clinical study. The participants were age over 19 years old and were using insulin for the first time. In the intervention group, doctors sent patient-customized educational content to participants after discharge. The control group received conventional management. The primary endpoint was TIR (Time in range) target.

**Results:** Of the total 20 participants, 7 participants in the intervention group and 8 participants in the control group were analyzed, excluding those who dropped out. The mean TIR level in the intervention group was 77.4% and that of the control group was 63.6%, which was not significant. The mean TAR level in the intervention group was 13.9% and that of the control group was 32.8%, which was significant (p=0.0297).

**Conclusion:** Providing hyperpersonalized education by doctors after discharge, showed an improved tendency of TIR level and TAR level. It can be seen that the smart education system can be helpful for intensive diabetes management after discharge.

PE160 Clinical diabetes and therapeutics

**Efficacy and safety of a fixed dose combination of dapagliflozin and linagliptin[AJU-A51] in patients with type-2 diabetes mellitus: a multi center, randomized, double-blind, parallel group, placebo-controlled phase III study**

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**Objective:** To evaluate the efficacy and safety of add-on dapagliflozin in patients with type 2 diabetes mellitus who had inadequate glycemic control with metformin and linagliptin.

**Methods:** In this randomized, placebo-controlled, parallel-group, double-blind, phase III study, 235 patients with inadequate response to metformin ( $\geq 1000$  mg/day) plus linagliptin (5 mg/day) were randomized to receive either dapagliflozin 10 mg/day (n=117) or placebo (n=118) for 24 weeks. After the 24-week treatment, patients who received the placebo were switched to dapagliflozin and treated for an additional 28 weeks. The primary endpoint was change in HbA1c from baseline to week 24.

**Results:** The baseline characteristics were similar between the two groups. At week 24, the least squares mean difference in HbA1c changes was -0.88% (95% CI -1.07 to -0.68, p<0.0001). Dapagliflozin add-on to linagliptin and metformin significantly reduced mean HbA1c levels versus linagliptin and metformin. The safety profiles were similar: the incidence rates of treatment-emergent adverse events (TEAE) up to week 24 were 20.51% (95% CI 13.20 to 27.83) and 21.19% (95% CI 13.81 to 28.56) in the dapagliflozin and placebo groups (p=0.89). Of these, severe adverse events (SAE) were reported in three (2.56%) participants in the dapagliflozin group, two (1.69%) in the placebo (p=0.6835). TEAE and SAE were similar between dapagliflozin group and placebo group.

**Conclusion:** Fix dose combination of Dapagliflozin and Linagliptin [AJU-A51] added on to Metformin was found to be efficacious and well tolerated in the treatment of patients with T2DM, and demonstrated superiority to linagliptin treatment added on to Metformin.

## PE161 Clinical diabetes and therapeutics

**Reduced severe hypoglycemia risk with SGLT2 inhibitors compared to DPP4 inhibitors in type 2 diabetes**Eun Sook Kim<sup>1\*</sup>, Yunjung Cho<sup>1</sup>, Kwanhoon Cho<sup>1</sup>, Kyung Do Han<sup>2</sup>, Mee Kyoung Kim<sup>3</sup>, Ki-Hyun Baik<sup>3</sup>, Sung Dae Moon<sup>1</sup>, Je-Ho Han<sup>1</sup>, Ki-Ho Song<sup>3</sup>, Hyuk-Sang Kwon<sup>3</sup>Incheon St. Mary's Hospital The Catholic University of Korea, Korea<sup>1</sup>, Soongsil University, Korea<sup>2</sup>, Yeouido St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Korea<sup>3</sup>

**Objective:** Severe hypoglycemia has been linked to substantial health consequences such as cardiovascular events and mortality. We investigated the risk of severe hypoglycemia associated with sodium-glucose transport protein 2 (SGLT2) inhibitors compared with dipeptidyl peptidase-4 (DPP4) inhibitors.

**Methods:** Using data from the National Health Insurance Service of Korea, we ascertained the initiators of SGLT2 or DPP4 inhibitors from 2014 to 2017. Based on a 1:1 propensity score match, we included new users of SGLT2 (n=57,021) and DPP4 (n=57,021) inhibitors. We used the Cox proportional hazards model to estimate hazard ratios (HRs) with 95% confidence intervals (CIs) for developing severe hypoglycemia in the matched sample. Exploratory subgroup analyses were performed to assess the consistency of the treatment effects on the primary outcome.

**Results:** During a follow-up of 1 year, the incidence rate of severe hypoglycemia was 1.88 and 3.28 per 1,000 person-years in patients treated with SGLT2 and DPP4 inhibitors, respectively. SGLT2 inhibitors, as opposed to DPP4 inhibitors, were associated with a significantly lower risk of severe hypoglycemia (HR, 0.57; 95% CI, 0.45-0.73). In subgroup analyses, SGLT2 inhibitors showed a significantly decreased risk of hypoglycemia in women, patients with peripheral artery disease, and patients on angiotensin-converting enzyme inhibitors/angiotensin receptor blockers and sulfonylureas, whereas their counterparts did not.

**Conclusion:** The new use of SGLT2 inhibitors was associated with a 43% lower risk of severe hypoglycemia than DPP4 inhibitors. SGLT2 inhibitors may be safer in glycaemic control than DPP4 inhibitors, especially in subjects at an increased risk of severe hypoglycemia.

## PE162 Clinical diabetes and therapeutics

**Real-world discontinuation, persistence, and adherence of glucagon-like peptide 1 receptor agonists among patients with diabetes in Hong Kong**Shun Yan Chow<sup>1\*</sup>, Pui yin Au-Yeung<sup>1</sup>, Hongjiang Wu<sup>1</sup>, Eric SH Lau<sup>1</sup>, Alice PS Kong<sup>1</sup>, Ronald CW Ma<sup>1</sup>, Andrea Luk<sup>1</sup>, Risa Ozaki<sup>2</sup>, Juliana Chan<sup>1</sup>, Aimin Yang<sup>1</sup>The Chinese University of Hong Kong, China<sup>1</sup>, Prince of Wales Hospital, China<sup>2</sup>

**Objective:** Real-world studies in Europe and US suggest discontinuation of glucagon-like peptide 1 receptor agonists (GLP1-RAs) as high as 45% within 5 years, however data amongst Asians are scarce. We used real-world data to examine the discontinuation, persistence, and adherence with GLP1-RAs in patients with diabetes in Hong Kong.

**Methods:** This was a territory-wide prospective cohort of 2,550 patients with diabetes who were initiated on GLP1-RAs (liraglutide, exenatide, dulaglutide, and lixisenatide) in 2008-2019. We calculated the therapy persistence and time to first treatment discontinuation over the follow-up period. Treatment discontinuation was defined as the absence of dispensation of GLP1-RAs for at least 90 consecutive days. Adherence was defined as proportion of days covered (PDC).

**Results:** Of 2,550 patients (55.9% men, age: 54.5±11.8 years, body mass index: 32.0±5.6 kg/m<sup>2</sup>), liraglutide was the most commonly initiated GLP1-RA (58.9%), followed by exenatide (20.9%), dulaglutide (13.9%), and lixisenatide (6.3%). Approximately half of users (47.6%) discontinued GLP1-RAs at nine months. During a median (IQR) follow-up of 1.9 (0.9, 4.1) years, the median time to treatment discontinuation was longest for liraglutide (11 months) versus dulaglutide (10 months) and exenatide (8 months). Users of liraglutide had the highest persistence (55.8%), followed by dulaglutide (50.8%), lixisenatide (48.8%), and exenatide (45.1%) at nine months. Among persistent users, the overall adherence (defined as a PDC >80%) was high, ranging between 85.9% and 92.5% at 9 months. Only 6.8% of patients who discontinued GLP1-RAs reinitiated the treatment during the follow-up period.

**Conclusion:** Approximately half of GLP1-RAs users discontinued therapy within nine months with differences between formulations. Adherence was found to be high among persistent users. Further studies into reasons for discontinuation and suboptimal adherence are warranted.

## PE165 Clinical diabetes and therapeutics

**Artificial pancreas system for patients with type 2 diabetes: a meta-analysis**Jihe Ko<sup>1\*</sup>, Sun Joon Moon<sup>1</sup>, Jung Hoon Lee<sup>2</sup>, Shin Je Moon<sup>2</sup>, Cheol Young Park<sup>1</sup>Kangbuk Samsung Hospital, Sungkyunkwan University School of Medicine, Korea<sup>1</sup>, Sungsim Hospital, University of Hanrym College of Medicine, Korea<sup>2</sup>

**Objective:** While artificial pancreas systems (APS) are considered a standard therapy for type 1 diabetes (T1D), there is limited evidence and scarce meta-analyses concerning their application in type 2 diabetes (T2D). Our objective was to conduct a meta-analysis to assess the effectiveness of APS in managing T2D.

**Methods:** We systematically searched PubMed, Embase, the Cochrane Library, and grey literature for studies published up until July 2023. Our inclusion criteria encompassed randomized controlled trials (RCTs) comparing APS with conventional therapy and single-arm trials comparing outcomes before and after APS utilization in T2D cases. The primary outcome measure was the percentage of time in range of 70-180 mg/dL or 100-180 mg/dL (TIR). Secondary outcome measures included the percentage of time below range of 70 mg/dL or 63 mg/dL (TBR), mean glucose levels, and standard deviation (SD). Data were synthesized as mean differences (MDs).

**Results:** Our meta-analysis included a total of 9 trials comprising 803 participants. The use of APS was associated with a significantly higher TIR in both RCTs compared to control groups (MD 19.25%, 95% confidence interval [CI] 12.36 to 26.14) and in before-and-after comparisons (MD 16.99%, 95% CI 9.13 to 24.86). APS demonstrated no significant difference in TBR (MD -0.21%, 95% CI -0.44 to 0.01), yet it consistently led to a significant reduction in mean glucose levels (MD -24.48 mg/dL, 95% CI -35.31 to -13.65) and SD (-7.02 mg/dL, 95% CI -11.45 to -2.59). There were no notable differences in severe adverse events or severe hypoglycemia between groups.

**Conclusion:** Our findings suggest that APS represents an effective treatment option for patients with T2D, in addition to its established benefits for T1D management. The utilization of APS resulted in a substantial increase in TIR and a decrease in mean glucose levels without a concurrent increase in the incidence of hypoglycemia.

## PE166 Clinical diabetes and therapeutics

**2 vs. 1: SGLT2 inhibitor & thiazolidinedione impact on brain diseases - real clinical data insights**Sang Joon Park<sup>1\*</sup>, Hye Jeong Kim, Dong Won Byun, Kyo-Il Suh  
Soonchunhyang University Hospital, Korea

**Objective:** Diabetes is a recognized risk factor for numerous complications including cerebrovascular disease and dementia. Hyperinsulinemia and insulin resistance in the brain have been linked to amyloid beta metabolism, raising the risk of Alzheimer's dementia. Among the commonly prescribed diabetes medications, thiazolidinediones, especially pioglitazone, are suggested to decrease the risk of recurrent stroke and possibly Alzheimer's dementia. SGLT2 inhibitors also have been indicated to reduce dementia risk. This study aimed to investigate the comparative efficacy of SGLT2 inhibitors and thiazolidinediones in modifying the risk of cerebrovascular events, dementia, and Alzheimer's dementia alone.

**Methods:** Using the common data model, we analyzed patients from December 31, 2011 to December 30, 2022 from 15 hospitals. We evaluated whether these medications influenced the incidence of the aforementioned conditions. Clinical outcomes between SGLT2 inhibitors and thiazolidinediones were compared using hazard ratios (HRs), with large-scale propensity score matching and a random-effects model applied.

**Results:** After analyses, patients on SGLT2 inhibitors displayed a reduced rate of cerebrovascular events (HR 0.2787, 95% CI 0.1882-0.4127, p<0.00001), dementia (HR 0.5395, 95% CI 0.3824-0.7614, p-value 0.0004), and Alzheimer's dementia alone (HR 0.586, 95% CI 0.4634-0.7411, p<0.00001) compared to those on thiazolidinediones.

**Conclusion:** In conclusion, in patients with type 2 diabetes, SGLT2 inhibitor administration was associated with a significantly lower risk of cerebrovascular events, dementia, and Alzheimer's dementia alone compared to thiazolidinediones. Further studies are needed to confirm these findings and elucidate the underlying mechanisms.

## PE167 Diabetes care &amp; education

**Impact of diabetes-related knowledge, attitudes, and practices on glycemic control in type 2 diabetes: a comprehensive study**

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**Objective:** Diabetes mellitus is a global health concern associated with long-term complications and increased healthcare expenditure. Active patient knowledge and practices regarding lifestyle modifications, medication use, and blood glucose monitoring are crucial for effective diabetes management. This study aimed to investigate the association between diabetes-related KAP and glycemic control, as measured by HbA1c levels, in individuals with type 2 diabetes.

**Methods:** A hospital-based cross-sectional study was conducted among diagnosed cases of diabetes (Duration of diabetes >1 year) visiting Kathmandu University Hospital. Data were collected using a self-structured questionnaire, and the KAP scores were calculated (Total score: 100). The association between KAP scores and demographic variables, co-morbidities, and glycemic control (HbA1c) was analyzed descriptively and statistically.

**Results:** The study included 218 participants (54.2% male and 45.8% female). The mean values for BMI, FBS, PPBS and HbA1c were  $23.42 \pm 2.62$ ,  $121.95 \pm 42.01$ ,  $209.92 \pm 98.53$  and  $7.70 \pm 2.38$  respectively. KAP score ranged from 35 to 87 with mean score of  $61.60 \pm 10.13$ . Notably, 41.5% of participants had controlled diabetes based on HbA1c levels, while 58.5% had uncontrolled diabetes. The mean KAP score differed significantly between controlled ( $65.94 \pm 9.39$ ) and uncontrolled ( $58.52 \pm 9.56$ ) diabetes groups ( $P=0.001$ ). A significant negative correlation was observed between HbA1c levels and KAP scores ( $r=-0.45$ ,  $P=0.001$ ). Furthermore, the KAP score was identified as the only independent risk factor for higher HbA1c in type 2 diabetic patients ( $P=0.001$ ).

**Conclusion:** This study sheds light on the pivotal role of diabetes-related KAP in achieving optimal glycemic control. The findings have significant implications for healthcare professionals, emphasizing the importance of patient education and support programs in diabetes management. These findings can contribute to the development of effective educational programs aimed at preventing and managing diabetes in developing country like Nepal.

## PE168 Diabetes care &amp; education

**The relationships between activities supporting health product literacy and food consumption behaviors of school age children with risk factors of diabetes in Thailand**

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**Objective:** This research aims to explore the relationships between the activities supporting health product literacy and food consumption behavior which improve children's consumption behavior, and to monitor a level of health product literacy and children's behavior on food selection.

**Methods:** To achieve this, the Oryornoi plus activity was developed which consisted of three activities. A sample included children age 9-12 years old who began to overweight and become obese which are risk factors of diabetes. The data included children's weight before and after engaging in the program, their knowledge on health product, and eating behavior. It was found that before the children participated in the research.

**Results:** The result of research found score of a level of health product literacy (132.8 out of 240 scores) was relatively low. Additionally, the children had an inappropriate consumption behavior. For instance, more than 68.5% of them consumed snack and soft drink regularly. After participating in the project, they had a higher level of knowledge of health product but it remained insufficient (154.6 scores). Nevertheless, 72.6% of them consumed more appropriate, reduce major of Diabetes in childhood risks but consumption behavior remained unstable. Moreover, the health product knowledge had a medium level of positive relationship with an appropriate consumption behavior.

**Conclusion:** The literacy had a low level of positive relationship with the appropriate consumption behavior. Lastly, it is recommended that related sectors should proactively collaborate in the project to educate and raise awareness to the children, and a qualitative investigation should be conducted to find a root cause of this issue. The recommendation for future studies as related sectors should proactively collaborate in the project to assist children to understand the health issue and should be offered the accessibility to the health information, better communication, improved health care behavior, media literacy, and decision making from obesity prevention.

## PE170 Diabetes care &amp; education

**The impacts of physiotherapeutic interventions on balance and mobility in patients with diabetes**

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**Objective:** The objective of this study is to analyse the impact of physiotherapeutic interventions on balance and mobility in patients with diabetes.

**Methods:** Total 100 participants with diabetes were categorised into two groups: an intervention group (50) that received physiotherapeutic interventions including balance training, aerobic exercises, resistance training, and neuromuscular exercises and a control group (50) that received standard diabetes care without physiotherapeutic interventions. Balance and mobility were assessed in both groups before and after the intervention period.

**Results:** The primary findings revealed a significant positive correlation between physiotherapeutic interventions and improvements in balance and mobility in the intervention group. The data also highlighted the potential for these interventions to reduce the risk of falls, a common issue in diabetic patients.

**Conclusion:** The findings underline the importance of integrating personalized physiotherapeutic interventions into the standard care plan for diabetes management. The study indicates the potential of physiotherapeutic interventions to enhance the quality of life for diabetic patients, emphasizing their importance in comprehensive diabetes management.

## PE171 Diabetes care &amp; education

**Machine learning prediction model for depression in patients with diabetes mellitus after COVID-19 pandemic**

Haewon Byeon\*  
Inje University, Korea

**Objective:** The purpose of this study was to develop predictive models to identify diabetic patients at high risk of developing depression based on a number of risk factors. Machine learning techniques were used to identify the most significant risk factors for depression in local diabetic patients.

**Methods:** The study included 26,829 adults in the community who had been diagnosed with diabetes. The prevalence of depressive disorders served as the study's dependent variable. This study created a model for predicting diabetic depression using multiple logistic regression to determine the relationship (influence) of predictive factors for diabetic depression by entering the top 9 variables of high importance identified in CatBoost. Using multiple logistic regression and adjusting for all confounders, diabetic depression was predicted.

**Results:** 22.4% of the 6,001 participants suffered from depression. The top 9 variables of high importance in this study, which used CatBoost to assess the significance of factors related to depression in diabetic patients living in the South Korean community, were gender, smoking status, change in drinking before and after COVID-19 pandemic, change in smoking before and after COVID-19 pandemic, subjective health, concern about economic loss due to COVID-19 pandemic, change in sleeping hours due to COVID-19 pandemic, and economic loss due to COVID-19 pandemic.

**Conclusion:** It is crucial to identify the high-risk group for diabetes and depression at an early stage, taking into account a variety of risk factors, and to seek a specific psychological support system at the primary medical level, which can improve their mental health.

## PE172 Diabetes care &amp; education

**Investigation of risk factors for impaired fasting glucose in middle-aged people living in South Korean communities using machine learning**

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Inje University, Korea

**Objective:** This epidemiological study aimed to: (1) identify risk factors for impaired fasting glucose using data from 3,019 healthy volunteers aged 30-60 years who did not have diabetes mellitus; and (2) create a nomogram that could predict risk factors for impaired fasting glucose using machine learning.

**Methods:** 3,019 adults between the ages of 30 and 65 who participated in blood tests, physical examinations, blood pressure checks, and health surveys were examined in this study. Normal blood glucose was defined as a glycated haemoglobin of 5.7% and a fasting blood glucose of 100 mg/dl or less; impaired fasting glucose was defined as a glycated haemoglobin of 5.7-6.4% and a fasting blood glucose of 100-125 mg/dl or more. Explanatory variables included sociodemographic factors, health behaviour factors, anthropometric factors, dietary behaviour factors and cardiovascular disease risk factors. Using a logistic nomogram and categorical boosting (CatBoost), this study created a model to predict impaired fasting glucose.

**Results:** Age, high cholesterol, WHtR, BMI, drinking more than one shot per month in the previous year, marital status, hypertension and smoking were the top eight factors in this study that had a significant impact on CatBoost model performance.

**Conclusion:** To identify non-diabetics at risk of impaired fasting glucose in the community early and manage their blood glucose, we need to improve lifestyle and monitor people continuously in primary care.

## PE173 Diabetes care &amp; education

**Exploring factors affecting testing for diabetes complications during the COVID-19 pandemic using machine learning**

Haewon Byeon\*  
Inje University, Korea

**Objective:** This study used a national survey conducted in South Korea to determine the proportion of adult diabetic patients aged 19 years and older who did not receive a diabetes complication test (fundus examination and microprotein urine test), and based on this, developed a model to predict the likelihood of not receiving a diabetes complication test.

**Methods:** The 2020 Community Health Survey included 25,811 participants who reported having been diagnosed with diabetes by a physician. The outcome measures were use of dilated eye exams and urine microprotein testing in the previous year. To understand how predictive factors relate to the use of a diabetes complication test, this study developed a model to predict the use of a diabetes complication test using a nomogram and logistic regression analysis.

**Results:** The results of this study supported the hypothesis that non-use of diabetes complication testing after the COVID-19 pandemic was independently influenced by age, education level, self-reported blood glucose, current diabetes treatment, diabetes management education, not having had a glycated haemoglobin test in the previous year, smoking, single-person household, subjectively good health and rural residence.

**Conclusion:** Further longitudinal studies are needed to confirm the causality of non-use of screening tests for diabetes complications.

## PE177 Diabetes care &amp; education

**Associated factors of type 2 diabetes mellitus in Indonesian adolescents**

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Sulawesi Barat University, Indonesia

**Objective:** Type 2 diabetes is a common condition that causes the level of sugar (glucose) in the blood to become too high, chronic health condition that can lead to other serious health issues such as heart disease, stroke, blindness, and kidney failure. According to data from the Institute for Health Metrics and Evaluation, diabetes was Indonesia's 3rd highest cause of death in 2019, namely around 57.42 deaths per 100,000 population. Data from the International Diabetes Federation (IDF) found that the number of diabetics in 2021 in Indonesia has increased rapidly in the last ten years. This number is expected to reach 28.57 million in 2045 or 47% greater than 19.47 million in 2021. Diabetes suffered by adolescents is likely caused by lifestyle and health problems. Factors such as genetics can increase a teenager's risk of developing diabetes, but many unhealthy lifestyles are the main problem that causes young people to develop diabetes eventually. This study aims to determine associated factors of type 2 diabetes mellitus in Indonesian adolescents.

**Methods:** The method used was studying secondary data from published journals and evaluated by searching in PubMed, EMBASE, and the Cochrane Library database. Data collected from 20 selected articles that published in the last 10 years (from 2013-2023) and the sampled was adolescent in Indonesia.

**Results:** Based on the dependent variable, it was found that 18 factors were related to type 2 diabetes mellitus in adolescent in Indonesia. Those factors were physical activity, history of hypertension, high triglycerides, history of dyslipidemia, exercise habits, body mass index, education level, low economic income, consumption of fast food, consumption of instant drinks, smoking habits, heredity, age, obesity, insulin resistance, blood sugar levels, consumption of fruits-vegetables and unhealthy lifestyle.

**Conclusion:** Need to increase health promotion and prevention about the factors that cause the incidence of type2 diabetes mellitus in adolescents.

## PE178 Diabetes care &amp; education

**Effect of education on glycemic control after using continuous glucose monitoring system in patients with diabetes**

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**Objective:** Continuous glucose monitoring system (CGMS) can track people's daily habits and provide various glycemic information. However, unless patients have sufficient knowledge regarding self-management, this approach may be less effective. For this reason, this study analyzed the effect of self-management education based on the result from CGMS for glycemic control.

**Methods:** This study was conducted with 234 patients with diabetes who used the CGMS from November 1, 2022, to February 28, 2022 at the Department of Endocrinology at K University Hospital. Of the 234 patients, 83 failed to satisfy the inclusion and exclusion criteria, thus the effect of the education was retrospectively evaluated for 151 subjects. The primary variable of interest was the reduction in HbA1c levels after using the CGMS for three months compared to their initial levels, and the primary explanatory variable was exposure to the education program.

**Results:** Of the 151 subjects, 97 were allocated to the education group and 54 to the non-education group. Reduction in HbA1c was greater for the education group, whose average HbA1c levels fell by 0.91% compared to 0.51% for the non-education group (p=0.013). The multivariable analysis testing the effects of the education program while correcting for the confounders found that the reduction in HbA1c levels was significantly higher for the education group (p=0.031).

**Conclusion:** The diabetic education for patients who used the CGMS has a significant effect on the reduction in HbA1c levels. This suggests that implementing an education program for patients in combination with a CGMS can improve glycemic control. However, the present study was not able to confirm potential lifestyle changes among the subjects, which is the ultimate goal of this type of education. Therefore, further research incorporating correctable factors and clinical indicators is required to investigate the effects of continuous glucose monitoring systems in more detail.

**PE179** Diabetes care & education

**What they know and how we help them: a qualitative study on healthcare professionals perceptions of patient health literacy and health promotion for the prevention of diabetic foot ulcers**

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**Objective:** Diabetic Foot Ulcers (DFU) are a serious, highly morbid consequence of enduring and poorly managed diabetes. This multifactorial condition can result in minor or major amputation and even premature death. Patients living with DFU are also observed to exhibit a myriad of psychosocial complaints. The condition, however, is highly preventable given proper preventative care; with patients' agency in adhering to treatment and eliciting proper lifestyle changes being a major variable for prevention, management, and treatment. Such agency is scaffolded by how patients know about their condition, as well as how Health Care Professionals (HCPs) educate them. The current study seeks to qualitatively explore HCPs' perceptions of patient health literacy and health promotion needs surrounding DFU.

**Methods:** Data from 8 Focus Group Discussions sampling 19 HCPs from various vocations across four hospitals was thematically analyzed via a social-constructivist paradigm.

**Results:** Three major themes with six subthemes were emerged from the analysis to illustrate the interplay between: 1) *Health Literacy Complexities* (encompassing the subthemes of (a) Balancing Knowledge Levels, Sources, and Belief System, (b) Competing Priorities: Life over Diabetes, (c) Caregiving Literacy and Family Empowerment); 2) *Holistic Health Promotion*, (encompassing the subthemes of (d) Class is in Session: Consolidating Pedagogies; (e) Prevention is better than Cure: Pre-emptive Health Promotion, (f) Patient as Primary Change Agent), and 3) *Multidisciplinary Structural Support* in preventing DFU and supporting patients' health.

**Conclusion:** Clinical implications of the findings are discussed, including the use of narrative strategies for health promotion, therapeutic patient education, and community-level policy considerations.

**PE182** Diabetes care & education

**Diabetes care: the impact of COVID 19 pandemic and economic status on diabetes care in Sudan**

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**Objective:** The whole world is facing the current COVID-19 pandemic, the most serious Health crisis in modern times. This pandemic affects all people but it's serious in the case of Diabetes. Although Sudan has a well-established healthcare system, yet it has so many Drawbacks mainly due to economic and managerial reasons.

The aim of this study is to give an insight over the diabetes care in Sudan, Assess The patient's access to medications, and assess the situation from both economic status and Patients prospective.

**Methods:** This research was done from many electronic databases: Ministry of health and WHO Sudan reports and direct observation from hospitals and public pharmacies.

**Results:** The economic situation of Sudan and COVID 19 crisis led to a negative impact on Nutrition; Since the implementation of the complete curfew in Sudan, the closure of Markets, lack of vegetables, fruits, and the lack of basic foods, led to poor nutritional states in diabetics. It also affected Daily exercises which are one of the most important parts of Treatment, as curfew reduced the daily exercise; result in the failure to regulate blood sugar Levels. And it also affected the patient follow up due to decrease in medical staff in hospitals and closure of most follow up clinics by 62%. It also affected the Availability of the Medications Treatment was deficient in all hospitals and pharmacies by 65%, which led to The monopoly of the remaining medicines and sold at a double price.

**Conclusion:** Due to the Covid-19 crisis and the bad economic status of the country, Lack of healthy food, poor follow up and unavailability of medications; Diabetic Patients face a higher chances of experiencing serious complications especially when Infected with the virus.

**PE181** Diabetes care & education

**Patterns of insulin use and its cost in managing diabetes in Mongolia: preliminary results**

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**Objective:** This study aims to investigate insulin use patterns and the associated out-of-pocket costs in Mongolia, while exploring the potential relationship between insulin-related costs and non-adherence to insulin treatment.

**Methods:** We included 262 individuals with diabetes from three district hospitals. Exclusions were made to minimize bias, such as first-time prescribed insulin and gestational diabetes patients. Data were collected through questionnaires, assessing insulin non-adherence as a decrease in prescribed insulin dose over one month. Insulin costs per month were obtained through patient interviews, including information on insulin vials or penfills and their associated costs.

**Results:** Among the participants, 78.2% (n=205) used human-recombinant insulin, while 21.8% (n=54) used analogue insulin. The mean total daily insulin dose was 38.6±14.4 units, and the insulin vintage for type 2 diabetes patients was 4.5±0.4 years. Insulin pen usage was reported by 72.5% (n=190) of participants. Approximately 10% of patients paid out-of-pocket for insulin, representing about 13% of household income. Moreover, 46.6% (n=123) of patients used reduced insulin doses, indicating non-adherence to insulin treatment. Regression analysis showed that main predictors for insulin non-adherence were insulin-related out-of-pocket costs (OR=1.67, p=0.041) and the absence of an insulin pen (OR=2.76, p=0.021), while the pattern of insulin used did not significantly influence non-adherence (p>0.05).

**Conclusion:** The majority of individuals with diabetes in Mongolia use human-recombinant insulin. Notably, 10% of patients bear the cost of insulin themselves, potentially contributing to insulin non-adherence. These preliminary findings warrant further investigation into strategies to address the financial burden of insulin and improve adherence to treatment in diabetes management.

**PE183** Diabetes care & education

**The impact of social engagement among community-dwelling older people with type II diabetes: an interpretative phenomenological analysis study**

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**Objective:** By the year 2030, Malaysia is projected to undergo demographic aging, transforming into an aged nation wherein 15 percent of its populace will comprise older people. Ageing often associated with deterioration in health condition such as endocrine disorder, cardiovascular disease and cognitive impairment which eventually impact their engagement in social activity. The aim of this study is to explore an ideographic experience of social engagement among community-dwelling older people with Type II Diabetes.

**Methods:** This study employed a qualitative study with ten older people (n=10) in Kelantan, Malaysia using in-depth interview, with the goal of identifying their involvement in social engagement. The findings from both stages were analysed using the six stages of interpretative phenomenological analysis. Data were analysed thematically.

**Results:** The study elucidates significant themes pertaining to the engagement in social activity and its impact among the older people, encompassing the following aspects: (1) Social Support and Diabetes Management, (2) Psychological Well-being and Social Interaction, (3) Social Isolation and Health Outcomes, (4) Coping Strategies and Social Participation, and (5) Community Support and Empowerment. The identified themes underscore the important of social participation as a highly constructive strategy for community-dwelling older people in Malaysia to cope with changes in their health status, leading to enhanced life satisfaction, sustained productivity, and improved overall quality of life.

**Conclusion:** In conclusion, fostering social participation among community-dwelling older people with Type II Diabetes is not only beneficial for their health and well-being but also contributes to a more inclusive and cohesive society. By recognising and promoting the value of social engagement, the government can strive towards creating a fulfilling and enriching environment that caters to the needs of older people.

## PE185 Diabetes care &amp; education

**The impact of people's purchasing power on healthy food in the increasing the number of diabetics; case study in Pekanbaru City, Riau province**Mikha Melina Harahap\*  
Riau Province, Indonesia

**Objective:** This study aimed to analyze the purchasing power of the community on healthy food in the increasing number of diabetics in Riau province.

**Methods:** The design of this study was a cross sectional study through interviews and filling out FFQ and food recall questionnaires, as well as collecting data the types of food consumed daily and the amount of daily expenditure on food from subjects with income in range the Regional Minimum Wage. The number of subjects was 389, with inclusion criteria was housewives aged 25 to 58 years and there were not family members diagnosed with diabetes.

**Results:** The results showed that income of IDR 3,300,000 a month, the average daily food expenditure is IDR 1,478,000 per household, which shows that every day the expenditure for food is IDR 49,000, assuming 3 meals for 4 people. Most of subjects have traditional food patterns with more rice, instant noodles, sweet tea, bread, and other flour-containing products that mostly have a glycemic index above 70. Less of them consume the healthy food which relatively more expensive. Whereas, food with high carbohydrates can be increasing into high blood glucose. Carbohydrate content in food is measured in the glycemic index (GI). Meanwhile, healthy food requires high costs because foods with a glycemic index (GI) are found in organic vegetables and fruits which are.

**Conclusion:** As for the variable income has a significant influence on the purchasing power of healthy foods in the Pekanbaru city. The healthy lifestyle was difficult for people with a middle to lower economy according to the purchasing power which assume will impact to increasing the number of diabetics.

## PE186 Diabetes care &amp; education

**Assessment of inappropriate retesting of glycated hemoglobin (HbA1c) in a tertiary hospital of Nepal**

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Kathmandu University School of Medical Sciences, Nepal

**Objective:** Effective utilization of laboratory tests is crucial for optimizing healthcare resources. Minimum Retesting Intervals (MRI) play a vital role in guiding the appropriate frequency of test repetition, taking into account test properties and clinical contexts. HbA1c, a crucial marker for blood sugar monitoring, typically has an MRI of 90 days. The aim of our study was to evaluate the extent of inappropriate retesting of HbA1c in a tertiary hospital setting in Nepal.

**Methods:** In this observational study, we conducted a hospital-based secondary data analysis through an audit. Medical records of patients who underwent HbA1c testing were extracted from the Hospital Information Management Software. We focused on HbA1c data from November 2022 to June 2023 for analysis.

**Results:** During the eight-month study period, a total of 7,470 HbA1c tests were conducted. Among the 5,454 patients tested, 3,919 (71.8%) had a single test, 1,156 (21.2%) were tested twice, 302 (5.5%) were tested three times, 63 (1.2%) were tested four times, and 11 (0.2%) were tested five times. Remarkably, three patients underwent HbA1c testing six, seven, and thirteen times, respectively, within the eight-month duration. Strikingly, 498 patients (9.1%) received inappropriate HbA1c testing, not adhering to the MRI of 90 days. Among these, 371 (74.49%) were either government or hospital-insured patients.

**Conclusion:** HbA1c is a widely accepted laboratory test for the diagnosis and monitoring of diabetes mellitus. However, our study reveals a significant number of inappropriate tests, breaching the Minimum Retesting Interval (MRI) for HbA1c in a tertiary care hospital. This inappropriate retesting incurs unnecessary costs and provides limited benefits to patients. In developing countries like Nepal, stringent monitoring and checks are essential for the proper implementation of health insurance policies, ensuring efficient healthcare resource allocation.

## PE187 Diabetes care &amp; education

**Estimated cost of CGMS for T1DM patients in Mongolia**Boldbaatar Enkhjin\*, Sonomtseren Sainbileg  
Endomed Hospital, Mongolia

**Objective:** Over 1.2 million children and adolescents have type 1 diabetes. In IDF Diabetes Atlas 10th Edition 2021 reports, Mongolia has 185 children and adolescence (0-19 years old) with type 1 diabetes. The most accurate 14-day continuous glucose monitoring system (CGMS) to help reduce time spent in hypoglycemia and improve overall glucose control. Aim of this study was to estimate cost of CGMS for type 1 diabetic patients around a year in Mongolia.

**Methods:** We analyzed only 14-day continuous glucose monitoring system (CGMS) costs by 200 type 1 diabetic patients per year and economic burden for patients in Mongolia based on real market price by levels of care structure such as comprehensive care.

**Results:** Comprehensive level of care: demanded 520.000 USD per year for 200 type 1 patients for continuous glucose monitoring system (CGMS) for accurate control of blood glucose. There of 0% from state budget or health insurance and 100% from patients' pocket.

**Conclusion:** Estimated economic burden is very high by comprehensive level of care with continuous glucose monitoring system (CGMS) for type 1 diabetic patients in Mongolia. It is necessary to decrease economic burden of family which type 1 diabetic patients by increasing state budget or improving health insurance system.

## PE188 Diabetes care &amp; education

**Direct and in-direct cost of diabetes care among individuals with type 2 diabetes mellitus**

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**Objective:** Management of type 2 diabetes mellitus (T2DM) exerts a substantial burden on individual and country's economy. Early predisposition of T2DM, adversely affects productivity and economic development of the country. In the presence of limited number of studies conducted to assess both the direct and indirect cost of T2DM in Sri Lanka, the current study was conducted to assess the healthcare cost of diabetes management by estimating direct and indirect costs of disease management.

**Methods:** Hundred and seventy-two (n=172) T2DM individuals were recruited from government and private hospitals. Interviewer administered questionnaire was used to collect socio-demographic, clinical data and healthcare expenditure.

**Results:** T2DM individuals were in the age range of 40-65 years. Nearly 16% of the monthly income of T2DM has spent on the diabetes management. The estimated total cost for a T2DM individual was 11, 114 LKR per month. Direct cost (7,717 LKR per month; 69%) was two folds higher than that of the indirect cost (3,397 LKR per month; 31%) for the T2DM individuals. Cost of oral hypoglycaemic agents (3, 972 LKR) accounted for the largest share (51%) of direct cost followed by cost of dietary management (16%). The highest proportion of indirect cost (LKR) was from temporary unemployment (36%) followed by cost due to absenteeism (LKR 27%). Diabetes management expenditure was higher among male with higher educational level and high monthly income. Urban residents and full time employees borne more cost of diabetes management compared to rural residents with part-time employments. With the increased number of chronic complications and longer diabetes duration, T2DM had spent more on diabetes management

**Conclusion:** Therefore, it can be concluded that the substantial proportion of T2DM patients' income is spent on diabetes care thus it imposes a significant financial burden on the individuals, families as well as healthcare systems of the country.

PE189 Diabetes care & education

**Human development and accessibility for screening diabetes: an analysis of district level on Java island**

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**Objective:** Most people with diabetes live in low and middle-income countries, including Indonesia. Only 1.8% of Indonesian do a routine screening by checking their blood sugar levels due to accessibility and access to health screening, including Java Island. Although Java is Indonesia's most advanced developed island, disparities remain. We aim to elaborate on the demographic condition and regular screening of diabetes at the district level.

**Methods:** Data from 119 districts of six provinces were extracted from Basic Health Research (BHR) Indonesia 2018. Bivariate analysis using simple linear regression was performed to examine the association between demographic conditions and the proportion of regular screening for diabetes from each district.

**Results:** Based on BHR 2018 data, in the all-age category, no province on Java Island has a proportion of routine blood sugar checks >5%. The proportion of people with low incomes and those with difficulty accessing the primary health center (Puskemas) were associated with a lower proportion of those doing routine diabetes screening. On the other hand, increased Human Development Index (HDI) ( $\beta=0.23$ , 95%CI (0.20-0.27)) and the average year in school ( $\beta=0.77$ , 95%CI (0.66-0.88)) were associated with increased routine diabetes screening proportion.

**Conclusion:** The district's demographic conditions affect routine diabetes screening. Availability and ease of access for the community to Puskemas as primary health care need to be improved as a place for health screening, including diabetes. In addition, improving human development, including improving public education, can help increase the proportion of diabetes screening so that the diabetes rate can be reduced.

PE192 Diabetes care & education

**Impact of the hyperpersonalized smart education platform for chronic disease management, doctorvice on T2DM management: randomized clinical study**

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**Objective:** We developed 'Doctorvice Clinic<sup>®</sup>', an innovative smart education platform designed to revolutionize chronic disease management leading to patient-centered approach. Through 'Doctorvice Clinic<sup>®</sup>', doctors can check and monitor the patient's generated health data. Also, it is possible to conduct a personalized education using digital contents based on the data. The purpose of this study is to see the impact of the smart personalized education platform on diabetes management in T2DM patients.

**Methods:** Among T2DM patients who visited the diabetes center of Seoul St. Mary's Hospital, total of 78 participants enrolled in a randomized clinical study. The participants were age over 19 years old and within HbA1c levels of 7.5% to 9.5%. In the intervention group, doctors sent patient-customized educational contents to participants when doctor and patient meet in the office through Doctorvice Clinic<sup>®</sup> and the doctors the doctor also sent some contents to the patients remotely and regularly. The control group received a conventional out-patient clinic management. The primary endpoint was the change in HbA1c from baseline after a 6-month intervention.

**Results:** Of total 78 participants, 29 participants in the intervention group and 33 participants in the control group were analyzed, excluding those who dropped out. Baseline HbA1c was  $8.3 \pm 0.6\%$  in the intervention group and  $8.0 \pm 0.5\%$  in the control group. After 6 months, HbA1c decreased by  $0.4\%$  to  $7.9 \pm 0.9\%$  in the intervention group and by  $0.2\%$  to  $7.8 \pm 0.8\%$  in the control group. The degree of HbA1c reduction in the intervention group was greater than that of the control group, but it was not significant.

**Conclusion:** Providing hyperpersonalized education by doctors to patients using the smart education platform, showed an improved tendency showing decreasing  $0.4\%$  reduction of HbA1c. It suggests that such the smart education system could be an additive tool for diabetes management in T2DM patients.

PE193 Diabetes care & education

**Utilization of diabetes care services during COVID 19-pandemic in Pokhara Metropolitan, Nepal: a cross sectional study from the perspectives of diabetes mellitus patients**

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**Objective:** Diabetes Mellitus is a metabolic disorder requiring continuous medical care. People with diabetes suffer disproportionately from acute Corona Virus Disease-19 (COVID-19) with serious complications. Lock-down strategies compromised routine diabetic care services. American Diabetes Association (ADA) has recommended to visit the diabetes centers more than two times in a year for those with deranged glycemic level. We aim to explore the factors affecting diabetes care services utilization during COVID 19 pandemic in resource constrain nation.

**Methods:** Consented 160 adult diabetes patients aged > 18 years with at least one year history of diabetes mellitus and at least second time of visit to one of the large tertiary hospital of Pokhara. Semi structured questionnaire was adopted for self-reported utilization of diabetes care services dated October 2020 to October 2021. Effective utilization of diabetes health service during COVID pandemics is defined as >2visits/year based on ADA guideline. Univariate and bivariate analyses done to determine the factors associated with diabetes health service utilization.

**Results:** Only 42% got COVID positive and 46% of diabetic patients utilize the diabetes health service as recommended by ADA (>2visits/year). Only 20% of them utilized the service through video call and telephone. Duration of disease, cancellation of appointment, occupation, residency, mode of transport, treatment place, travel expense, satisfaction with health-workers were significantly associated with utilization (P<0.001). Formal sector occupation, urban & semi-urban residency, specialized health service prioritizer and duration of diabetes with less than 4 years were more likely to utilize diabetic health services during pandemics. (OR: 6,3,13 & 2 with P<0.05)

**Conclusion:** Diabetes health service utilization during pandemic was compromised. But the rays of hope still exist through virtual technology. We suggest future integration of digital tools during and beyond the unforeseen pandemic to prevent further deterioration of metabolic disorders.

PE194 Diabetes care & education

**Evaluation on nursing home compliance towards diabetes care for elderly in Klang valley, Kuala Lumpur**

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**Objective:** Malaysia has shown significant rise on the opening of old folks center. Although the opening of elderly center has been helpful for working class adult to assist their parents while going to work, concern has been raised on readiness of one center to take care parents with critical illness as such diabetes. This study has been done towards 27 old folks center in Klang valley, Kuala Lumpur and their certification at handling parents with diabetes care. The research is done to identify center with professional nursing certificate. Then, the data is further discussed amongst experts to address and structure standard operating procedure (SOP) nationwide.

**Methods:** The methodology of the study consists of closed-ended survey collected from all 27 old folks center in order to quantitatively analysis number of nursing home with professional certification. Second, data are brought to experts and Ministry of Health professionals to design and implement a new proposal of standard operating procedure (SOP) for standardization in regards of diabetes care.

**Results:** Result shows 33% of old folk center are not provided with certified nurse and professional care-taker to ensure diabetes care as per guideline recommendation. And 12 out of 27 center are identified facilities are evaluated as underequipped to facilitate patient with diabetes

**Conclusion:** In conclusion, the negligence to comply with standard operating procedure (SOP) towards old folks with diabetes care will allow further risk contributing to other related critical illness that will affect the patient greatly. Nursing home should be taking necessary measure before establishing one center. Monitory and evaluation from authority should be taking place on timely manner to ensure new standard operating procedure (SOP) introduced are being followed respectfully.

## PE195 Diabetes care &amp; education

**Glucose control practices of patients with diabetes mellitus in Angeles city, Philippines: a cross-sectional study**

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**Objective:** Limited published literature is available on the glucose control practices of patients with diabetes mellitus (DM) in the province of Pampanga hence, we performed an initial cross-sectional survey in Angeles City to have insightful baseline data.

**Methods:** With ethical approval, 443 patients with DM from Angeles City and currently undergoing treatment for the disease were recruited for the study. A self-administered questionnaire assessed their sociodemographic (SD) status and glucose control practices (GCP). Data obtained were then collected, summarized, and statistically analyzed.

**Results:** Most participants in the study displayed unsatisfactory GCP (395 out of 443, 89.2%). The top unsatisfactory GCP displayed by the respondents is: (a) forgetting to take medications; (b) not buying medicine due to financial reasons; and (c) difficulty in following the treatment plan due to multiple drugs being taken. Of all the SD obtained, only income was significantly associated with GCP (OR: 0.1, CI: 0.02, 0.41,  $p < 0.001$ ).

**Conclusion:** Overall, our study shows that among the selected population, there is a high degree of unsatisfactory GCP. Hence, efforts should be made in the locale to address these issues, given the importance of controlling blood glucose levels in preventing life-threatening complications.

## PE196 Diabetes care &amp; education

**Healthy plate diet and physical activity effect during the diabetes school**

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**Objective:** A healthy plate meal is the easiest way to manage blood sugar. Physical activity can lower blood sugar up to 24 hours after a workout by making the body more sensitive to insulin. The study aimed to compare blood glucose levels before and after a healthy plate diet and physical activity in type 2 diabetic patients.

**Methods:** The cross-sectional study included 194 patients (male 74, female 120) with type 2 diabetes who participated in one day of Diabetes school. Blood glucose was measured before and 2 hours after a healthy plate diet lunch and after a 30-minute walk 2 hours after lunch. Fasting and postprandial glucose levels were compared. Before and after physical activity blood glucose levels were compared. A paired T-test was calculated.

**Results:** Type 2 diabetes mellitus patients' mean age was  $54.5 \pm 12.2$  years old, fasting blood glucose mean level was  $11.9 \pm 5.4$  mmol/L and postprandial glucose mean level was  $11.4 \pm 4.7$  mmol/L. Before and after a healthy plate lunch blood glucose levels were no different by paired T-test ( $p = 0.112$ ). After physical activity, diabetic patients' mean blood glucose was  $9.7 \pm 4.5$  mmol/L. After physical activity blood glucose was significantly lowered by 1.7 mmol/L ( $11.4 \pm 4.7$  mmol/L vs  $9.7 \pm 4.5$  mmol/L;  $p = 0.037$ ).

**Conclusion:** A healthy plate diet is helpful for better control of postprandial glucose in diabetic patients. Physical activity is effective for decreasing postprandial glucose for type 2 diabetic patients.

## PE197 Diabetes care &amp; education

**Nurturing healthier futures: the empowering journey of the sobat diabet academy for the youth**

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**Objective:** Diabetes is getting younger. Approximately 1 out of 5 people under 40 years old are living with diabetes and the number is keep increasing. Knowing the fact that type 2 diabetes is preventable, a lot of people still do not understand what diabetes is and why people can get diabetes. The aim of the "Sobat Diabet Academy" is to educate young people about diabetes, nutrition, and physical activities as a part of action in Sobat Diabet, a nonprofit community originating from Indonesia since 2014 which has more than 500 volunteers across different region.

**Methods:** The Sobat Diabet Academy offers various standardized activities to educate young individuals about diabetes prevention and management. It includes interactive sessions and workshops focused on diabetes awareness, nutrition education, and the importance of physical activities in maintaining a healthy lifestyle. We performed a survey base analysis using questionnaire and post event interview to evaluate the action. All the activities in Sobat Diabet are conducted informally to grab more attention among youth people.

**Results:** Through the Sobat Diabet Academy, young participants gain a comprehensive understanding of diabetes and the significance of making informed dietary choices and engaging in regular physical activities. The Sobat Diabet Academy facilitates the acquisition of knowledge (82% average score), attitudes and practices that empower young individuals to make healthier lifestyle decisions, both in terms of their eating habits and physical routines.

**Conclusion:** The Sobat Diabet Academy stands as a vital component of the Sobat Diabet community. By equipping young people with essential knowledge about diabetes, nutrition, and physical activities, it plays a pivotal role in fostering a generation that is well-informed and proactive in maintaining their health, also inspiring others. Through its multifaceted activities, the Sobat Diabet Academy contributes to building a stronger foundation for healthier lifestyle among the youth.

## PE198 Diabetes care &amp; education

**Development of digital education materials for women with hyperglycaemia in pregnancy**

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**Objective:** Hyperglycaemia in pregnancy (HIP) is becoming a significant public health problem in Sri Lanka. Women with HIP are at risk of hypertension, abortions/miscarriage and/or a pregnancy resulting macrosomal newborn, preterm birth and/or perinatal death. HIP can contribute to the future burden of type 2 diabetes and cardio-metabolic disorders of the affected women and the newborn. Majority of the affected women can be managed effectively with the proper glucose monitoring and intensive lifestyle modification counseling through the provision of self-awareness and self-care. Therefore, the current study was conducted with the objective of developing digital materials for as novel tools to assist the women affected with HIP in monitoring and self-managing the condition.

**Methods:** This cross-sectional descriptive study was conducted in three phases as need analysis, design and development of the materials. Individual, semi structured interviews were conducted with 65 women with HIP to identify their perceptions on usability and content identification for the digital materials. Perceptions were analyzed using NVivo 12 software and themes were generated. A 3-day diet diary and 3-day physical activity diary were used to assess their usual dietary intake pattern.

**Results:** Majority of the participants (70%) perceived a smartphone app, educational booklet on diet, activity booklet and online activities as effective tools in assisting their blood glucose monitoring and managing their glycaemic control. Based on the perceptions, suggestions and current dietary practices of women affected with HIP, a smart phone app, dietary education booklet, booklet with interactive activities and digital games on dietary modifications to attain proper glycaemic control were developed.

**Conclusion:** It is expected that the developed materials and resources will assist the women with HIP in improving the food and nutrition literacy to achieve the good glycaemic control, their responsibilities, motivation and attitudes to better pregnancy outcomes.

PE199 Diabetes care & education

**An integrative review of diabetes care on middle-aged and older women with type 2 diabetes**

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**Objective:** Middle-aged and older women have a higher prevalence of type 2 diabetes and lower glucose control than men because of the changes in insulin sensitivity and glucose metabolism during menopause. With rapid developments in healthcare technology, relevant interventions have recently been developed for diabetes care. However, very few studies have focused on middle-aged and older women who are at risk of diabetes or diabetes-related complications. Therefore, the aim of this study was to describe the current status of diabetes care in middle-aged and older women with type 2 diabetes.

**Methods:** An integrative review was conducted. PubMed, Embase, Cumulative Index to Nursing and Allied Health Literature, Cochrane Library, and Web of Science were searched from 2013–2023. We used "type 2 diabetes", "middle-aged", "older", and "women" as the search keywords. Studies written in either Korean or English and that focused on middle-aged and older women (>40 years old) with type 2 diabetes were considered eligible.

**Results:** A total of 48 studies were selected, including 3 randomized controlled trial and 45 observational or quasi-experimental studies. Most of the studies were to explore the associated factors such as obesity, diet, sleep, physical activity etc. In addition, most existing studies focused on menopause status which had higher linkage with diabetes care, only one RCT tested the effects of the eHealth wellness program for diabetic midlife women.

**Conclusion:** The review showed that middle aged and older women need targeted diabetes care, and technological intervention had a positive impact on the clinical outcomes. However, strategies tailored to middle-aged and older women are insufficient. We recommend the development of technology-based interventions that can facilitate integrative care for their quality of life in middle-aged and older women with type 2 diabetes mellitus.

PE200 Diabetes care & education

**Development of a personalized dietary advice website as a solution to reduce food waste for individuals with diabetes**

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**Objective:** Indonesia is currently experiencing a diabetes epidemic, ranking 7th among the top 10 countries with the highest number of diabetes patients. Additionally, 49.86% of the total waste in Indonesia is food waste. Education and medical nutrition therapy are two important pillars in the management of diabetes. Both education and medical nutrition therapy can be supported and made more accessible through the use of easily available and sustainable platforms, such as websites. One crucial step in developing such media is to validate it through the input of professionals and target group respondents. The objective of this study is to explore the development and validation of the website, which provides personalized dietary advice and offers a solution to food waste for individuals with diabetes.

**Methods:** This validation is based on the input of professionals and respondents with diabetes. The research follows a quantitative approach in three steps: development, validity, and evaluation, with a sample size of 11 professionals and 20 respondents with diabetes.

**Results:** Based on the validity tests conducted by professionals, the website content was deemed valid, with a Content Validity Ratio (CVR) value of  $\geq 0.80$  and a Content Validity Index (CVI) value of  $\geq 0.80$ . The website construct was also validated, with an average correlation coefficient ( $r$ ) of  $\geq 0.632$ . The validity test conducted with diabetic respondents confirmed the validity of the website content, with a Mean Item-CVI (I-CVI) of 0.95. The website construct was also declared valid, with an average correlation coefficient ( $r$ ) of  $\geq 0.7$ .

**Conclusion:** Therefore, the results of the validation process indicate that the website is a valid resource for personalized dietary advice and addressing food waste for individuals with diabetes. The study recommends the use of an attractive website design, easy-to-understand language, and Search Engine Optimization (SEO) to enhance the effectiveness and usability of the website.

PE202 Diabetes care & education

**Deciding the measures on most influential determinants of diabetes prevention among mothers and children in underprivileged community: evidence using a health promotion approach in Sri Lanka**

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**Objective:** Diabetes is one of the most burden disease and a growing cause of mortality and morbidity in Sri Lanka. This study aimed to develop the measures on most influential determinants of Diabetes prevention among mothers and children in underprivileged community.

**Methods:** A community based interventional study was conducted with a selected group of mothers aged above 28 years and children aged between 10-18 years. The intervention was conducted for 06 months that included initial interactive discussions on the importance of diabetes prevention using success stories to empower mothers followed by the prioritization of the determinants and facilitation of the mothers to develop the measures to assess the changes to measure changes. Qualitative data was collected using focus group discussions. Each group consisted of 8-10 participants and lasted between 50-60 minutes. Data were analyzed using thematic analysis.

**Results:** 74 mothers and 26 children were involved the study. The main perceived factors identified were; "high consumption of sugar, oil, salt and instant food", "physical inactivity", "tobacco and alcohol usage", "Negative commercial influences". Calendars were developed by mothers to measure daily sugar, salt, oil consumption. To address the high consumption of instant food, boxes were created by children to collect the junk food packets. Charts that are written E-numbers were developed. Allocated fixed time to do collective physical activities and promoted the home gardening. measuring cards were created to measure Body Mass Index in once a month. Poster campaign was conducted in drug used places to address the tobacco and alcohol usage. Happiness moods measuring calendars were developed to assess the happiness level of family members. Books were developed to mark negative influenced advertisements.

**Conclusion:** Simple, yet, effective health promotion interventions could be carried out to decide the measures in the low socio-economic community, while addressing the context-specific perceived factors to diabetes prevention.

PE205 Diabetes care & education

**Association of mental health conditions with suicide risk among patients with type 2 diabetes: a nationwide population-based cohort study**

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**Objective:** Understanding the impact of mental disorders on health outcomes is important in the management of diabetes. This study aimed to investigate the influence of various mental health conditions on the risk of suicide among people with diabetes.

**Methods:** Using Korean National Health Information Database, subjects with type 2 diabetes aged 20 years or older who underwent a health examination in 2009 were identified (n=173,177) and followed until the end of 2021. The relationship between mental health conditions (depression, bipolar disorder, schizophrenia, anxiety and insomnia) and suicide risk was estimated using multivariate Cox proportional hazard analysis. Suicide was defined as death with recording of ICD-10 codes X60-X84.

**Results:** During the median follow-up of 11.28 years, 850 people died by suicide. After adjusting for possible confounders, the risk of death by suicide increased by 2.91 (95% CI, 2.38-3.56) times in the presence of depression, 4.12 (95% CI, 1.95-8.71) times in the presence of bipolar disorder, 5.41 (95% CI, 2.78-10.51) times in the presence of schizophrenia, 1.84 (95% CI, 1.53-2.22) times in the presence of anxiety, and 2.20 (95% CI, 1.78-2.71) times in the presence of insomnia. On the other hand, the risk of all-cause mortality was approximately 30% higher in people with mental disorders compared to mentally healthy people with diabetes.

**Conclusion:** Comorbid mental health conditions were associated with significant risk of suicide among people with type 2 diabetes. Active assessment and care of mental health should be emphasized in people with diabetes.

## PE206 Diabetes care &amp; education

**Comprehensive community health screenings: a holistic approach to diabetes care and education**

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**Objective:** In recent years, Diabetes Singapore has taken an active role in improving community health through extensive mass health screenings. Starting from 2022, the organization has significantly expanded its screening efforts, moving beyond glucose screening (HbA1c) to a more thorough evaluation involving various health indicators. Previously concentrating on glycemic monitoring, Diabetes Singapore acknowledged the necessity for a broader perspective on diabetes-related risks. This led to the inclusion of lipid (cholesterol) screening, microalbumin (kidney) testing, and immediate nurse counseling within the screening process. Furthermore, the initiative has extended to include diabetic foot screening whenever possible, offering valuable insights into foot health, especially for those with diabetes. This change in screening protocols aligns with the understanding that diabetes management encompasses more than just blood sugar control. By addressing cholesterol and kidney health, intertwined risk factors influencing diabetes progression and complications are considered. The goal is to empower individuals by enabling early detection and intervention through a comprehensive approach. The combined screening and counseling model not only boosts participant engagement but also provides timely guidance for managing diabetes and associated concerns. Beyond identifying potential problems, it facilitates proactive measures, minimizing the likelihood of complications. By presenting a unified overview of participants' health, these screenings promote a deeper recognition of how diabetes interacts with other physiological aspects. In essence, Diabetes Singapore's shift from glucose-focused screening to a multifaceted strategy showcases the organization's dedication to diabetes care and education. Through comprehensive health assessments and immediate counseling, the initiative empowers individuals to make well-informed decisions about their health. This abstract underscores the importance of holistic screening in advancing our comprehension of diabetes management and underscores the organization's commitment to fostering healthier communities.

## PE207 Diabetes care &amp; education

**Necessity of education on continuous glucose monitoring in type 1 patients with hypoglycemia insensitivity objective**

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A 19-year-old female patient with no medical disease visited the emergency room on December 19, 2022 with symptoms such as polydipsia and general weakness that started 1 week ago. When visiting the hospital, blood pressure is checked within the normal range or heart rate is 168, and blood sugar is measured as HIGH. Blood glucose measured with serum was measured at 1059, and DAK was confirmed, and a case of hospitalization in an intensive care unit. Glycated hemoglobin 14.6% Glycosylated albumin 54.4 was checked and confirmed as type 1 diabetes. To control blood sugar, administer Humlin-R mixed infusion in Dextrose 5%, followed by multiple injection therapy As the symptoms improved, she was moved to a general ward and a complication test was performed, but there were no abnormal findings. On January 3, hypoglycemia occurred at 66 mg/dl, and no symptoms were felt. Description of hypoglycemia symptoms and risks. 1/5 Blood sugar 60mg/dl measured at 3 am Hypoglycemia occurred, but no symptoms.

Due to the fear of not feeling the symptoms of type 1 diabetes and hypoglycemia that suddenly developed at a relatively adult age, the guardians also have a high desire for education and are concerned accordingly.

Teaching to apply continuous glucometer.

Comparative education with self-monitoring blood glucose. The fear of not being able to cope with low blood sugar was reduced while using the continuous blood glucose monitor. Instead of a receiver, it is possible to measure easily with a smartphone using the NFC function, so that hypoglycemia can be dealt with before it occurs.

## PE208 Diabetes complications-basic &amp; translational

**The effect of glycerol blanked triglyceride assays on calculated LDL-Cholesterol levels in patients with diabetes mellitus- a cross-sectional study**

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**Objective:** Cardiovascular disease (CVD) is the primary cause of death in individuals with type 2 diabetes mellitus (T2DM). Triglyceride levels are commonly measured using enzymatic hydrolysis by lipase, which breaks down triglycerides into glycerol. It is essential to account for excess glycerol by applying glycerol correction, which ensures accurate measurement of triglyceride levels, particularly in diabetes. The objective of our study was to assess the effect of glycerol-corrected triglyceride assays in the calculation of LDL-Cholesterol in individuals with diabetes mellitus.

**Methods:** This analytical cross-sectional study enrolled 200 patients with Diabetes mellitus and 200 controls. Blood samples were analyzed for Triglyceride (TG) levels using the Beckman Coulter AU680 Analyzer in the Clinical Biochemistry Lab. To account for endogenous glycerol, Glycerol blanked triglyceride assays (GBTG) from Sekisui were used. LDL was estimated both by the direct method (Beckman Coulter) (LDL-D) and calculated using Freidewald's (LDL-F) and Martin Hopkins' (LDL-MH) formulae.

**Results:** Our study demonstrated a significant difference between TG and GBTG in controls (p-value: 0.0261) and diabetes (p-value: 0.0019). The median (IQR) of LDL-D in controls and diabetes was 122.5 (100-148.5) mg/dL and 124 (101-153.5) mg/dL. When we compared the LDL-F and LDL-MH which were calculated using TG and GBTG assays, we observed a higher LDL-F and LDL-MH in GBTG assays than TG assays in both controls and patients with diabetes. However, the differences were not statistically significant. Interestingly, the LDL calculated using GBTG assay were closer to LDL-D than that of TG assay.

**Conclusion:** Our study demonstrated that, in patients with diabetes mellitus, triglyceride assays tend to overestimate when compared to Glycerol blanked triglyceride assays. However, the LDL calculated using different formulae was higher in Glycerol blanked triglyceride assays, the difference was not observed to be statistically significant.

## PE210 Diabetes complications-basic &amp; translational

**The complexity of diabetic foot problem screening and management: serial case**

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**Objective:** Diabetic foot ulcers are non-traumatic lesions on the skin of people with diabetes mellitus-related complications of peripheral neuropathy or peripheral arterial disease. The purpose of discussing this case series is to find out the preventive, promotive, curative, and rehabilitative management of DM patients so they don't fall into a diabetic ulcer.

**Methods:** This series covers two interesting cases of diabetic ulcers. In the first case, a 59-year-old woman with uncomplicated type 2 diabetes with poor control and pain in her left lower extremity was treated non-pharmacologically (modified diet and exercise for 2 days). once, pharmacological therapy (insulin), and supportive therapy like mecobalamin, conservative vascular control, and control of revascularization by digital subtraction angiography (DSA). In the second case, a 67-year-old man presented with ulceration and necrosis of the foot sinuses (Wagner 4), neuropathic pain and vascular disease, uncomplicated type 2 diabetes, hypoalbuminemia, and thrombocytosis. Patients are managed with metabolic control (adequate nutrition, insulin, albumin); anti-infection (injection of antibiotics, amputation of the left third distal tibia); wound care control; vascular control; off-loading control.

**Results:** In our center, we aim to be able to prevent and detect diabetes early through the principles of indication control to control diabetic ulcers, control possible infections, control metabolism, wound care control, vascular control, and discharge control, one of which is through the above two examples by administering the prevention and treatment of vascular control with DSA through thoracic and cardiovascular surgery. In the first patient, symptoms improved and did not progress to a diabetic ulcer. Since then, we strive to screen early for vascular disease in diabetic patients so that diabetic ulcers can be prevented as early as possible.

**Conclusion:** Treatment of patients with diabetes at all stages should be comprehensive and early detection is essential to prevent possible complications.

## PE212 Diabetes complications-basic &amp; translational

**Overweight, obesity and dietary practices among adolescents aged: a cross-sectional online survey in central region of Malaysia**

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**Objective:** Childhood overweight/obesity has become a significant public health concern globally because of its adverse health consequences and escalating prevalence. Adolescents' growth and healthy development are essential indicators for all developing countries. Therefore, this study determines the prevalence of overweight, obesity and dietary practices among adolescents.

**Methods:** Total parents (N=534) of adolescents aged 12- and 18 years old stay in the central region of Malaysia (Selangor, Kuala Lumpur, and Putrajaya) responded to an online survey from September 2022 through February 2023. The questionnaires consist of weight, height, age, and dietary practices. BMI-for-age z-scores (BAZ) were computed, and body-weight status was determined according to the World Health Organization (WHO) Growth Reference for 5-19 years. Data were analyzed using SPSS version 26.

**Results:** The prevalence of overweight among the participants in this study was 19.5%, while the prevalence of obesity was 19.1%. Girls show a high prevalence of overweight (11.23%), and boys show a high prevalence of obesity (10.11%). It was revealed that most of the adolescents consume snacks in between meals (81.6%), choose instant food as the main meal (75.3%), eat fried food 3-5 times a week (73.8%), 92.9% eat instant food 3 to 5 times per week, only 9.9% eat fruits every day, and 81.1% rarely take vegetables in their dietary meals.

**Conclusion:** Our study indicates the alarming signal of overweight obesity prevalence among adolescents aged. The need to broaden the scope of dietary standards, public health policies, and health education programmes should be taken as preventative measures. In addition, this study shows unhealthy dietary practices, especially instant food, as the norm meal among adolescents. Involvement in parenting's roles in overweight and obesity management are crucial to prevent adolescent generations from growing up as obese adults and become as one of the non-contagious disease (NCD) patients in future.

## PE214 Diabetes complications-basic &amp; translational

**Study of vitamin D levels, pancreatobiliary diseases factors and inflammation data in school going adolescents relation to non-alcoholic fatty liver disease patients**

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**Objective:** Non-alcoholic fatty liver disease (NAFLD) is a burdensome and increasingly prevalent disease throughout the world. Inflammation plays an important role in pathogenesis of pancreatobiliary diseases factors and vitamin D deficiency is postulated to promote endothelial dysfunction in NAFLD patients. Aim of present study was to investigate the association between markers of pancreatobiliary diseases and pancreatic inflammation with vitamin D levels in school going adolescents relation to NAFLD patients

**Methods:** Sixty-two adolescents patients with NAFLD and macrovascular complication and 68 patients without macrovascular complication were included in the study. Sixty healthy subjects served as the control group. Serum vitamin D levels were measured in all subjects as were ABI and pulse wave velocity (PWV). As markers of pancreatic inflammation, glypican-1 (GPC1), trypsinogen and procarboxypeptidase B activation peptide, adiponectin, free fatty acids, CA19-9 test, serum amyloid A (SAA), and procalcitonin (PCT) and tumour necrosis factor-alpha were studied.

**Results:** Levels of glypican-1 (GPC1), trypsinogen and procarboxypeptidase B activation peptide and body mass indices(BMI) were significantly higher in patients with vitamin D levels below 25 nmol/l than patients with vitamin D levels above 25 nmol/l. Apolipoprotein A1, SAA, PCT levels and tumour necrosis factor-alpha levels showed a negative correlation with vitamin D levels in all subjects. Also, there was a negative correlation between waist circumference, BMI and vitamin D levels among NAFLD patients. No significant difference between patients with vitamin D levels above or below 25 nmol/l was found for NAFLD adolescents patients. There was no significant difference between NAFLD patients with and without macrovascular complications regarding vitamin D levels.

**Conclusion:** Levels of vitamin D is closely associated with markers of pancreatic inflammation in NAFLD adolescents patients. Vitamin D deficiency also correlates with a predisposition to pancreatobiliary diseases, obesity and inflammation.

## PE217 Diabetes complications-basic &amp; translational

**Antifibrotic effect of mefloquine, an antimalarial medicine, on renal fibrosis**

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**Objective:** Drug repurposing is a strategy to identify new uses for approved drugs that are outside the scope of the original medical indication, and is emerging as an important tool in the fight against many diseases. We found very interesting results for mefloquine, a medication used to prevent or treat malaria against plasminogen activator inhibitor-1 (PAI-1), one of the fibrotic factors, in renal cells. However, the effect of mefloquine on renal fibrosis remains unknown.

**Methods:** We investigated whether mefloquine can inhibit renal fibrotic factors in cultured renal fibroblast cells. TGF- $\beta$ -treated NRK-49F cells were incubated with the indicated dose of mefloquine for 24 hours. The CCK-8 assay, promoter assay, real-time q-PCR, western blot analysis, and ELISA were performed.

**Results:** Mefloquine did not affect the cell viability at 0.5 to 5  $\mu$ M but at 10  $\mu$ M the viability was slightly decreased in renal fibroblasts, NRK-49F. Mefloquine significantly inhibited TGF- $\beta$ -stimulated PAI-1 secretion as well as PAI-1 promoter activity. In addition, mefloquine decreased inhibited TGF- $\beta$ -stimulated PAI-1 mRNA and protein expression. To investigate the effects of mefloquine on other renal fibrotic factors, we identified the expression of collagen type 1, fibronectin, and  $\alpha$ -smooth muscle actin ( $\alpha$ -SMA). Mefloquine decreased TGF- $\beta$ -stimulated the expression of collagen type 1, fibronectin and  $\alpha$ -smooth muscle actin ( $\alpha$ -SMA). We investigated the effect of mefloquine on Smad3 activity to elucidate its mechanism on renal fibrosis. Mefloquine inhibited TGF- $\beta$ -induced phosphorylation of Smad3.

**Conclusion:** These results show that mefloquine attenuates kidney fibrotic factors via inhibition of TGF- $\beta$ /Smad3 signaling pathway. We propose that mefloquine is a potential therapeutic agent for kidney disease through drug repurposing.

## PE219 Diabetes complications-basic &amp; translational

**Metixene hydrochloride hydrate inhibits TGF-beta-induced renal fibrosis**

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**Objective:** Chronic kidney disease (CKD) is increasing in prevalence and can cause social and economic problems. Unfortunately, very few anti-renal fibrotic agents exist. Metixene hydrochloride hydrate (MHH), discovered through drug screening, is an anti-cholinergic agent; however, its effects on renal fibrosis remain unknown.

**Methods:** We investigated whether MHH can attenuate TGF- $\beta$ -induced renal fibrosis in kidney fibroblasts. NRK-49F was incubated with TGF- $\beta$  for 24 hours in the presence of the indicated dose of MHH. We performed the CCK-8 assay, real-time qPCR, western blot analysis, and ELISA.

**Results:** To examine the cell toxicity of MHH, NRK-49F were incubated with 0.5 to 10  $\mu$ M of MHH and measured their viability using CCK-8 assay. MHH did not affect the cell viability at 0.5 to 5  $\mu$ M but at 10  $\mu$ M the viability of NRK-49F was less than 90%. MHH significantly inhibited TGF- $\beta$ -induced PAI-1 mRNA expression as well as PAI-1 protein expression and secretion. In addition, MHH decreased TGF- $\beta$ -stimulated PAI-1 promoter activity. MHH inhibited TGF- $\beta$ -stimulated gene and protein expression of collagen type 1, fibronectin, and  $\alpha$ -smooth muscle actin ( $\alpha$ -SMA). To determine the molecular mechanism by which MHH inhibits renal fibrotic factors, we examined whether MHH inhibits Smad3 activity. MHH inhibited TGF- $\beta$ -stimulated the phosphorylation of Smad3 in NRK-49F.

**Conclusion:** Our results suggest that MHH ameliorates renal fibrosis through inhibition of the TGF- $\beta$ /Smad3 signaling pathway and has the potential of a novel reno-protective agent.

## PE220 Diabetes complications-basic &amp; translational

## Role of mucin-1 in diabetic neuropathy in type 2 diabetes

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**Objective:** Diabetic neuropathy is one of the most debilitating complications of diabetes. Diabetic neuropathy is a major cause of foot ulceration and neuropathic pain. Early detection of diabetic neuropathy is important to reduce morbidity and mortality. There is a need to develop non-invasive and accurate assessment markers. Therefore, we aimed to identify cytokines as novel biomarkers of diabetic neuropathy in type 2 diabetes (T2DM).

**Methods:** The first stage of the study included 33 subjects (20 diabetic patients without diabetic complication, 13 diabetic patients with only diabetic neuropathy, and 10 subjects with normoglycemia) for cytokine microarray analysis. Blood samples of the subjects were assessed for 310 cytokines to identify potential indicators of diabetic neuropathy. The second stage included 294 subjects (125 diabetic patients without diabetic complication, 69 diabetic patients with only diabetic neuropathy, and 100 subjects with normoglycemia) to validate the potential cytokine associated with diabetic neuropathy. We measured expression of mucin-1 in sciatic nerves of db/db mice using Western blot analysis.

**Results:** We identified 13 cytokines that differed by 1.5-fold or more in at least one out of the three comparisons (normoglycemia vs. T2DM, normoglycemia vs. diabetic neuropathy, and T2DM vs. diabetic neuropathy) among 310 cytokines. Finally, we selected mucin-1 and validated this finding to determine its association with diabetic neuropathy. Plasma mucin-1 levels were found to be increased in T2DM patients with diabetic neuropathy compared to those in T2DM patients without diabetic neuropathy or subjects with normoglycemia. In db/db mice, plasma mucin-1 level was increased while the expression level of mucin-1 in sciatic nerve was decreased.

**Conclusion:** Plasma mucin-1 levels were associated with diabetic neuropathy in T2DM. We suggest that mucin-1 may be a promising biomarker for the early detection of diabetic neuropathy. Further studies are needed to evaluate the relationship and mechanism between mucin-1 and diabetic neuropathy in T2DM.

## PE221 Diabetes complications-basic &amp; translational

## Role of protein z in hypercoagulable state in type 2 diabetes

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**Objective:** Type 2 diabetes mellitus (T2DM) is a progressive metabolic disease. Early detection of prediabetes is important to reduce the risk of T2DM. Protein z is a member of the coagulation cascade but its role in diabetes is unknown. Therefore, we aimed to identify protein z as a novel biomarker of T2DM and to elucidate its role in T2DM.

**Methods:** The first stage of the study included 43 subjects (13 subjects with newly diagnosed T2DM, 13 with prediabetes, and 16 with normoglycemia) for cytokine microarray analysis. Blood samples of the subjects were assessed for 310 cytokines to identify potential indicators of prediabetes. The second stage included 142 subjects (36 subjects with T2DM, 35 with prediabetes, and 71 with normoglycemia) to validate the potential cytokines associated with prediabetes. We measured the hepatic expression of protein z in high fat diet (HFD) or db/db mice using Western blot analysis.

**Results:** We identified 41 cytokines that differed by 1.5-fold or more in at least one out of the three comparisons (normoglycemia vs. prediabetes, normoglycemia vs. T2DM, and prediabetes vs. T2DM) among 310 cytokines. Finally, we selected protein z and validated this finding to determine its association with prediabetes. Plasma protein z levels were found to be decreased in patients with prediabetes ( $1,490.32 \pm 367.19$  pg/mL) and T2DM ( $1,583.34 \pm 465.43$  pg/mL) compared to those in subjects with normoglycemia ( $1,864.07 \pm 450.83$  pg/mL) ( $P < 0.001$ ). There were significantly negative correlations between protein z and fasting plasma glucose ( $P = 0.001$ ) and hemoglobin A1c ( $P = 0.010$ ). In addition, liver protein z levels were reduced in 20-week HFD or 6-week-old db/db mice.

**Conclusion:** Plasma protein z levels were associated with prediabetes and T2DM. We suggest that protein z may be a promising biomarker for the early detection of prediabetes. In addition, the reduced hepatic protein z might contribute to the development of coagulation disorders and vasculopathy in T2DM.

## PE222 Diabetes complications-basic &amp; translational

## A random forest algorithm-based discovery of hepatokine as biomarker of NASH

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**Objective:** Nonalcoholic fatty liver diseases (NAFLD), encompassing both nonalcoholic fatty liver (NAFL) and nonalcoholic steatohepatitis (NASH), exhibit a considerable global prevalence and impose a significant medical expense. Numerous other noncommunicable illnesses, such as type 2 diabetes and metabolic syndromes, have strong connection to the epidemiology and pathophysiology of NAFLD. These relationships can function synergistically to raise the risk of adverse clinical complications. NASH is the irreversible stage that is usually under-diagnosed because liver tissue examination under the microscope is required for its confirmed diagnosis. Recent research underscores the role of hepatokines, distinct secretory peptides from the liver, in NAFLD development. However, their potential as NASH biomarkers remains understudied. This investigation seeks hepatokine-based biomarkers for accurate NASH diagnosis.

**Methods:** We aimed to improve the accuracy of stage classification by utilizing RNA sequencing data using a machine learning algorithm named random forest. Further investigations involve the validation of our findings in extra publicly available multi-omics datasets, as well as conducting laboratory experiments using blood samples acquired from patients in a medical center.

**Results:** Several candidates with superior sensitivity and accuracy were discovered during the process of model training. The outcomes derived from the external validation successfully conformed to the consensus agreement in assessing the efficacy of novel biomarkers. The ELISA technique has demonstrated efficacy in quantifying the concentration of these biomarkers in the patient's blood samples. Based on our research, a formula called ioaScore has been devised, which enables the high sensitivity and accuracy of the NASH diagnosis.

**Conclusion:** In conclusion, this study pioneers machine learning algorithms for hepatokine-based biomarker identification in NASH diagnosis, offering a novel contribution to the field.

## PE223 Diabetes complications-basic &amp; translational

## Characterizing diurnal fluctuations in gut microbiota composition: insights into temporal patterns, disrupted rhythms, and potential links to metabolic dysregulation in type 2 diabetes mellitus

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**Objective:** The gut microbiota is crucial for metabolic health, especially in Type 2 Diabetes Mellitus (T2DM). New research shows that gut microbiota changes throughout the day, impacting metabolism. This study investigates daily variations in gut microbiota for T2DM patients and healthy individuals, revealing insights into metabolic health patterns.

**Methods:** We assembled a well-defined cohort comprising individuals with T2DM ( $n=30$ ) and age-matched healthy controls ( $n=30$ ) for this investigation. Stool samples were meticulously collected at six distinct time points across a 24-hour period, encompassing pre-meal morning, post-meal morning, pre-meal afternoon, post-meal afternoon, pre-meal evening, and post-meal evening. Employing high-throughput metagenomic sequencing, we obtained comprehensive taxonomic and functional profiles of the gut microbiota. Analysis encompassing alpha and beta diversity metrics, differential abundance examination, and metabolic pathway prediction enabled us to dissect diurnal dynamics and potential implications for T2DM.

**Results:** Evident diurnal rhythmicity was observed in the composition of gut microbiota for both individuals with T2DM and healthy participants. Fluctuations in alpha diversity were noteworthy, with morning samples exhibiting the highest microbial richness (Chao1 index: 258, 95% CI: 248-268), while evening samples demonstrated reduced richness (Chao1 index: 203, 95% CI: 194-212). Beta diversity analysis revealed discernible clustering patterns corresponding to distinct time points, indicative of time-dependent shifts in microbial communities. Notably, individuals with T2DM exhibited disrupted diurnal patterns, characterized by diminished oscillations in microbial diversity and composition. Differential abundance analysis identified specific taxa, particularly butyrate-producing bacteria, which displayed significant temporal variations and were implicated in metabolic pathways relevant to T2DM.

**Conclusion:** This study reveals daily gut microbiota changes in T2DM and healthy individuals, linking them to metabolism. Disrupted T2DM patterns may impact metabolism. Altered key microbes, especially tied to short-chain fatty acids, hint at a connection between daily shifts and metabolic health. Understanding this could lead to innovative circadian-related metabolic disorder treatments.

## PE224 Diabetes complications-basic &amp; translational

**Relationships between IMT and diabetic complications in Mongolian patients with type 2 diabetes mellitus**

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**Objective:** The aim of this study was to clarify the clinical significance of IMT for diabetic complications in Mongolian patients with type 2 diabetes mellitus.

**Methods:** This cross-sectional study enrolled 199 patients with type 2 diabetes mellitus. (153 males and 46 females; mean age, 53.9±9.7 years (mean±standard deviation)). Patients were divided into two groups according to the IMT: Normal (IMT<0.9, n=96) and abnormal (IMT>0.9 n=103).

**Results:** The mean age of patients was 53.9±9.7 years and the mean IMT value was 0.94±0.23. Specially very high frequency of waist obesity in Mongolian diabetic patients (85.9%). Mean IMT (0.92±0.23 mm vs. 1.02±0.21 mm vs. 1.07±0.28 mm, in the low, moderate, and high groups, respectively) increased with increasing CAVI P=0.001. There were no differences in the HbA1c, fasting plasma glucose, systolic and diastolic blood pressure, total cholesterol, HDL-C, LDL-C and triglyceride levels among the two groups (p>0.05). In the whole population DR was diagnosed in 35 (17.6%) patients. Thirty-three patients (16.58%) had a NPDR, 2 patients (1%) had a PDR. In the study population proteinuria, stroke, ischemic heart disease and CKD was diagnosed respectively in 58 (29.1%), 7 (3.5%), 14% (7) and 22 (11.1%) patients. There were no differences in the DR, stroke, ischemic heart disease and CKD frequency among the two groups (p>0.05).

**Conclusion:** We showed a no significant relationship between IMT and diabetic complications in patients with type 2 diabetes mellitus. Only CAVI was positively correlated with IMT.

## PE226 Diabetes complications-clinical &amp; epidemiology

**Predictors of breastfeeding self-efficacy among gestational diabetes mellitus mothers in Malaysia: a cross sectional**

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**Objective:** Extensive studies reported breastfeeding outcomes among mothers with GDM (Gestational Diabetes Mellitus) were lower than mothers without GDM. Mothers with higher breastfeeding self-efficacy will have a likelihood to initiate breastfeed early, breastfeed for longer duration, and practicing breastfeeding up to two years. As proposed by Theory of Planned Behaviour (TPB), perceived behavioral control and behavioral intention will predict actual behavior. Therefore, higher breastfeeding self-efficacy may lead to a higher rate of breastfeeding outcomes. Hence, this study was conducted to determine level of self-efficacy of breastfeeding among GDM mothers and investigate the predictors of breastfeeding self-efficacy among pregnant mothers with GDM.

**Methods:** This cross-sectional study was conducted to pregnant mothers visiting selected government health clinics in Selangor, Malaysia. Breastfeeding self-efficacy and attitude were evaluated using self-administered validated Breastfeeding Self-Efficacy Scale Short-form (BSES-SF) and Iowa Infant Feeding Attitude Scale (IIFAS). Data were analysed using descriptive statistics to determine breastfeeding confidence and attitude towards exclusive breastfeed. Further analysis with simple linear regression (SLR) was tested to identify the predictors of breastfeeding self-efficacy among pregnant mothers with GDM. Level of significance with value p<0.05 was applied.

**Results:** A total of 205 mothers with GDM was recruited with mean age of 29.50±3.4 years old. About 92.2% (n=189) of them had high breastfeeding self-efficacy (mean 56.1±2.7), 28.7% (n=59) had positive breastfeeding attitudes, 58.5% (n=120) had breastfeeding experience, and majority of them had intention to exclusively breastfeed (98.5%, n=202). Further analysis suggested that breastfeeding experience (95% CI 2.92 (0.37, 4.20), p<0.05) and positive attitude towards breastfeeding (95% CI 0.42 (0.28, 0.56), p<0.001) were the only predictors of breastfeeding self-efficacy among this population.

**Conclusion:** This study provides new insights to design specific intervention by providing continuous antenatal education on breastfeeding to enhance breastfeeding confidence and therefore, may increase the rate of exclusive breastfeeding among this targeted population.

## PE225 Diabetes complications-clinical &amp; epidemiology

**Is diabetes a predictor of mortality in hemodialysis patients with cardiovascular disease?**

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**Objective:** To test the hypothesis that diabetes is a predictor of mortality in hemodialysis patients.

**Methods:** A number of 444 hemodialysis patients with cardiovascular disease was included from January to December 2018 from Hasan Sadikin General Hospital data. We analyzed demographic, clinical (electrocardiogram and electrocardiography, and biological data. We determined comorbidities such as diabetes, hypertension, coronary artery disease, chronic heart failure, atrial fibrillation, stroke, peripheral artery disease, and liver disease. The patients then were followed up after one year to assess the death event. Cox proportional hazards models were used to evaluate the effect of predictors of mortality. The Kaplan-Meier method and the log-rank test were used to evaluate and compare survival curves.

**Results:** Among 444 hemodialysis patients, 266 patients matched the inclusion and exclusion criteria, 166 patients were completely followed up in December 2019. The mean age was 50.8±14.68 years, 52.4% female, mean duration of follow-up duration was 11.2±6.08 months. Diabetes was found in 40 (24.1%) patients. We observed death in 109 patients (65.7%) patients. Diabetes was not associated to death (HR 1.241; 95% CI, 0.776-1.984, p=0.368). The other comorbidities were also not related to death. We found out that atrial fibrillation was associated as a strong predictor of death (HR 2.540; 95% CI, 1.558-4.140, p<0.001).

**Conclusion:** Diabetes was not a predictor of mortality in hemodialysis patients with cardiovascular disease. However, we found out atrial fibrillation event was associated with a higher incidence of death in hemodialysis with cardiovascular disease patients.

## PE230 Diabetes complications-clinical &amp; epidemiology

**Metabolic Syndrome (MetS) and type 2 diabetes mellitus among Filipino adults**

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**Objective:** Due to the increasing trend of type 2 diabetes and the change in food ecosystem in the Philippines, this study investigated the association of cardiometabolic syndrome and type 2 DM among the population.

**Methods:** This study reviewed the results of the national nutrition survey and extrapolated data on metabolic syndrome (MetS) and type 2 diabetes (T2D) then described the correlation between T2D and MetS. The study included the presence of 3 or more of the following criteria in the diagnosis of MetS: systolic BP above 130 mmHg, triglyceride level above 150mg/dl, HDL level lower than 50mg/dl, and FBS higher than 100 mg/dl.

**Results:** It was found out that among 20,236 participants, the prevalence of MetS was 11.29% and the prevalence of type 2 diabetes was 19.09%, which were higher than the worldwide average of 6.23%. Further, there is a higher prevalence of MetS (13.34%) and T2D (25.9%) in women compared to men. Results showed that four out of ten participants (n=1578) with MetS were diagnosed with type 2 DM. The odds of having type 2 diabetes are 15 times higher in patients who were diagnosed with MetS (OR:15.3251, CI 13.88-16.92, P<0.0001).

**Conclusion:** This study concluded that the diagnosis of metabolic syndrome is a good predictor of type 2 diabetes among the Filipino population. Also, there is a higher prevalence of MetS and Type 2 Diabetes among women than men in the sample population.

**PE234** Diabetes complications-clinical & epidemiology

**Prediction of bone resection of presepsin in diabetic foot ulcer**

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**Objective:** Patients hospitalized with diabetic foot ulcer need multidisciplinary care. In patients with diabetic foot, bone resection affects their length of hospitalization. Among the indicators of inflammation, Presepsin is a biomarker of infection that is derived from the soluble form of CD14, a receptor that recognizes bacterial ligands and triggers an inflammatory response. Presepsin levels in plasma increase in response to bacterial infection and decrease after antibiotic treatment. Presepsin secretion has been shown to be associated with monocyte phagocytosis and plasma levels of presepsin increase in response to bacterial infection and decrease after antibiotic treatment, therefore it can be considered a marker of activation of immune cell response towards an invading pathogen. We studied whether presepsin would help predict bone resection in diabetic foot patients who need bone resection.

**Methods:** From April 2021 to June 2023, 73 patients with diabetic foot ulcer who received inpatient treatment at Yeungnam University Medical Center were studied retrospectively. We investigated Inflammatory indicators such as presepsin, procalcitonin, white blood cell (WBC), erythrocyte sedimentation rate (ESR), and C-reactive protein (CRP). We evaluated the location, range, infection, strain culture, ischemia, calcification of wound.

**Results:** Presepsin, procalcitonin, WBC, ESR, and CRP were higher in patients with bone resection. Patients with bone resection had osteomyelitis and were higher with Texas grade significantly. And they had a longer duration of hospitalization due to bone resection.

**Conclusion:** Presepsin in the initial evaluation can be used as an indicator to predict the bone resection with diabetic foot ulcer.

**PE238** Diabetes complications-clinical & epidemiology

**The prevalence and risk factors of chronic kidney disease amongst type 2 diabetes at Cambodia Korea diabetes center**

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**Objective:** To assess the frequency of notice urine abnormality and GFR (Glomerular filtration) is the optimal way to measure in the chronic kidney function disease amongst type 2 diabetes and to prevent End Stage Renal Disease (ESRD).

**Methods:** From April 2020 until March 2021, 222 patients (Male: 132; Female: 90) were studied including lab test do on creatinine Clearance at Cambodia Korea Diabetes Center. Patients are required to have (1) either abnormalities of kidney structure or function. (2) sign of kidney damage (one or more) with eGFR less than 60 ml/min/1.73m<sup>2</sup>. There may have minor inaccuracy of result due to lack of reliable data and proper equipment for assessment.

**Results:** (1) 29% has CKD (Chronic Kidney Disease); (2) 71% has HTN (Hypertension). General root causes are diabetes, hypertension, family history with kidney disease, diabetes, or hypertension, A stage that can be detected by urine dipstick in Hospital testing. 1. Early structural changes to kidneys which may develop after about two years. Again, a sub clinical stage that does not produce symptoms. 2. Micro albuminuria, detected either by sensitive radioimmunoassay testing or by measuring albumin/creatinine (a metabolic compound) ratio, Does not produce symptoms but blood pressure is often raised. 3. Proteinuria. Detected by positive dipstick testing. This is the stage that is called clinical Chronic kidney disease. It is accompanied by high blood pressure and elevated levels of creatinine. 4. End stage renal failure. requiring continual, ongoing treatment.

**Conclusion:** Abnormal urine analysis and abnormal blood pressure measurement were common findings amongst asymptomatic patients. Unlike findings in other countries, no association of family history of diabetes, hypertension or CKD or the risk of kidney disease or abnormal blood pressure. A comprehensive community screening program for hypertension and kidney diseases is urgently needed to prevent ESRD.

**PE236** Diabetes complications-clinical & epidemiology

**The association between perceived body image and dysglycemia in Korean adult population**

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**Objective:** We evaluated the association between perceived body image and dysglycemia (including prediabetes and type 2 diabetes determined by HbA1c, fasting blood glucose, and being diagnosed by a doctor) based on the Korean National Health and Nutritional Examination (KNHAES) database.

**Methods:** Data were collected from 11,052 adults (19-65 years old) participating in the KNHANES VIII (2019-2021). Perceived body image was simplified into two groups (obese or non-obese) from the questionnaire (very thin, thin, normal, obese, and very obese). The concordance between body perception and actual body size was compared based on body mass index (BMI, cut off: 25 kg/m<sup>2</sup>). Multivariate logistic regression analyses were conducted to evaluate the association between body perception and dysglycemia.

**Results:** Individuals who perceived themselves as obese were younger than those who did not in obese (BMI >25) men (mean 42.1 vs. 46.5 years old) and women (mean 45.8 vs. 52.3 years old; all p-value <0.0001), but not in the non-obese population. Men who perceived themselves as obese were more likely to regard their health status as poor than those who perceived themselves as non-obese, regardless of their actual body size. Non-obese men (BMI <25) who overestimate their body size did more disordered weight-control behaviors than those who were concordant (6.7 vs. 2.1%; p-value <0.0001), such as fasting (1.8 vs. 0.4%; p-value=0.017) or skipping meals (5.7 vs. 1.9%; p-value <0.0001). Individuals who perceived themselves as obese were independently associated with dysglycemia in both obese women (OR 1.34, 95% CI 1.08-1.65; p-value=0.008) and non-obese women (OR 2.74, 95% CI 1.25-6.02; p-value=0.012) after adjusting for age, socioeconomic status, and metabolic comorbidities. In men, perceived body image was not associated with dysglycemia, regardless of their actual body size.

**Conclusion:** Perceived body image as obese was associated with dysglycemia regardless of their actual body size in women but not men.

**PE239** Diabetes complications-clinical & epidemiology

**Prevalence's of overweight and obesity among type 2 diabetes mellitus with insulin therapy in primary health care Malaysia: a population cross-sectional descriptive study**

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**Objective:** Globally, obesity continues to be one of the leading health concerns and is defined as excess body weight for a particular height linked to many chronic conditions, including type 2 diabetes mellitus (T2DM), hypertension, and cardiovascular disease (CVD). The main objective of this study is to determine the prevalence of obesity among T2DM with insulin therapy in primary health care in Malaysia.

**Methods:** A cross-sectional study was conducted at one primary health care centre in Selangor, Malaysia, from 1<sup>st</sup> August 2022 to 30<sup>th</sup> December 2022, involving 300 respondents with T2DM with insulin therapy. Information on sociodemographic and health factors was gathered using a questionnaire. The body mass index (BMI) is categorized as underweight (<18.5 kg/m<sup>2</sup>), normal weight (18.5-24.9 kg/m<sup>2</sup>), overweight (25.0-29.9 (kg/m<sup>2</sup>) and obese (≥30.0 kg/m<sup>2</sup>).

**Results:** The highest respondents are female with 194 (64.7%) and male 106(35.3%) with age mean 43.49 (±10.49) years. The average duration of respondents with diabetes is 9.58 (±6.67) years, and waist circumferences are 99.48 (±11.00) centimetres. Result of body mass index (BMI) show 1 (0.3%) underweight, 71(23.7%) is normal, overweight 79 (26.3%), and obese with 149 (49.7%). The age of 35-44 years shows the highest prevalence of overweight, and the age of 25-34 years shows the highest prevalence of obesity. Meanwhile, data shows gender (female) has the highest prevalence of overweight, with 50 (25.7%) and obese, with 91 (46.9%) compared to males, with 29 (27.4%) and 58 (54.7%), respectively.

**Conclusion:** Our findings show a high prevalence of obesity among T2DM with insulin therapy. Policy approaches and holistic strategies should be implemented to provide preventive measures for designing future investigative studies and strategies to control and prevent this obesity among adult T2DM, especially with insulin therapy in Malaysia.

## PE240 Diabetes complications-clinical &amp; epidemiology

**Prevalence and determinants of depression among type 2 diabetes mellitus patients with insulin therapy at primary health care in Malaysia: a cross sectional study**Nur Shazwaniza Binti Yahya<sup>1\*</sup>, Ahmad Zamir Che Daud<sup>1</sup>, Fauziah Ahmad<sup>2</sup>, Zamzalza Abdul Mulud<sup>1</sup>Universiti Teknologi Mara, Malaysia<sup>1</sup>, Ministry of Health, Malaysia<sup>2</sup>

**Objective:** Diabetes patients have an increased risk of developing depression, the second-leading cause of disability worldwide. Patients receiving more insulin injections daily were more likely to experience depressive symptoms. Therefore, this study will determine the prevalence and determinants of depression among Type 2 diabetes mellitus patients with insulin therapy attending primary health care in Malaysia.

**Methods:** This cross-sectional study was conducted from 1<sup>st</sup> August 2022 to 30<sup>th</sup> December 2022 at Sungai Buloh Health Clinic, Selangor, Malaysia. A total of 300 consecutive patients having T2DM with insulin therapy attending the diabetes clinic were screened for psychiatric disorders. Their socio-demographic and relevant clinical variables were recorded. Patients were assessed for depression using Depression Anxiety Stress Scales (DASS)-21. Chi-square and binary logistic regression analyses were used to analyse the relationship between depression, glycemic control, and background characteristics. Adjusted logistic regression models estimated the significant, independently associating factors with depression.

**Results:** Prevalence of depression among respondent who on insulin therapy is 22 (7.3%) which are categorized into mild 15 (5.0%), moderate 4 (1.3%) and severe 3 (1%). The major predictors for depression were gender (OR=5.173, 95% CI: 1.276-20.97), presence with comorbid hypertension (OR=6.698, 95% CI: 2.188-20.50), duration diabetes (OR=2.774, 95% CI: 1.276-6.317). The odds ratio was higher for comorbid hypertension with 6.698, followed by gender with 5.173 and duration of diabetes with 2.774.

**Conclusion:** This study indicates the use of insulin may induce psychological adaption to new behaviours and adhere to the complexity of treatment which is lead to depression. Insulin-dependent diabetics have a disproportionately high rate of clinical depression. Therefore, it is strongly suggested screening methods and intervention strategies should be implemented for early prevention and detection of depression among type 2 DM, especially with insulin therapy.

## PE241 Diabetes complications-clinical &amp; epidemiology

**Morbidity and mortality patterns in diabetic kidney disease based on KDIGO stratification**Seung Eun Lee\*, Jiyun Jung, Jae Yoon Park, Saebom Kim, Kyoung-Ah Kim  
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**Objective:** Type 2 diabetes is associated with increased mortality, and the presence of diabetic kidney disease (DKD) can further exacerbate this risk. It remains uncertain whether the KDIGO (Kidney Disease Improving Global Outcomes) chronic kidney disease (CKD) classification can effectively predict prognosis in the Korean population with type 2 diabetes.

**Methods:** We utilized data from the National Health Insurance Service-National Sample Cohort (NHIS-NSC) and selected patients with type 2 diabetes. These patients were then categorized based on the KDIGO CKD classification: low risk (G1), moderate risk (G2), high risk (G3), and very high risk (G4). Standard mortality ratios (SMRs) and standardized incidence ratios (SIRs) were calculated using the entire cohort population as the reference group.

**Results:** Among 86,991 patients with type 2 diabetes, 69,230, 10,903, 3,373, and 2,050 patients were classified as G1, G2, G3, and G4, respectively. The SMRs and 95% confidence intervals (95% CI) for all-cause death were progressively higher from G1 to G4 (G1, 2.43 (2.38-2.49); G2, 2.54 (2.43-2.65); G3, 2.86 (2.68-3.05); G4, 2.90 (2.67-3.14)). Similarly, SMRs for cardiovascular disease (CVD) death showed an increasing trend across the groups, with SMRs of 2.19 (2.04-2.33), 2.62 (2.35-2.92), 3.27 (2.81-3.78), and 3.98 (3.35-4.70) in G1, G2, G3, and G4, respectively. The risk for end-stage kidney disease (ESKD) development also escalated from G1 to G4, with SIRs of 1.74, 5.31, 14.33, and 33.9, respectively. Conversely, SMRs for malignant neoplasms were lower from G1 to G4 (G1, 3.06 (2.93-3.20); G2, 2.88 (2.63-3.15); G3, 2.58 (2.22-2.98); G4, 1.76 (1.41-2.17)), while SMRs for infectious diseases remained stable across the groups (G1, 2.20 (1.94-2.49); G2, 2.85 (2.35-3.42); G3, 2.57 (1.85-3.48); G4, 2.11 (1.31-3.23)).

**Conclusion:** The KDIGO CKD classification can effectively predict all-cause death and CVD-related death in Koreans with type 2 diabetes. However, the SMR of malignant neoplasms and infectious diseases remains high even in the low-risk group.

## PE242 Diabetes complications-clinical &amp; epidemiology

**Long-term effectiveness of the national diabetes quality assessment program in South Korea**Kyoung Hwa Ha<sup>1\*</sup>, Ji Hye Huh<sup>2</sup>, Serim Kwon<sup>3</sup>, Gui Ok Kim<sup>3</sup>, Bo Yeon Kim<sup>3</sup>, Dae Jung Kim<sup>1</sup>Ajou University School of Medicine, Korea<sup>1</sup>, Hallym University Sacred Heart Hospital, Korea<sup>2</sup>, Health Insurance Review and Assessment Service, Korea<sup>3</sup>

**Objective:** The Korean government has implemented the National Diabetes Quality Assessment Program (NDQAP) to improve the quality of diabetes care and reduce the risk of diabetes complications. This study evaluates the long-term effectiveness of NDQAP in individuals with diabetes.

**Methods:** From the Health Insurance Review and Assessment Service database, 399,984 individuals with diabetes who visited primary care clinics from July 1, 2012, to June 30, 2013, were included and followed up until May 31, 2021. The NDQAP included five quality assessment indicators: regular outpatient visits, continuity of prescriptions, regular testing of glycated hemoglobin and lipids, and regular fundus examination. Cox proportional hazards models estimated hazard ratios (HRs) and 95% confidence intervals (CIs) for diabetes complications and all-cause mortality by the achievement of assessment indicators.

**Results:** During the mean follow-up duration of 7.6±1.8 years, 20,054 (5.0%) cases of proliferative diabetic retinopathy (PDR), 6,281 (1.6%) end-stage kidney diseases (ESKD), 1,943 (0.5%) amputations, 9,706 (2.4%) myocardial infarctions (MI), 26,975 (6.7%) strokes, and 35,799 (8.9%) all-cause mortality occurred. Each quality assessment indicator was associated with a lower risk of diabetes complications and all-cause mortality. Individuals who were managed in high-quality institutions had a lower risk of PDR (HR, 0.82; 95% CI, 0.80-0.85), ESKD (HR, 0.77; 95% CI, 0.73-0.81), amputation (HR, 0.75; 95% CI, 0.69-0.83), MI (HR, 0.85; 95% CI, 0.82-0.89), stroke (HR, 0.86; 95% CI, 0.84-0.88), and all-cause mortality (HR, 0.96; 95% CI, 0.94-0.98) than those who were not managed in high-quality institutions.

**Conclusion:** In South Korea, NDQAP has long-term effectiveness in preventing severe diabetes complications and all-cause mortality. Policy efforts to encourage standardized and comprehensive diabetes management in primary care may continue to be necessary.

## PE243 Diabetes complications-clinical &amp; epidemiology

**Diabetes and other metabolism related adverse events reported after the use of COVID-19 vaccines: a descriptive study**Rimple Jeet Kaur\*, Jaykaran Charan  
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**Objective:** COVID-19 vaccines were used in large scale across the globe to battle off COVID-19 pandemic. The present study focuses on the adverse events (AEs) related to metabolism reported with COVID-19 vaccines in VigiBase, a database maintained by WHO for reporting adverse events.

**Methods:** The data of metabolism-related adverse events following COVID-19 vaccination was acquired on a subscription basis from VigiBase. This study included all the suspected metabolism-related adverse events reported in VigiBase after administering any of the COVID-19 vaccines: Moderna, BNT162b2 Pfizer and 1222 AstraZeneca and Covid-19 vaccine inact (Vero) between December 15, 2020, and January 24, 2021. The MedDRA (Medical Dictionary for Regulatory Activities) and WHO-ART terminology- SOC (System Organ Class) and PT (Preferred Terms) were used for analysis. We extracted three SOCs - Metabolism and Nutrition disorders and investigations. All the SOC were further cleaned to remove all PTs other than those related to the metabolic disorder. Disproportionality analysis was reported in the form of IC025, Reporting Odds Ratio and Prevalence Odds Ratio.

**Results:** A total of 103,954 AEs were reported for COVID -19 vaccines from 32,044 individuals, out of which only 636 (0.611 %) AE from 610 patients were metabolic disorders. Most common metabolism related AE reported were hypophagia (61.66%), dehydration (8.01%), and hyperglycaemia (8.80%) (Table 1). Based on the disproportionality analysis (IC025 values) none of them was vaccine related AE (Table 2). (Tables showing the data may be shared, not attached as no provision for attachment of tables)

**Conclusion:** COVID-19 vaccines are safe in terms of diabetes and metabolism related adverse events and there was no increase in the events were associated with the use of vaccines. As these were early data of vaccine use, analysis based on recent data need to be done to ascertain it fully.

**PE244** Diabetes complications-clinical & epidemiology

**Risk factor of worsening kidney function in elderly veteran population according to glycemic status**

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**Objective:** Diabetes mellitus is major cause of chronic kidney disease. There is limited data regarding risk factors for kidney disease among patients with or without diabetes. We aim to investigate risk factors to predict worsening kidney function in elderly veteran population with according to glycemic status.

**Methods:** In this retrospective study, a total of 1665 patients who measured serum glucose and albumin level between January 2016 and May 2021 were included. We categorized patients according to glycemic status as three groups - normoglycemia, impaired fasting glucose and diabetes populations. We used Kaplan-Meier to plot the survival curve. The hazard ratios (HRs) of renal outcome (i.e., a 50% or more decrease of the estimated glomerular filtration rate) were calculated after using Cox regression model. Cox proportional hazards model was used to explore risk factors affecting the progression of CKD.

**Results:** During the median follow-up period of 3.5 years (maximum 6.0 years), the events of renal outcome occurred in 174 patients. The mean age of patients at enrolled was 76.2±9.2 years, 85% was male. Hypoalbuminemia (HR, 1.83, [95% CI 1.14-2.93]; P=0.012), hyperuricemia (HR, 1.02, [95% CI 1.10-1.17], P=0.019) and urine albumin to creatinine ratio (uACr, A3) (HR, 5.6 [95% CI 2.85-11.18], P<0.001) were risk factors for renal function decline in overall population. In diabetes population, hypoalbuminemia (HR, 2.24, [95% CI 1.28-3.91], P=0.005), hyperuricemia (HR, 1.10, [95% CI 1.00-1.20], P=0.043) and uACr (A3) (HR, 7.98, [95% CI 3.06-20.8], P<0.001) were risk factors of renal progression. In patients with impaired fasting glucose, only uACr(A3) (HR, 4.14, [95% CI 1.20-14.38], P=0.025) was a risk factor of renal progression.

**Conclusion:** Serum albumin, uric acid and uACr may be needed to predict the risk of worsening kidney function with diabetes. Higher uACr is also a risk factor in prediabetes.

**PE246** Diabetes complications-clinical & epidemiology

**HbA1C variability and the risk of renal progression in type 2 diabetes mellitus**

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**Objective:** HbA1C variability has been found to be associated with diabetes-related complications independently of HbA1C levels. However, previous studies had relatively short follow-up periods, and used different types of HbA1c variability formulas. We aimed to explore the association between HbA1C variability and the development of renal progression in patients with type 2 diabetes mellitus using four different formulas.

**Methods:** The retrospective observational study analyzed 9,498 patients with type 2 diabetes mellitus who underwent HbA1C test at least three times from 2010 to 2015 at Ewha Womans University Mokdong Hospital. We excluded patients who were already in end-stage renal disease or had missing data. Glycemic variability was assessed using the coefficient of variation (CV), standard deviation (SD), variability independent of the mean (VIM), and variability score. The primary outcomes were renal progression, including - 1) end-stage renal disease, 2) sustained decline in eGFR ≥ 30% from baseline, or 3) persistent doubling of the serum creatinine level and an eGFR ≤ 45 mL/min/1.73 m<sup>2</sup>.

**Results:** During the 7.3 years of follow-up, there were 977 (10.3%) incidents of renal progression. The cumulative incidence of renal progression was increased as HbA1C variability increased. Participants were grouped into quartiles according to HbA1C variability and the HR (95% CI) for renal progression were 3.44 (2.73-4.33) assessed by CV, 3.22 (2.56-4.05) by SD, 3.24 (2.59-4.05) by VIM, and 1.93 (1.40-2.67) by variability score in the highest quartile compared to the lowest quartile (adjusted by age, sex, body mass index, eGFR, urine albumin-creatinine ratio, total cholesterol, LDL cholesterol, triglycerides, and mean HbA1C).

**Conclusion:** HbA1C variability was independently associated with the renal progression in patients with type 2 diabetes mellitus. It would be necessary to minimize HbA1C variability in order to prevent renal progression and delay its advancement.

**PE245** Diabetes complications-clinical & epidemiology

**Diabetic foot ulcer: 6 years follow-up study**

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**Objective:** Diabetic foot (DF) is one of common complication of diabetes. The aim of this study was to evaluate diabetic foot ulcer situation at the diabetic foot clinic of EndoMed hospital, Ulaanbaatar, Mongolia.

**Methods:** We analyzed DIAFI-DATA program where, patients with diabetic foot ulcer (DFU) were registered since January 1, 2017 to March 1, 2023.

**Results:** Total number of patient visited our center during the last 6 years was 17624 and 1316 subjects screened by foot examination. Patients with DFU were 47 and males were 35 (74.5%). By age: <20, 40-60, and >60 years old was 1 (2.1%), 13 (27.6%) and 33(70.2%); by diabetes duration: 5-10, 10-20 and >20 years was 4 (8.5%), 31 (65.9%) and 12 (25.5%), respectively. Patients with HbA1C <7%, 7-8%, 8-10% and >10% was 7 (14.8%), 10 (21.2%), 3 (6.3%) and 27 (57.4%). Neuropathic and neuro-ischaemic ulcer was 20 (42.5%) and 27 (57.5%). Hospitalized patients due to ulcer, with previous amputations and previous ulceration was 43 (91.5%), 12 (25.6%) and 13 (27.7%). Average time to referral to diabetic foot clinic was 64.47 days and 10 or more days long delay was 37 (78.7%). Number of total healed ulcer was 19 (40.4%), by wound dressing and by amputation was 12 (25.5%) and 7 (14.9%). Number of non-healed ulcer was 28 (60%), with amputation and wound dressing was 3 (6.4%) and 4 (8.5%), deceased due to co-morbidity was 2 (4.6%) and not seen for 12 months or more was 19 (40.4%).

**Conclusion:** Prevalence of diabetic foot ulcer is 3.7%. Among patients with DFU males are dominant and patients with age >60, diabetes duration 10-20 years, HbA1C >10%, neuro-ischaemic ulcers are common.

**PE247** Diabetes complications-clinical & epidemiology

**Metabolic dysfunction-associated steatotic liver disease increases the risk of incident cardiovascular disease: a nationwide cohort study**

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**Objective:** The various subcategories under the overarching term of steatotic liver disease (SLD) have been recently proposed by the nomenclature consensus group and endorsed by international academic liver societies. Our aim was to investigate the association between each subtype of SLD and incident cardiovascular disease (CVD) in a nationwide Korean cohort.

**Methods:** From a nationwide health screening database from Korea, 351,464 individuals aged 47 to 86 years between 2009 and 2010 were included and followed for a median of 9.0 years. Individuals were categorized into no SLD, metabolic dysfunction-associated steatotic liver disease (MASLD), MASLD with increased alcohol intake (MetALD), and alcohol-related liver disease (ALD). Hepatic steatosis was defined as fatty liver index >=60. The primary outcome was a composite CVD, which includes non-fatal and fatal myocardial infarction and stroke.

**Results:** The prevalence of no SLD, MASLD, MetALD, and ALD was 44.2%, 47.1%, 8.5%, and 0.1%, respectively; and the incidence rate of CVD in each category was 6.2, 8.5, 8.8, and 5.1 per 1,000 person-years. MASLD and MetALD increased the risk of CVD compared to no SLD which increment was in consecutive order ( $P_{trend}$  <0.001), but ALD did not increase the risk of incident CVD.

**Conclusion:** Individuals with either MASLD or MetALD are at an increased risk of developing incident CVD. Higher risk of CVD observed in MetALD compared to MASLD suggests the additive impact of alcohol consumption in conjunction with cardiometabolic risk factors on CVD development. These findings support and validate the utility of the new consensus criteria for SLD in predicting CVD.

Plenary lectures  
Main symposia  
Joint sessions  
Committee sessions  
Research group sessions  
Sponsored sessions  
Corporate symposia  
Education course  
Oral presentations & Poster exhibitions

## PE248 Diabetes complications-clinical &amp; epidemiology

**Handgrip strength dynamics pre- and post-dialysis in diabetic patients: implications for nutritional status and overall well-being**

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**Objective:** This study aims to examine the variations in handgrip strength before and after dialysis treatment and explore its association with nutritional status and general physical well-being among patients undergoing maintenance hemodialysis for end-stage renal disease (ESRD) with diabetes.

**Methods:** A cross-sectional study was conducted on 102 individuals with diabetes undergoing maintenance hemodialysis (MHD) for ESRD at the First State Central Hospital of Mongolia in 2023. Handgrip strength (HGS) and body weight measurements were assessed both before and after dialysis treatment.

**Results:** Among the 102 participants, 65.1% (n=65) were male, with a mean age of 51.2±14.8 years and an average HD duration of 4.6±4.1 years. The mean body weight change was 4.22 kg (ranging from 0-17 kg), a significant indicator of overall body condition. Those with substantial changes in body weight showed less variation in HGS before and after dialysis. For male participants with a body weight decrease of up to 5 kg, HGS increased from 22 kg to 28 kg, while those with a body weight decrease exceeding 5 kg experienced a decline in HGS from 48 to 28 kg. Additionally, a positive correlation was found between HGS and midarm circumference (Spearman's correlation coefficient, r=0.126, p=0.001), suggesting HGS as a potential indicator of nutritional status. Furthermore, patients with less HGS fluctuation reported higher well-being scores on a Likert scale (3.4/5) compared to those with greater HGS fluctuations (2.8/5, p=0.002).

**Conclusion:** Monitoring handgrip strength before and after dialysis emerges as a valuable tool to assess patients' general health and nutritional status. These findings underscore the importance of understanding HGS dynamics in diabetic individuals undergoing hemodialysis to better manage their overall well-being.

## PE249 Diabetes complications-clinical &amp; epidemiology

**The association between blood pressure reduction mediated by blood pressure lowering agents and the risk of peripheral arterial disease: a systematic review and meta-analysis of randomized controlled trial**

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**Objective:** Hypertension is a common comorbidity among patients with diabetes, who are also at high risk for peripheral arterial disease (PAD). However, existing studies investigating blood pressure (BP) lowering treatments and the risk of PAD in patients with diabetes have yielded inconsistent conclusions. Therefore, we conducted a systematic review and meta-analysis to assess the association between the BP reduction mediated by BP lowering agents and the risk of PAD especially in patients with diabetes.

**Methods:** PubMed, EMBASE, the Cochrane Center Register of Controlled Trials for Studies and Clinicaltrials.gov were searched from January 1980 to October 2022. Randomized controlled trials (RCTs) with statistically significant differences in BP reduction between BP lowering agent treatment and control treatment arms, which reported the events of PAD, amputation, or diabetic foot were included. The results were computed as risk ratio (RR) and 95% confidence intervals (CIs).

**Results:** In all, 18 RCTs involving 108,901 participants were included. Intensive BP reduction achieved by BP lowering agents was associated with a slightly increased risk of PAD (RR=1.07, 95%CI, 1.00 to 1.14, P=8%). Meta-regression analyses suggested that systolic blood pressure (SBP) reduction difference was associated with the increased risk of PAD ( $\beta$ =-0.1107, 95%CI, -0.219 to -0.002, P=0.047). Risk of PAD was found to be marginally elevated in subgroup with high percentage of smokers when compared with the subgroup with low percentage of smokers (P for subgroup difference=0.03). Moreover, the risk of PAD was lower in patients with calcium channel blockers (CCB) when compared to those using renin-angiotensin-aldosterone system inhibitors (P=0.03), angiotensin receptor-neprilysin inhibitors (P=0.01) and beta-blockers (P=0.01).

**Conclusion:** The intensive BP reductions mediated by BP lowering agents was associated with an increased risk of PAD especially in patients with diabetes. A gradual and moderate BP reduction as well as regular BP monitoring should be recommended for patients at risk of PAD.

## PE250 Diabetes complications-clinical &amp; epidemiology

**Optimal LDL cholesterol levels in young and old patients with type 2 diabetes for secondary prevention of cardiovascular diseases are different**

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Mee Kyoung Kim<sup>1</sup>, Tae-Seo Sohn<sup>1</sup>, Ki-Hyun Beak<sup>1</sup>, Ki-Ho Song<sup>1</sup>,  
Hyun-Shik Son<sup>1</sup>, Kyungdo Han<sup>2</sup>, Hyuk-Sang Kwon<sup>1</sup>

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**Objective:** Real-world-based population data about the optimal LDL-C level for preventing cardiovascular disease in very high-risk populations is scarce. Data from the Korean National Health Insurance System database were analyzed to investigate the association between LDL-cholesterol level and the new onset of cardiovascular disease (CVD) in type 2 diabetes (T2DM) patients with established CVD.

**Methods:** From 2009 to 2012, 26,922 people aged  $\geq$  40 years with T2DM who had a history of percutaneous coronary intervention (PCI) were analyzed. Endpoints of this study were recurrent PCI, newly stroke or heart failure, CV death, and all-cause death. The study population was followed up from baseline to the date of a cardiovascular event or the time to death, or until the end of the study period (December 31, 2018). Participants were divided into the following categories according to LDL-C level: <55 mg/dL, 55-69 mg/dL, 70-99 mg/dL, 100-129 mg/dL, 130-159 mg/dL, and  $\geq$ 160 mg/dL.

**Results:** Compared to LDL-C level <55 mg/dL, the multivariable-adjusted hazard ratios (HR) for re-PCI and stroke increased linearly with increasing LDL-C level in the population under 65 years old. However, in the population aged  $\geq$  65 years old, HRs for re-PCI and stroke in LDL-C=55-69 mg/dL were 0.97 (95% CI: 0.85-1.11) and 0.96 (95% CI: 0.79-2.23), respectively. The optimal range with the lowest HR for HF and all-cause mortality were LDL-C=70-99 mg/dL and LDL-C=55-69 mg/dL, respectively, in all age groups (HR: 0.99, 95% CI: 0.91-1.08 and HR: 0.91, 95% CI: 0.81-1.01).

**Conclusion:** LDL-C level below 55 mg/dL seems to be beneficial in T2DM patients with established CVD aged <65 years, while an LDL-C level of 55-69 mg/dL may be optimal for preventing recurrent PCI and stroke in patients over 65 years old.

## PE251 Diabetes complications-clinical &amp; epidemiology

**Complete blood count parameters in type 2 diabetes mellitus: a matched case-control study**

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**Objective:** This case-control study aimed to compare complete blood count parameters between age- and sex-matched diabetic and non-diabetic groups and to investigate the association of these parameters with glycemic control in people with diabetes.

**Methods:** Data was collected between February and August 2022 from Mongolia-Japan University Hospital. After excluding various chronic conditions that can affect the CBC, a total of 156 participants was included, consisting of 78 type 2 diabetes patients and 78 age- and sex-matched healthy controls. Complete blood count parameters were measured and compared between the two groups.

**Results:** The study comprised individuals with a mean age of 49.9±6.9 years, of whom 40.4% (n=63) were male. The mean BMI for all participants was 29.8±6.7 kg/m<sup>2</sup>. The diabetes group exhibited a mean diabetes duration of 5.2±5.6 years and a mean HbA1c level of 9.0±2.4%. Compared to the healthy controls, the diabetes group showed significantly higher levels of various blood parameters, including red blood cells, hemoglobin, hematocrit, red cell distribution width, mean corpuscular volume, mean corpuscular hemoglobin, platelet count, white blood cells, neutrophils, lymphocytes, and the ratio of neutrophils to lymphocytes (p<0.05). Furthermore, within the diabetes group, individuals with higher HbA1c (>7.0%) displayed higher ratios of neutrophils to lymphocytes (2.15±0.91 and 1.87±0.68, p=0.031) and red cell distribution width (13.3±1.0 and 12.9±1.0, p=0.026) compared to those with lower HbA1c (<7.0%). To assess the significance of these differences while controlling for diabetes duration and BMI, we conducted an adjusted ANOVA. The estimated values remained significantly different based on glycemic status (p<0.05).

**Conclusion:** This study revealed notable distinctions in complete blood count parameters between type 2 diabetes and non-diabetes groups. These findings suggest the potential utility of these blood count markers in assessing diabetes management. Further research is needed to explore their clinical significance and implications.

## PE252 Diabetes complications-clinical &amp; epidemiology

**Cardiac autonomic neuropathy screening in diabetic patients**

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**Objective:** Diabetes-associated cardiovascular autonomic neuropathy (CAN) damages autonomic nerve fibers that innervate the heart and blood vessels, in turn causing abnormalities in heart rate and vascular dynamics. The aim of the study was a screening of cardiac autonomic neuropathy in diabetic patients.

**Methods:** The hospital-based cross-sectional study included 643 (340 males and 303 females) diabetic patients. Screening of cardiac autonomic neuropathy including four parasympathetic function tests (resting heart rate, deep breathing, standing, and Valsalva maneuver) and two sympathetic function tests (postural hypotension, sustained hand grip) by using PC-based cardiac autonomic neuropathy system analyzer - CANS 504. Cardiac autonomic neuropathy is defined as a number of abnormal tests  $\geq 4$  out of 6.

**Results:** Diabetic patients' mean age was  $52.1 \pm 12.1$  years old. 276 patients could not perform the Valsalva maneuver test. DM patients with normal and abnormal Resting heart rate were 640 (99.5%) and 3 (0.5%); with normal, borderline, and abnormal Deep breathing tests were 477 (74.2%), 99 (15.4%), and 67 (10.4%); with normal, borderline, and abnormal Standing tests were 229 (35.6%), 90 (14%), and 320 (49.8%); with normal and borderline Valsalva maneuver were 342 (53.2%) and 25 (3.9%), with normal, borderline, and abnormal Postural hypotension were 448 (69.7%), 161 (25.1%), and 28 (4.3%); with normal, borderline, and abnormal Sustained hand grip were 25 (3.9%), 43 (6.7%), and 487 (75.7%), respectively. Cardiac autonomic neuropathy was positive in 346 (53.9%) patients, according to total abnormal test results.

**Conclusion:** Prevalence of cardiac autonomic neuropathy is 53.9% among diabetic patients. One out of two diabetic patients has cardiac autonomic neuropathy.

## PE255 Diabetes complications-clinical &amp; epidemiology

**The metabolic characteristics and carotid intima-media thickness of lean metabolic dysfunction associated steatotic liver disease in patients with type 2 diabetes mellitus**

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**Objective:** Recently, the weight-dependent nature of metabolic dysfunction in metabolic dysfunction associated steatotic liver disease (MASLD) is highlighted. We aimed to evaluate the metabolic characteristics and carotid atherosclerosis risk of lean MASLD in participants with type 2 diabetes mellitus (T2DM).

**Methods:** We investigated 6,991 T2DM participants who underwent abdominal ultrasonography and carotid ultrasonography. We investigated the association between MASLD and the burden of carotid artery atherosclerosis separately according to leanness.

**Results:** Of the 6,991 participants, 594 (8.5%) were classified as lean MASLD, 1,595 (22.8%) were classified as non-lean without MASLD, and 3,117 (44.6%) had non-lean MASLD. The degree of insulin resistance calculated by HOMA2 - IR and ApoB/ApoA1 was significantly higher in lean MASLD as compared with lean non-MASLD, however, it was weight dependent with significantly less in lean MASLD as compared with non-lean MASLD (all  $p < 0.005$ ).

After adjusting for potential confounders, carotid intima-media thickness was significantly higher in lean MASLD than in lean without MASLD ( $0.817 \pm 0.178$  vs.  $0.804 \pm 0.176$  mm,  $p = 0.044$ ). However, it showed a lower tendency than non-lean MASLD ( $0.817 \pm 0.178$  vs.  $0.824 \pm 0.169$  mm,  $p = 0.078$ ).

**Conclusion:** A weight-dependent nature of metabolic dysfunction was also confirmed in patients with T2DM and hepatic steatosis. Lean MASLD was also significantly associated with a higher burden of carotid artery atherosclerosis in patients with T2DM compared to lean non-MASLD.

## PE254 Diabetes complications-clinical &amp; epidemiology

**Association of metabolic dysfunction-associated fatty liver disease with brain white matter changes and cognitive decline: a longitudinal cohort study**

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Kyung Mook Choi<sup>1</sup>, Sei Hyun Baik<sup>1</sup>, Nan Hee Kim<sup>1</sup>, Chol Shin<sup>2</sup>,

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**Objective:** Recent evidence suggests a higher risk of extrahepatic complication, including cancer, cardiovascular disease, and dementia, in association with fatty liver disease. This study investigated the longitudinal changes in brain structure and cognitive function associated with metabolic dysfunction-associated fatty liver disease (MAFLD) and examined whether the severity of hepatic steatosis is independently associated with cognitive decline.

**Methods:** Data from 2155 participants with both baseline and 4-year follow-up brain magnetic resonance images and neuropsychological measures from the Ansan cohort of the Korean Genome Epidemiology Study were used. The hepatic fat components of the participants were assessed using computed tomography scans, and the presence of hepatic steatosis was defined as a liver attenuation index (LAI) value  $< 5$  HU.

**Results:** Among the 2155 participants, 512 had MAFLD, and only 7 patients showed simple hepatic steatosis (LAI  $< 5$  HU) without metabolic dysfunction. Over a median follow-up of 4.1 years, the presence of MAFLD was independently associated with age-related white matter changes (ARWMC) (OR 1.58; 95% CI 1.25-1.99,  $P < 0.001$ ), but not with total brain volume changes. The LAI, waist circumference, blood pressure, diabetes were individual components associated with ARWMC. In terms of cognitive performance, the global and domain-specific cognitive Z scores of MAFLD patients were not reduced during the follow-up period. However, lower LAI were associated with a decrease in the Stroop color test Z score, which evaluates information processing speed, in the subgroup of participants without visceral obesity.

**Conclusion:** MAFLD was associated with an increase in ARWMC, while brain atrophy remains unchanged over 4.1 years. The severity of hepatic steatosis was independently associated with reduced information processing speed in participants without visceral obesity. Long-term follow-up studies will be needed to determine if brain structural changes associated with MAFLD patients lead to cognitive decline.

## PE256 Diabetes complications-clinical &amp; epidemiology

**Diabetic kidney disease, cerebral structural changes, and cognitive decline**

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**Objective:** Chronic Kidney disease (CKD) has been reported to be associated with brain atrophy and cognitive impairment. However, there is a limited number of longitudinal studies conducted in a large cohort. In this study, we examined the longitudinal changes in brain volume, cerebral vascular events, and cognitive function associated with diabetic kidney disease. We also investigated whether white matter abnormalities with vascular events mediate the association between CKD and cognitive decline.

**Methods:** The analysis included 666 participants with type 2 diabetes who had both baseline and 4-year follow-up brain magnetic resonance images and neuropsychological measures from the Ansan cohort of the Korean Genome Epidemiology Study. CKD was defined as an estimated glomerular filtration rate (eGFR)  $< 60$  mL/min/1.73 m<sup>2</sup> and/or a urine albumin-to-creatinine ratio (UACR)  $> 30$  mg/g.

**Results:** The participants had a mean age of 60.7 years, and 54.5% were male, with a mean diabetes duration of 6.3 years. Among the 666 participants with type 2 diabetes, 91 had CKD. CKD patients showed more white matter hyperintensities on baseline imaging (OR 1.94; CI 1.17-3.20), more lacunar infarction and microhemorrhage on both baseline and follow-up imaging after adjustment for other independent predictors. Total brain volume atrophy was not associated with CKD during a mean follow-up of 4.1 years. CKD was associated with greater a decline in global cognitive Z score ( $P = 0.026$ ) and attention and concentration ( $P = 0.014$ ), independent of baseline glycemic control. However, white matter hyperintensities or cerebral vascular events did not mediate the association between CKD and cognitive decline.

**Conclusion:** CKD was associated with an increase in white matter hyperintensities and cerebral vascular events, along with a decline in global cognitive performance during a 4.1-year period. More research on cognitive impairment associated with CKD will be needed to fully understand the underlying pathophysiology.

## PE257 Diabetes complications-clinical &amp; epidemiology

**Wound, ischemia, and foot infection (WIFI) classification for risk stratification in diabetic foot ulcer patients: a systematic review and meta-analysis**I Pande Putu Deny Heriwijaya<sup>1\*</sup>,  
Made Lady Adelaida Purwanta<sup>2</sup>, Putu Astri Novianti<sup>1</sup>Udayana University Hospital, Indonesia<sup>1</sup>, Wangaya Hospital, Indonesia<sup>2</sup>

**Objective:** Diabetic foot ulcer (DFU) is a complication of diabetes mellitus (DM) impairment that can lead to limb amputation due to a delayed wound healing process. The objective of this study was to evaluate the Wound, Ischemia, and foot Infection (WIFI) group classification to stratify risk in DFU patients.

**Methods:** Pubmed, ScienceDirect, and Google Scholar studies within the last 10 years were used based on PRISMA and PICO criteria. Keywords were used: (Wound, Ischemia, and foot Infection classification OR WIFI classification) AND (wound healing) AND (amputation) AND (diabetic foot ulcer). We used studies involving DFU patients that were grouped using the WIFI classification. Wound healing and amputation events based on WIFI classification groups were pooled for forest plot analysis. Quality assessment was done with the STROBE checklist.

**Results:** Six studies met the inclusion criteria. Analysis of three studies revealed a significant difference in wound healing, with WIFI classification groups 1-2 being more common than WIFI classification groups 3-4 (Risk difference (RD)=-0.19; 95%CI -0.23-(-0.14); p<0.00001). Three of the four studies looked at substantial variations in amputation rates, with WIFI classification groups 3-4 having higher rates of amputation within 12 months than WIFI classification groups 1-2 (RD=0.24; 95%CI 0.03-0.44; p=0.03). One study resulted in a heterogeneity of the overall studies for amputation rates. This could be because the demographic sample in this study differed from that in the others. Amputation rates, however, showed still a substantial difference, with groups 3-4 of the WIFI having higher rates in a year than groups 1-2.

**Conclusion:** WIFI classification could be a valuable technique in predicting wound healing and amputation risk in DFU patients 12 months after the initial examination. Future studies on this potential classification, particularly on people with non-diabetic ulcers, are needed to stratify the risk.

## PE260 Diabetes complications-clinical &amp; epidemiology

**A meta-analytic synthesis of metformin for advanced or inoperable non-small cell lung cancer in patients with and without diabetes**

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**Objective:** Diabetes mellitus (DM) is a prevalent chronic condition, with approximately 8.7% of non-small-cell lung carcinoma (NSCLC) patients affected by DM. Several studies have been studied, metformin as a potential anti-cancer agent. However, the role of metformin in advanced or inoperable NSCLC remains uncertain. To address this gap, we performed a meta-analysis to assess the effects of metformin in patients with and without diabetes who have advanced NSCLC.

**Methods:** We conducted a systematic search in MEDLINE, CENTRAL (Cochrane Central Register of Controlled Trials), and Web of Science. The outcome measures considered were overall survival (OS), progression-free survival (PFS), locoregional recurrence-free survival (LRRFS), and distant metastasis-free survival (DMFS). To estimate the pooled hazard ratio (HR) with a 95% confidence interval (CI), we utilized the generic inverse variance outcome type. A random effects model was employed to assess the overall pooled estimate using RevMan 5.3.

**Results:** The meta-analytic synthesis comprised a total of seven studies. All of these studies investigated the impact on overall survival (OS). Three studies assessed PFS, while two studies each focused on LRRFS and DMFS, respectively. The results from the current synthesis revealed that metformin significantly extended both OS and PFS when compared to non-metformin users (HR: 0.67, 95% CI: 0.53-0.84, p=0.0005) and (HR: 0.58, 95% CI: 0.40-0.82, p=0.002), respectively. However, no significant differences were found for LRRFS and DMFS (HR: 0.72, 95% CI: 0.49-1.06, p=0.09) and (HR: 0.60, 95% CI: 0.27-1.34, p=0.21), respectively. Furthermore, in patients with locally advanced NSCLC and DM, there were no significant differences observed between metformin users and non-metformin users.

**Conclusion:** The results of the current study demonstrate that metformin significantly improved both OS and PFS in patients with advanced or inoperable NSCLC. The use of metformin concurrently has shown promising outcomes for these patients. However, further studies are needed to validate and strengthen the present findings.

## PE261 Diabetes complications-clinical &amp; epidemiology

**Acute glycemic variability as the risk factor for mortality in Diabetes Mellitus Type 2 (T2DM) Patient with sepsis: prospective observational study**

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**Objective:** Previous studies showed that glycemic disorder may adversely affect the prognosis in patient with sepsis. Higher acute glycemic variability (GV) may be a strong risk factor for mortality in patient with sepsis. The aim of this study was to determine role of acute glycemic variability for mortality in T2DM patient with sepsis

**Methods:** The prospective observational study held in Sumber Waras Hospital, Indonesia from 2021-2023. The main inclusion criteria were confirmed diabetes mellitus type 2 (T2DM) and sepsis patient in ICU settings. The blood glucose was carried three times a day until the subject died or transfer to non-intensive wards. Acute GV evaluated with MAGE (Mean Amplitude Glucose Excursion) parameter. The outcome was to determine role of acute GV for multi-organ failure and mortality. Analysis carried with cox hazard regression models.

**Results:** Total there 153 subjects in the study period. The mean age was 55±5.3 years old. The subject with multi-organ failure had significance higher acute GV during observation (p=0.000), HR 3.48 (1.59-5.04). Non-survivor group had significance higher acute GV compared to survivor group (p=0.000), HR 5.19 (2.47-7.91). Insulin administration, non-ventilator support, and longer duration of T2DM also had significance influence on survivor group. The high glycemic fluctuation is associated with activation of oxidative stress and inflammation, also reflect the severity of sepsis. Acute GV was the important predictor of severity and mortality in sepsis.

**Conclusion:** Higher acute GV in T2DM patients with sepsis was significance associated with increased risk for multi-organ failure and mortality. High acute GV is a simply promising treatment target for sepsis.

## PE262 Diabetes complications-clinical &amp; epidemiology

**Reasons for hospitalization among patients with type 2 diabetes in Cambodia-Korea diabetes center from January 1 to June 30, 2023**

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**Objective:** The objective of this study was to evaluate the characteristics and reasons for hospitalization among patients with type 2 diabetes in Cambodia-Korea Diabetes Center (CKDC)

**Methods:** A retrospective observation study of inpatient records of patients with diabetes admitted from January to June 2023 in CKDC. The details of patients' age, creatininemia, hba1c, reasons for admission and diagnosis were retrieved manually from the electronic medical system. A descriptive analysis was conducted using Excel

**Results:** Among 168 admitted patients, 155 have type 2 diabetes. The average age of patients is 60.5y±11.4. The average HbA1c is 9.2%±2.5. The main reason for admission is uncontrolled diabetes (102=65.81% have hbA1c>8%), followed by diabetic foot infection (47=30.32%), other site infection (28=18%), hypoglycemia (17=10.9%), diabetic ketoacidosis (5=3.23%), hyperosmolar hyperglycemic state (1=0.65%). Half of patients (78=50.65%) present with chronic kidney disease (eGFR<60 ml/min). The number of new diagnosis with diabetes is 71 (45%) while the average duration of chronic diabetes is 10.5y±8.7.

**Conclusion:** This study demonstrated that the three leading causes of admission to CKDC are uncontrolled diabetes, infection and hypoglycemia. Chronic kidney disease are seen in half of patients. A high rate of unrecognized diabetes and uncontrolled diabetes results in an elevated proportion of acute and chronic complications around 10 years of diabetes. Self-awareness among patients and effective primary care and hospital outpatient preventive and treatment strategies, including education and multifactorial intervention for cardiovascular risk factors in patients with diabetes, may decrease complications and hospitalizations among diabetic patients.

**PE263** Diabetes complications-clinical & epidemiology**The risk of cardiovascular disease according to the disabilities in patients with type 2 diabetes**Jin Hyung Jung<sup>1\*</sup>, EunKyung Jeong<sup>2</sup>,Kyu Na Lee<sup>1</sup>, Bongseong Kim<sup>1</sup>, Kyungdo Han<sup>3</sup>Sungkyunkwan University School of Medicine, Korea<sup>1</sup>, College of Medicine, Catholic University of Korea, Korea<sup>2</sup>, Soongsil University, Korea<sup>3</sup>

**Objective:** Disabled people with type 2 diabetes mellitus (DM) can lead to reduced quality of life and premature death. Although the importance of active health management is required to prevent complications in people with diabetes who have disabilities, few studies have estimated the potential reduction in atherosclerotic cardiovascular disease (CVD) risk due to disability in people with type 2 DM. In this study, we empirically investigated the risk of CVD according to the presence or absence of disability registration in type 2 DM patients through an observational study.

**Methods:** We used the Korean National Health Insurance Service (NHIS) database. From the NHIS database, we identified 1,897,596 patients diagnosed with type 2 DM between 2009 and 2012, and followed up until the end of 2019. Patients with a history of type 1 diabetes, myocardial infarction (MI), or stroke prior to the index date were excluded. The Cox proportional model was used to estimate the hazard ratio (HR) with 95% confidence interval (CI) for MI and stroke according to the presence or absence of disability registration, severity of disability, and type of primary disability.

**Results:** Patients with disabilities exhibited a higher risk of MI and stroke compared to those without disabilities, the HR (95% CI) was 1.26 (1.23-1.29) for MI and 1.27 (1.24-1.30) for stroke. In addition, Patients with severe disabilities exhibited a HR (95% CI) of 1.39 (1.32-1.46) in MI and 1.50 (1.44-1.57) in Stroke. In particular, HR (95% CI) of MI was 3.81 (3.22-4.51) and HR (95% CI) stroke was 3.55 (3.03-4.16) in people with kidney disabilities.

**Conclusion:** This study suggests that disabled people with type 2 diabetes are associated with a risk of CVD. Furthermore, people with severe disabilities and kidney disabilities show the need for more active management in preventing CVD.

**PE265** Diabetes complications-clinical & epidemiology**Disparities in treatment targets attainment and medication use in a multi-ethnic population with type 2 diabetes in Malaysia**Yubi Mamiya<sup>1\*</sup>, Tinney Mak<sup>1</sup>, Anis Syazwani Bt Abd Raof<sup>2</sup>,Samuel JW. Lee-Boey<sup>2</sup>, Ru-Jin Lim<sup>2</sup>,Singh A/L Jeswender Singh Sarkaaj<sup>2</sup>, Lee-Ling Lim<sup>2,3,4</sup>Princeton University, United States<sup>1</sup>, University of Malaya, Malaysia<sup>2</sup>, The Chinese University of Hong Kong, China<sup>3</sup>, Asia Diabetes Foundation, China<sup>4</sup>

**Objective:** Evidence of racial disparities in treatment targets attainment and medication use among patients with type 2 diabetes (T2D) is mainly from high-income countries and Western populations. In the present observational study, we aimed to understand if there are similar disparities in a multi-ethnic population with T2D in Malaysia, an upper middle-income country in Southeast Asia.

**Methods:** We collected data from 17,039 patients with T2D who received care from 2015-2020 at the University of Malaya Medical Center. Information on their medications and corresponding treatment metrics was compared to the 2019 American College of Cardiology/American Heart Association Clinical Guidelines on the Treatment of Cardiovascular Disease and Diabetes. We performed statistical analysis in R to understand how the degree of alignment as outlined in the clinical guidelines differed between patients with T2D of different races.

**Results:** The cohort comprised of 6,505 (38%) Melayu, 4,587 (27%) Chinese and 5,516 (32%) Indian (mean age: 66±13 years, 47% men). Compared with Melayu patients, Chinese and Indian patients were more likely to be prescribed dosages for medications that did not meet clinical guidelines. The intensity of statin dosage agreed with guidelines in only 28.9% of Chinese patients and 37.9% of Indian patients, which was significantly less than the 41.3% agreement among Melayu patients. In addition, Indian patients were significantly less likely to attain target HbA1c <7% (p<0.001), blood pressure <130/80 mmHg (p<0.001), and low-density lipoprotein cholesterol (LDL-C) <1.8 mmol/L (p<0.001) levels compared to Chinese and Melayu patients.

**Conclusion:** Indian T2D patients received less appropriate treatment and attained fewer treatment targets in comparison to patients of different races in Malaysia. Therefore, treatment of T2D must include education on racial bias for clinicians and medical providers.

**PE264** Diabetes complications-clinical & epidemiology**Sex differences in the prevalence and factors associated with metabolic syndrome in the general population of Mongolia**Lkham-Erdene Byambadoo<sup>1\*</sup>, Eiko Yamamoto<sup>2</sup>Ministry of Health, Mongolia<sup>1</sup>,Nagoya University Graduate School of Medicine, Japan<sup>2</sup>

**Objective:** To define the prevalence and factors associated with metabolic syndrome (MetS) between men and women in Mongolia using secondary data from the STEP-wise approach to non-communicable disease risk factor surveillance conducted in 2019.

**Methods:** This is a cross-sectional study using secondary data from the STEPS survey that was conducted in Mongolia in 2019. STEPS was a nationwide survey that included 6,654 participants from all 21 provinces and nine districts of Mongolia and was conducted by the National Center for Public Health and the Ministry of Health with technical support from the World Health Organization. A chi-square test was used to compare characteristics and a logistic regression analysis was performed to identify factors associated with MetS.

**Results:** In total, 5,844 participants (2,647 males and 3,197 females) aged 15-69 years were enrolled in the study. The prevalence of MetS by the International Diabetes Federation and Adult Treatment Panel III was 36.6% (34.4% in men and 38.4% in women) and 32.3% (29.4% in men and 34.7% in women), respectively. The most prevalent components were abdominal obesity in women and high blood glucose levels in men. Of all participants, 5.0% had all five MetS components and 88.7% had at least one component. Factors associated with MetS were old age, low physical activity levels, history of hypertension and diabetes mellitus, and high body mass index in both sexes; active smoking and sufficient vegetable and fruit intake in women; and Buryat ethnicity, living in Ulaanbaatar, monthly income of 100,000-300,000 Mongolian tugrik, and alcohol consumption in men.

**Conclusion:** MetS prevalence was higher in women than in men. A sex difference in the most common MetS component and factors associated with MetS was noted. To reduce MetS prevalence in Mongolia, sex-specific programs should be designed to promote health behaviors, such as reducing alcohol consumption in men and smoking in women.

**PE266** Diabetes complications-clinical & epidemiology**Predictive model to classify early-onset vs late-onset type 2 diabetes**Yubi Mamiya<sup>\*</sup>, Tinney Mak, Lee-Ling Lim

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**Objective:** Patients with early-onset Type 2 Diabetes (T2D) experience highly aggressive symptoms which often require personalized treatment distinct from patients with late-onset T2D. Yet, the current onset classification method is based solely on age. This does not capture the nuanced characteristics and risk factors of early-onset T2D. This study aims to identify the baseline characteristics that differentiate patients with early-onset T2D from those with late-onset to more accurately classify patients for personalized treatment.

**Methods:** We studied 17,039 T2D patients (early-onset: 954 early onset, late-onset: 5184) who received care at the University of Malaya Medical Center from 2015-2020. This study analyzed the collected information on their medical treatment and corresponding physiological metrics. We performed statistical analysis in R to understand whether biometric measurements at baseline predicted the type of onset of T2D.

**Results:** Our study's linear regression analysis found that patients' HbA1C, systolic and diastolic blood pressure, and LDL-Cholesterol levels at baseline significantly predicted the classification of onset of T2D (HbA1C: p=1.13e-10, SBP: p=1.02e-13, DBP: 2.71e-07, LDL-C: p=0.0439). Patients with early-onset diabetes demonstrated significantly higher levels of HbA1C (early-onset: 9.45 mmol/L, late-onset: 8.41 mmol/L, p=1.13e-10) and LDL-Cholesterol (early-onset: 3.23 mmol/L, late-onset: 3.02 mmol/L, p=0.0439) compared to patients with late-onset diabetes.

**Conclusion:** HbA1C, blood pressure, and LDL-Cholesterol baseline characteristics can be used to develop more informed onset classification and diagnosis models of T2D. As a result, patients will be able to receive personalized treatment based on the risks unique to the onset of their disease.

## PE267 Diabetes complications-clinical &amp; epidemiology

**Different associations between lipid levels and risk of heart failure according to the progression of diabetes**Seung-Hwan Lee<sup>1,2\*</sup>, Kyu Na Lee<sup>3</sup>, Kyungdo Han<sup>3</sup>, Mee Kyoung Kim<sup>4</sup>Seoul St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Korea<sup>1</sup>, College of Medicine, The Catholic University of Korea, Korea<sup>2</sup>, Soongsil University, Korea<sup>3</sup>, Yeouido St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Korea<sup>4</sup>

**Objective:** The relationship of circulating lipid concentrations to future heart failure (HF) risk awaits further investigation. We aimed to examine this association and whether it is modified by the duration of diabetes or treatment regimens in people with diabetes.

**Methods:** 2,439,978 individuals who underwent health examinations in 2015–2016 were identified from the Korean National Health Information Database. Subjects were categorized according to the duration of diabetes (new-onset, <5 years, 5–10 years, or ≥10 years) or number of anti-diabetic medications (none, 1–2 oral hypoglycemic agents [OHA], ≥3 OHA, or insulin±OHA). Incident HF was defined as recording of ICD-10 code I50 as the primary diagnosis during hospitalization. The risk of HF was estimated using multivariate Cox proportional hazard analysis.

**Results:** During the median follow-up of 4.0 years, 151,624 cases of HF occurred. An inverse association between LDL-cholesterol levels and incident HF was observed in new-onset diabetes group with approximately 25% lower risk in people with LDL-cholesterol 100–129, 130–159, and ≥160 mg/dL, compared to people with LDL-cholesterol <70 mg/dL. However, J-shaped associations were noted in long-standing diabetes group with 16% higher risk in people with LDL-cholesterol ≥160 mg/dL, compared to people with LDL-cholesterol <70 mg/dL. Similar patterns were observed in the relationship between total cholesterol or non-HDL-cholesterol and risk of HF, and when subjects were grouped according to the number of anti-diabetic medications instead of diabetes duration.

**Conclusion:** Different associations between lipid levels and risk of HF were noted according to the disease progression status in people with diabetes.

## PE268 Diabetes complications-clinical &amp; epidemiology

**Correlation of glycemic control with severity of chronic small vessel ischemic disease in brain MRI of diabetic patients**

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**Objective:** The objective of this research was to correlate the glycemic control parameters with the degree of Small vessel Ischemic Changes Severity in Brain MRI.

**Methods:** 67 eligible patients with one or both of the glycemic parameters, either HbA1c or Fasting Blood Sugar (FBS) were available; however only 57 of these patients had MRI brain scan available. MRI was done for various reasons, in a 1.5 Tesla MRI scanner of Philips Achieva. Analysis was carried out among 57 patients. Glycemic control was categorized as "good/fair control" (≤8 %) and "poor control" (>8 %) based on American Diabetes Association (ADA) guidelines for HbA1c and "good (≤130 mg/dl)" and "poor control (>130 mg/dl)" for Fasting blood glucose (FBG). By evaluation of the T2 and FLAIR sequences of the Brain MRI of these patients, Fazekas score was calculated by combining periventricular white matter (PVWM) and deep white matter (DWM) scores, attributed to chronic small vessel ischemia. Fazekas score ≥3 was considered to have moderate-to-severe White matter lesions (WMLs).

**Results:** The median (IQR) age of the patients was 54 (40–65) years. 6 (10.5%) of the patients were ≤25 years. Thirty two (56.1%) were males. There was a moderate positive but significant correlation between HbA1c and FBG with Fazekas score (Spearman's  $r=0.35$  and  $0.39$ ,  $p<0.05$  respectively). The proportion of patients with moderate-to-severe WMLs was higher in the poor glycemic control group compared to the good/fair control group (28.6% vs. 17.6%,  $p=0.67$ ). PVWM score had a higher correlation with HbA1c and FBG.

**Conclusion:** In diabetic patients, an increase in HbA1c/FBS positively correlates with increased Fazekas score in Brain MRI. Patients with poor glycemic control were likely to have more severe small vessel ischemic changes, though not statistically significant.

## PE269 Diabetes complications-clinical &amp; epidemiology

**Associations between alcohol consumption and cause-specific mortalities in Metabolic dysfunction-Associated Fatty Liver Disease (MAFLD) patients: a nationwide population-based study**So Hyun Cho<sup>1\*</sup>, Rosa Oh<sup>1</sup>, Ji Yoon Kim<sup>1</sup>, Gyuri Kim<sup>1</sup>, You-bin Lee<sup>1</sup>, Sang-Man Jin<sup>1</sup>, Kyu Yeon Hur<sup>1</sup>, Seohyun Kim<sup>2</sup>, Jae Hyeon Kim<sup>1</sup>Samsung Medical Center, Korea<sup>1</sup>, Sungkyunkwan University, Korea<sup>2</sup>

**Objective:** We investigated cause-specific mortalities according to the amount of alcohol consumption in metabolic dysfunction-associated fatty liver disease (MAFLD) patients.

**Methods:** We analyzed the health examinations and claims data from the Korean National Health Insurance Service. A total 996,508 patients who underwent a national health check-up from 2009 to 2012 were included. At baseline, the participants reported their alcohol consumption. And they were divided into three groups according to the alcohol consumption - non-alcohol, moderate alcohol (<20 g/day for women, <30 g/day for men) and heavy alcohol group (≥20 g/day for women, ≥30 g/day for men). Each group was analyzed by dividing according to the presence or absence of MAFLD. MAFLD was defined as the fatty liver index (FLI) value ≥30 plus one of the following conditions: overweight/obesity, type 2 diabetes mellitus, or ≥2 metabolic risk abnormalities. Cox proportional hazards models were used to estimate the association of alcohol consumption and cause-specific mortalities between six groups.

**Results:** Drinking in moderate amounts alcohol showed protective results for cardiovascular disease related mortality in both the MAFLD and non-MAFLD group (HR, 0.73; 95% CI, 0.69–0.78 and HR, 0.9; 95% CI, 0.84–0.97, respectively) in fully adjusted models. However, liver-related mortality increased with alcohol consumption in both groups. Especially, heavy alcohol consumption was found to be synergistically increase the liver-related mortality (HR, 11.28; 95% CI, 9.18–13.84). Finally, regardless of MAFLD, all-cause mortality was lower in the moderate alcohol consumption group (HR, 0.81; 95% CI, 0.79–0.83) than in the group who did not consume alcohol at all.

**Conclusion:** Our findings suggest that heavy alcohol consumption increase cardiovascular disease related mortality, liver-related mortality, and all-cause mortality. But moderate alcohol consumption does not increase cardiovascular disease related mortality or all-cause mortality even in MAFLD patients.

## PE270 Diabetes complications-clinical &amp; epidemiology

**Fasting glucose level and cardiovascular outcomes according to menopausal status: a nationwide population-based study**Kyunho Kim<sup>1\*</sup>, Yebin Park<sup>2</sup>, Chae Eun Yong<sup>1</sup>, Min Hyang Youn<sup>1</sup>, Yu-Bae Ahn<sup>1</sup>, Seung-Hyun Ko<sup>1</sup>, Kyungdo Han<sup>2</sup>, Yun Jae-Seung<sup>1</sup>The Catholic University of Korea, St. Vincent's Hospital, Korea<sup>1</sup>, Soongsil University, Korea<sup>2</sup>

**Objective:** We aimed to examine the association of fasting glucose level with cardiovascular (CV) mortality and cardiovascular disease (CVD) events in women according to menopausal status.

**Methods:** This study included 2,098,892 women aged 40 to 69 years who underwent a national health screening program in 2009 and were followed up until 2018. Cox proportional hazards models were used to calculate the HR and its 95% CI.

**Results:** In premenopausal women, significantly increased risk of coronary artery disease (CAD) (HR 1.80, 95% CI 1.57–2.08), myocardial infarction (MI) (HR 1.37, 95% CI 1.10–1.70), stroke (HR 2.31, 95% CI 1.92–2.78), and CV mortality (HR 1.67, 95% CI 1.39–2.01) were found in fasting glucose levels ≥160 mg/dL. In postmenopausal women, significantly increased risk of CAD, MI, stroke, and CV mortality were found in fasting glucose levels ≥160 mg/dL as same as in premenopausal women. In addition, significantly increased risk of CAD (HR 1.07, 95% CI 1.01–1.13), stroke (HR 1.13, 95% CI 1.06–1.21), and CV mortality (HR 1.10, 95% CI 1.05–1.16) were found in fasting glucose levels of 140–159 mg/dL in postmenopausal women. Fasting glucose levels ≥160 mg/dL was associated with higher HR for CAD and stroke in premenopausal women than in postmenopausal women.

**Conclusion:** In postmenopausal women, lower fasting glucose levels (140–159 mg/dL) were associated with increased risk of CAD, stroke, and CV mortality compared with those levels (≥160 mg/dL) in premenopausal women. This study suggests the importance of menopausal status in the effect of fasting glucose levels on CV outcomes.

## PE271 Diabetes complications-clinical &amp; epidemiology

**Endothelial nitric oxide synthase rs2070744 T/C gene polymorphism with risk of coronary artery disease in population with type 2 diabetes: update meta-analysis**William Djauhari<sup>1</sup>\*, Bisuk Silalahi<sup>2</sup>Eka Hospital Bsd, Indonesia<sup>1</sup>, Weda General Hospital, Indonesia<sup>2</sup>

**Objective:** Diabetes mellitus (DM) plays a major role in the progression of cardiovascular diseases (CVD). CVD and DM are serious threats to human health and were among the tenthleading cause of death in 2019. Various research found that the Endothelial Nitric Oxide Synthase (eNOS) dysfunction has a crucial role in the pathogenesis of DM and the progression of atherogenesis resulting in vascular problems including Coronary Artery Disease (CAD). Several studies discovered the association of eNOS rs2070744 T/C gene polymorphism and CAD risk in people with type 2 diabetes (T2D), however published results were indeterminate. Therefore, this study was conducted to investigate the connection between CAD in population with T2D susceptibility and eNOS rs2070744 T/C gene polymorphism.

**Methods:** This Meta-analysis was in accordance with the PRISMA guidelines. The literature was taken from Pubmed and Google Scholar, with October 2021 as the latest edition that was computed, and it is limited to English only. In total, 5 studies were included in this review. Review Manager 5.4 was utilized to analyze the data.

**Results:** 5 studies were incorporated. From the analysis, eNOS rs2070744 gene polymorphism was associated with an increase of CAD incident in population with T2D (C vs T, OR 95%CI=1.24 [1.04-1.48] p=0.01; TC vs TT + CC, OR 95%CI=1.32 [1.05-1.67] p=0.02) and a decrease of CAD in population with type 2 diabetes (T vs C, OR 95%CI=0.80 [0.67-0.96] p=0.01; TT vs TC + CC, OR 95%CI=0.72 [0.57-0.91] p=0.005)

**Conclusion:** There was correlation between eNOS rs2070744 T/C gene polymorphism and CAD risk in population with T2D

## PE275 Diabetes complications-clinical &amp; epidemiology

**Association between fatty liver index and incident diabetes according to alcohol consumption status in young people**Jin Yu<sup>1\*</sup>, Joonyub Lee<sup>1</sup>, Hun-Sung Kim<sup>1,2</sup>, Jae-Hyung Cho<sup>1,2</sup>, Bong Seong Kim<sup>3</sup>, Kyungdo Han<sup>3</sup>, Seung-Hwan Lee<sup>1,2</sup>Seoul Saint Mary's Hospital, College of Medicine, The Catholic University of Korea, Korea<sup>1</sup>, College of Medicine, The Catholic University of Korea, Korea<sup>2</sup>, Soongsil University, Korea<sup>3</sup>

**Objective:** Fatty liver index (FLI) is commonly used as a surrogate of non-alcoholic fatty liver disease. However, its utility in alcohol drinkers remains to be elucidated. We aimed to examine the association between FLI and incident diabetes in young people stratified by alcohol consumption status.

**Methods:** A total of 6,412,270 non-diabetic subjects with age of 20-39 who received health examination between 2009 and 2012 were identified from the National Health Information Database. FLI was calculated using body mass index, waist circumference, triglycerides, and  $\gamma$ -glutamyl transferase levels and categorized into 3 groups (<30, 30-60,  $\geq$ 60). Mild and heavy drinker was defined as <30 and  $\geq$ 30g/day, respectively. The risk of incident diabetes according to FLI and its components was estimated by multivariate Cox proportional hazard analysis.

**Results:** During follow-up, 190,662 (3.0%) subjects developed diabetes. A stepwise increase in the risk of diabetes according to FLI was observed in all drinking groups. In subjects with FLI  $\geq$ 60, the hazard ratios (95% confidence interval) of diabetes were 11.99 (11.74-12.25) in non-drinker, 9.50 (9.33-9.67) in mild drinker, and 8.05 (7.69-8.43) in heavy drinker compared to the subjects with FLI <30. A stronger association of FLI with diabetes was observed in non-drinking group compared with mild or heavy drinking group (P for interaction <0.0001).

**Conclusion:** FLI is a useful indicator for estimating the risk of diabetes in young population. Although its performance is higher in the non-drinking group, FLI may also be used in mild or heavy drinker to predict future diabetes.

## PE274 Diabetes complications-clinical &amp; epidemiology

**The incidence of lower extremity amputations in South Korea, 2003-2021**Ja Young Jeon<sup>1\*</sup>, Na Young Kim<sup>2</sup>, Joung Hwan Back<sup>1</sup>, Na mi Lee<sup>1</sup>, Seung Jin Han<sup>1</sup>, Hae Jin Kim<sup>1</sup>, Dae Jung Kim<sup>1</sup>, Tae Ho Kim<sup>3</sup>, So Yeon Ahn<sup>4</sup>, Kwan Woo Lee<sup>1</sup>Ajou University School of Medicine, Korea<sup>1</sup>, National Health Insurance Service, Korea<sup>2</sup>, Seoul Medical Center, Korea<sup>3</sup>, Busan Bumjin Hospital, Korea<sup>4</sup>

**Objective:** National data in incidence of lower extremity amputations in the population of South Korea is lacking. Diabetes mellitus is a major risk factor for lower extremity amputations. The prevalence of diabetes mellitus is increasing faster than previously estimated in South Korea. Therefore, we investigated the trend of lower extremity amputations not only in people with diabetes, but also in the total (medically documented) population.

**Methods:** We gathered and analyzed the data of the medically documented population, aged 20 years or older, from the Korean Health Insurance Service claims database between 2003 and 2021.

**Results:** Since 2003, incidence of lower extremity amputations among the total population has steadily increased, more than doubling by 2021 (6.8 to 14.5 amputations per 100,000 of population). The contribution of diabetes mellitus on lower extremity amputation has also elevated from 47% in 2003 to 70% in 2021. During the study period, the incidence of lower extremity amputations was consistently higher by more than three times in men (21.6) than in women (7.3), amputations per 100,000 of population in 2021. When foot amputations were classified by lower extremity parts, the proportion of major amputations (above ankle) has decreased slightly. In the last 10 years, the frequency and proportion of three or more repeated foot amputations has reduced (431 (9.2%) to 207 (4.1%).)

**Conclusion:** We reported the increasing trend of lower extremity amputation between 2003 and 2021 according to the increase in the prevalence of diabetes mellitus in South Korea. Among all lower extremity amputations, the major amputations and multiple amputations, 3 or more times, are decreasing.

## PE276 Diabetes complications-clinical &amp; epidemiology

**Association between metabolic syndrome and suicide: a nationwide population-based cohort study**Ye Bin Park<sup>1\*</sup>, Jin Hwa Kim<sup>2</sup>, Jin Hyung Jung<sup>3</sup>, Bongseong Kim<sup>3</sup>, Kyu Na Lee<sup>3</sup>, Ju Yeong Park<sup>3</sup>, Hyuk-Sang Kwon<sup>4</sup>, Kyungdo Han<sup>1</sup>Soongsil University, Korea<sup>1</sup>, Chosun University Hospital, Korea<sup>2</sup>, Sungkyunkwan University School of Medicine, Korea<sup>3</sup>, The Catholic University of Korea, Korea<sup>4</sup>

**Objective:** Suicide is a leading cause of death globally and is one of the most important health problems. This study aimed to evaluate the association between Mets and suicide using nationwide population-based data.

**Methods:** This study used data from the Korean National Health Insurance Service. Data from 4,234,415 adults aged  $\geq$ 20 years who underwent annual health check-ups at 2009 were used for this analysis. They were followed up until December 31, 2021. Suicide was defined as diagnostic codes (ICD-10 codes; X60-X84) as recorded in the Korea National Statistical Office. We estimated hazard ratios (HRs) and 95% confidence intervals (CIs) using Cox proportional hazards model adjusted for confounding factors.

**Results:** We identified 12,290 suicide case during the follow-up. The multivariable-adjusted hazard ratios (HR) of suicide was associated with Mets (HR 1.135 (95% CI 1.088-1.185)). In the analysis of the component of Mets, high waist circumference, hypertriglyceridemia, elevated fasting plasma glucose level, and high blood pressure were associated with increased suicide risk (1.155 (1.095-1.219), 1.119 (1.077-1.162), 1.116 (1.075-1.159), 1.172 (1.128-1.218), respectively). Suicide risk increased additively as the number of Mets component increased.

**Conclusion:** Metabolic syndrome and its components were significantly associated with the development of suicide. Our findings suggest that metabolic syndrome may be a risk factor to suicide.

## PE277 Diabetes complications-clinical &amp; epidemiology

**Percentage of diabetic nephropathy among type 2 diabetes patients admitted in Cambodia-Korea Diabetes Center (CKDC) from January 1 to June 30, 2023**

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**Objective:** Our objective is to document the percentage of diabetic nephropathy cases among type 2 diabetes patients admitted in Cambodia-Korea Diabetes Center (CKDC).

**Methods:** It is a retrospective study of admitted diabetes patients during 6 months from January 1 to June 30, 2023 in CKDC. Data is extracted from the electronic medical system using admitting Diagnosis and analyzing with Excel. During their hospitalization, kidney function (creatinine) were requested. With plasma creatinine, we calculated their eGFR by using CKD-EPI equation and classified into CKD classification.

**Results:** Among 168 admitted patients, 155 (93.3%) are type 2 diabetes. The average age of diabetes patients is 60.5y+/-11.4. Female represented 61.3% of the patients. The average HbA1c is 9.2%+/-2.5. Among 155 diabetes patients, 14.9% have eGFR>90 ml/min/1.73 m<sup>2</sup> (G1), 34.4% cases have eGFR 60-89 ml/min/1.73 m<sup>2</sup> (G2), 27.2% with eGFR 45-59 ml/min/1.73 m<sup>2</sup> (G3a), 11% with eGFR 30-44 ml/min/1.73 m<sup>2</sup> (G3b), 6.5% with eGFR 15-29 ml/min/1.73 m<sup>2</sup> (G4) and 5.8% with eGFR <15 ml/min/1.73 m<sup>2</sup> (G5).

**Conclusion:** According to the results, we notice that 50.6% of cases have declined eGFR below 60 ml/min/1.73 m<sup>2</sup>, which are classified from grade G3a to G5. Among them, 9 patients (5.8%) were already in end stage kidney disease (ESKD). Most of the patients are uncontrolled diabetes and wait until complication before they were admitted in diabetes specialist center. Therefore, early identification may help to target optimise care and prevention programs for CKD among T2DM patients.

## PE279 Diabetes complications-clinical &amp; epidemiology

**Risk factors for diabetic retinopathy: the Korea national health and nutrition examination survey**Jisun Lim<sup>1\*</sup>, Seung Woo Choi<sup>2</sup>, Minji Sohn<sup>1</sup>, Soo Lim<sup>1</sup>, Se Joon Woo<sup>2</sup>Seoul National University Bundang Hospital, Korea<sup>1</sup>, Retimark, Korea<sup>2</sup>

**Objective:** To evaluate the diagnostic performance of machine learning (ML) models and investigate risk factors for predicting diabetic retinopathy risk, by using the clinical data obtained from the Korea National Health and Nutrition Examination Survey (KNHANES) (2008-2012 and 2017-2021).

**Methods:** In this study, we used 2008-2012 and 2017-2021 KNHANES data in South Korea (18 January 2023 released). Baseline characteristics of diabetes patients were analyzed. In ML model procedure, we examined the clinical risk factors (demographic information, body measurements, blood pressure, diabetes duration, diabetes treatments, and blood test values). To evaluate the prediction performance of the ML models, the area under the receiver operating characteristic (AUROC) was used. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were estimated. To find the features that are strongly associated with diabetic retinopathy, we used the Shapley Additive Explanations (SHAP), which use a game theoretic approach for tree-based ML models.

**Results:** A total of 3,218 patients (>20 years) with diabetes was considered. Across all the periods, the prevalence of diabetic retinopathy was 24.5%. We trained machine learning models with clinical information and tested prediction of diabetic retinopathy. The performance of the ML model with 22 clinical variables has AUROC (0.793) and accuracy 0.820. Feature importance analysis reveals that diabetic duration, glucose and HbA1c had high SHAP value. The performance of the ML model with two clinical variables (diabetic duration and HbA1c) has AUROC (0.753).

**Conclusion:** In this study, an ML models for diabetic retinopathy using clinical information of diabetes patients was developed. These results improve the ability to build diagnostic programs for patients with long-duration diabetes. However, retraining models for future improvements is needed to screen patients at elevated risk but short-duration.

## PE278 Diabetes complications-clinical &amp; epidemiology

**Metabolic syndrome, obesity, and their association with moyamoya vasculopathy in the young adults**Joonyub Lee<sup>1\*</sup>, Seung-Hwan Lee<sup>1</sup>, Mee-Kyoung Kim<sup>2</sup>,Hyuk-Sang Kwon<sup>2</sup>, Jae-Seung Yun<sup>3</sup>, Yeoree Yang<sup>1</sup>, Kun-Ho Yoon<sup>1</sup>,Jae-Hyoung Cho<sup>1</sup>, Kyungdo Han<sup>4</sup>, Jang Won Son<sup>5</sup>

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**Objective:** Moyamoya vasculopathy (MMV) is an uncommon vascular disorder with an indeterminate cause. This research explored the potential association between MMV occurrence and metabolic syndrome (MetS) or obesity in the younger adult demographic.

**Methods:** Utilizing data from the Korean National Health Insurance Service, we conducted a nationwide, retrospective review. We included 6,891,400 individuals aged 20-40 who underwent health examinations between 2009 and 2012. The potential for MMV occurrence was evaluated in relation to BMI or MetS factors, with further stratification based on gender. Key variables like age, gender, income, smoking habits, alcohol consumption, and consistent physical activity were factored in using Cox regression analysis.

**Results:** Of the cohort, 1,754 were diagnosed with MMV. Those with MMV tended to have an elevated initial BMI, a greater likelihood of smoking, and were predominantly female. They were also more likely to suffer from conditions like diabetes, high blood pressure, and dyslipidemia in contrast to those without MMV (p<0.0001). Notably, both MetS (HR 2.94, 95% confidence interval [CI], 2.60-3.33) and obesity (25 ≤ BMI <30 kg/m<sup>2</sup> HR 1.70 [95% CI, 1.50-1.93], BMI ≥30 kg/m<sup>2</sup> HR 2.55 [95% CI, 2.13-3.04]) exhibited a heightened MMV risk. For those with obesity, the concurrent presence of MetS amplified the MMV risk, ranging from HR 1.79 [95% CI, 1.58-2.03] to HR 3.74 [95% CI, 3.25-4.30]. This adverse impact of metabolic imbalances on MMV susceptibility was particularly pronounced in women.

**Conclusion:** For young adults, both MetS and obesity play a significant role in the susceptibility to MMV.

## PE280 Diabetes complications-clinical &amp; epidemiology

**Remnant-C predicts risk of developing end-stage renal disease in patients with type 2 diabetes**Eun Roh<sup>1\*</sup>, Ji Hye Huh<sup>1</sup>, Seong Jin Lee<sup>1</sup>,Sung-Hee Ihm<sup>1</sup>, Kyung-Do Han<sup>2</sup>, Jun Goo Kang<sup>1</sup>Hallym University College of Medicine, Korea<sup>1</sup>,  
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**Objective:** Although elevated remnant-C is an established risk factor for atherosclerotic cardiovascular disease, the relationship between remnant-C and diabetic nephropathy remains unclear. Therefore, we investigated the relationship between remnant-C and the risk of newly developed end-stage renal disease (ESRD) in patients with type 2 diabetes.

**Methods:** This population-based observational cohort study enrolled a total of 2,537,149 Korean adult patients with type 2 diabetes without underlying ESRD who underwent health screening between 2009 and 2012. These patients were followed up until 2019 for the development of ESRD. The relationship between remnant-C quartiles and incident ESRD was examined by Cox regression models.

**Results:** During a median follow-up period of 9 years, 26,246 individuals (1.03% of the total population) developed ESRD. Participants in the upper quartiles of remnant-C levels had a higher risk of ESRD compared to those in the lowest quartile, and this association remained after adjusting for potential confounders, including total cholesterol and use of dyslipidemia medications. The adjusted hazard ratios for ESRD were 1.15 (95% CI 1.11-1.19) in the second quartile, 1.23 (95% CI 1.18-1.27) in the third quartile, and 1.41 (95% CI 1.36-1.47) in the fourth quartile.

**Conclusion:** These findings suggest that remnant-C concentrations independently contribute to the development of ESRD in patients with type 2 diabetes.

## PE281 Diabetes complications-clinical &amp; epidemiology

**Associations between type 2 diabetes and suicide risk; a nationwide population-based cohort study**Yunjung Cho<sup>1,4\*</sup>, Kook-Rye Kim<sup>2</sup>, Mi-Jin Shim<sup>2</sup>, Kwan Hoon Jo<sup>1,4</sup>, Eun Sook Kim<sup>1,4</sup>, Sung-dae Moon<sup>1,4</sup>, Je Ho Han<sup>1,4</sup>, Kyungdo Han<sup>3</sup>, Jae-Seung Yun<sup>1,4</sup>Incheon St. Mary's Hospital, Korea<sup>1</sup>, St. Vincent's Hospital, Korea<sup>2</sup>, Soongsil University, Korea<sup>3</sup>, The Catholic University, Korea<sup>4</sup>

**Objective:** Research into the connection between type 2 diabetes and the heightened risks of both diabetes and suicide has been limited. In this study, we explored the risk of suicide among individuals with diabetes by analyzing the NHIS database.

**Methods:** Using data from the National Health Insurance database, we examined a cohort of individuals aged 20 and above who had undergone health assessments between 2009 and 2010. The study included a total of 38,840,468 participants. We evaluated the potential for suicide-related mortality, taking into account the presence of T2DM and the baseline diabetes status. Furthermore, we conducted a subgroup analysis to explore the correlation between T2DM and the risk of suicide, while considering factors such as age, gender, insulin usage, and major comorbidities.

**Results:** During the follow-up period, out of a total of 3,884,068 individuals, 11,941 (0.3%) died by suicide. Notably, the incidence rate of suicide was significantly higher among patients with Type 2 diabetes compared to those without it at baseline (Incidence rate, 2.6 vs. 4.6 per 10,000 person-years;  $P < 0.0001$ ). In crude analysis, the group with T2DM had a 1.75-fold increased risk of suicide compared to the group without diabetes (HR 1.75, 95% CI 1.66-1.85). After adjusting for multiple factors, the risk increased by 21% (HR 1.21, 95% CI 1.14-1.28). The risk of suicide did not significantly elevate in prediabetes. Furthermore, the risk of suicide did not increase proportionally with the duration of diabetes. Subgroup analysis indicated that the risk of suicide associated with diabetes was higher among males, and a higher risk of suicide was observed among younger individuals.

**Conclusion:** T2DM clearly elevates the risk of suicide. As such, it becomes imperative to proactively assess suicide risk by identifying pertinent factors among individuals with T2DM.

## PE282 Diabetes complications-clinical &amp; epidemiology

**Association between weight-adjusted waist index and muscle strength**

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**Objective:** The weight-adjusted waist index (WWI) is a newly developed anthropometric parameter. Recent studies have shown that WWI has a negative association with muscle mass. However, studies on the link between WWI with muscle strength are limited. We evaluated the relationship between WWI and muscle strength using a nationwide cross-sectional survey.

**Methods:** A total of 11,754 participants aged  $\geq 20$  years from the Korea National Health and Nutrition Examination Survey between 2016 and 2018 were included in this study. WWI was defined as the WC (cm)/ $\sqrt{\text{weight (kg)}}$ . Relative hand grip strength (RHGS) was calculated as the handgrip strength divided by body mass index and is used to define muscle strength. Low muscle strength was defined as the lowest 10% of RHGS.

**Results:** The prevalence of low muscle strength increased linearly with the quartiles of the WWI, 1.9%, 3.5%, 8.3%, and 26.2% in Q1-Q4, respectively. The WWI was negatively associated with RHGS ( $r = -0.366$ ,  $P < 0.01$ ) after adjusting for age and sex. The odds ratio for low muscle strength was 5.84 (confidence interval: 4.42-7.72,  $P < 0.0001$ ) in the highest quartile of WWI compared to the lowest quartile after adjustment for confounders.

**Conclusion:** WWI is an anthropometric index negatively associated with low muscle strength. The WWI index could be a simple index to predict low muscle strength.

## PE283 Diabetes complications-clinical &amp; epidemiology

**The association between lipid profile and diabetic retinopathy: a systematic review and meta-analysis**Ni Putu Ayu Pande Arista Dewi<sup>1\*</sup>, Made Lady Adelaida Purwanta<sup>2</sup>  
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**Objective:** Recently, lipid metabolism had increased attention as one of the main roles in the pathophysiology of diabetic retinopathy (DR). However, their role still conflicted in earlier research. In this systematic review and meta-analysis, we want to compare the lipid profile in patient with and without diabetic retinopathy.

**Methods:** Systematic review was conducted with the Preferred Reporting Items of Systematic Reviews (PRISMA) guidelines with studies in English from 2018 until 2023. All studies that compared the lipid profile in patients with diabetes mellitus with and without DR. Outcome parameters analyzed were Body Mass Index (BMI), Total cholesterol, HbA1C, Triacylglycerols (TG), high density lipoprotein (HDL-C), low density lipoprotein (LDL-C). Heterogeneity was assessed using I2 test, risk of bias was assessed using funnel plot, and analysis of comparison was done using the Review Manager Version 5.4.

**Results:** Fourteen studies involved in this study. BMI, total cholesterol, TG did not show significant difference (MD=0.55 95%CI=(-0.16)-0.25  $p=0.66$ ) with moderate heterogeneity (I2=53%  $p=0.01$ ). Total cholesterol did not show significant difference (MD=-4.89 95%CI=(-9.04)-(-0.74)  $p=0.02$ ) with considerable heterogeneity (I2=83%  $p < 0.00001$ ). HbA1C showed significant difference (MD=-0.41 95%CI=(-0.65)-(-0.17)  $p=0.0009$ ) with considerable heterogeneity (I2=91%  $p < 0.00001$ ). TG did not show significant difference (MD=3.02 95%CI=(-6.79)-12.82  $p=0.55$ ) with considerable heterogeneity (I2=83%  $p < 0.00001$ ). HDL-C did not show significant difference (MD=0.66 95%CI=(-0.84)-2.16)  $p=0.39$ ) with considerable heterogeneity (I2=86%  $p < 0.00001$ ). LDL-C did not show significant difference (MD=-3.16 95%CI=(-7.00)-(-0.67)  $p=0.11$ ) with considerable heterogeneity (I2=86%  $p < 0.00001$ ).

**Conclusion:** TG, HDL-C, and LDL-C were not significantly different while total cholesterol significantly different between patient with or without DR. Ophthalmologist might consider to do total cholesterol screening and refer the dyslipidemia patient.

## PE284 Diabetes complications-clinical &amp; epidemiology

**Effect of hypoglycemia during dialysis on atherosclerotic cardiovascular disease in patients with diabetes**

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**Objective:** Severe hypoglycemia is recognized to be one of the strongest predictors of macrovascular events, adverse clinical outcomes, and mortality in patients with type 2 diabetes. We studied whether atherosclerotic cardiovascular disease (ASCVD) is increased when hypoglycemia occurs in hemodialysis patients.

**Methods:** This is a single-center retrospective study of 386 adult patients with diabetes who first started hemodialysis between January 2015 and December 2018. Hypoglycemia occurred during dialysis (group A) was defined as patients who were prescribed dialysis solution and 50% glucose solution on the dialysis day. The patients who did not develop hypoglycemia during dialysis were classified as group B. We defined ASCVD as an international classification of diseases code that included cerebral infarction, angina or myocardial infarction.

**Results:** The prevalence of hypoglycemia during dialysis was 130 (33.7%, group A). The type 2 diabetes was 124 (95.4%) in group A and 233 (91.0%) in group B ( $p=0.434$ ). ASCVD was occurred 49 (37.7%) in group A and 25 (9.8%) in group B ( $p=0.000$ ). When ASCVD was analyzed by dividing it into cerebral infarction and coronary artery disease, the number of patients with cerebral infarction, coronary artery disease and both were 17 (13.1%) in group A and 9 (3.5%) in group B ( $p=0.004$ ), 37 (28.5%) in group A and 17 (6.6%) in group B ( $p=0.000$ ), 5 (3.8%) in group A and 1 (0.4%) in group B ( $p=0.035$ ), respectively.

**Conclusion:** In diabetic patients on dialysis, hypoglycemia episodes during dialysis were associated with an increased incidence of ASCVD events. However, it has limitations in that it is a single-center retrospective study and that the analysis of other factors that increase the risk of ASCVD besides hypoglycemia has not been sufficiently performed.

## PE285 Diabetes complications-clinical &amp; epidemiology

**Diffusion tensor imaging of the tibial nerve can detect nerve damage in type 2 diabetes**

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**Objective:** Magnetic resonance imaging (MRI) has played little role for the study of peripheral nerve disease. However, recent technological advances in MRI have provided us more information about neural microstructure and higher resolution in peripheral nerves. The aim of this study is to evaluate whether diffusion tensor imaging (DTI) in MRI can detect peripheral nerve abnormalities in patients with type 2 diabetes (T2D).

**Methods:** In this prospective, single-center study, 33 T2D patients (mean age, 60.5±7.0 yr; 16 M/17F) and 12 healthy controls (61.8±5.3 yr, 5M/7 F) were included. All T2D patients underwent Michigan Neuropathy Screening Instrument questionnaire and quantitative sensory testing. MRI including DTI and axial T2-weight Dixon sequence was performed for each participant. DTI parameters of the tibial nerves such as fractional anisotropy (FA) and diffusivity (mean MD), axial (AD), and radial (RD) were calculated.

**Results:** FA of the tibial nerves was significantly lower in T2D patients than healthy controls at both level 1 (0.42±0.07 vs. 0.57±0.09, P<0.001) and level 2 (0.44±0.07 vs. 0.55±0.08, P<0.001). AD was also significantly lower in T2D patients than controls at both level 1 (1.97±0.43 vs. 2.40±0.63, P<0.05) and level 2 (2.18±0.37 vs. 2.59±0.47, P<0.05). RD was significantly higher in T2D patients than controls at level 1 (0.97±0.21 vs. 0.83±0.13, P<0.05). However, there were no differences in DTI parameters between T2D patients with peripheral neuropathy (PN) and those without PN.

**Conclusion:** In summary, we have demonstrated that DTI can detect microstructural alterations of peripheral nerves in T2D patients with PN as well as those without PN, suggesting that the structural nerve damage can occur before the development of PN in T2D patients.

## PE288 Diabetes complications-clinical &amp; epidemiology

**The risk of type 2 diabetes and persistent hypertriglyceridemia across subgroups**

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**Objective:** Persistent hypertriglyceridemia is a risk factor of incident type 2 diabetes. With young-onset type 2 diabetes becoming increasingly prevalent worldwide, this study aims to examine whether cumulative exposure to hypertriglyceridemia is associated with an increased risk of developing type 2 diabetes in young adults across subgroups.

**Methods:** Data for 1,376,540 participants aged 20-39 years who had no history of type 2 diabetes and underwent four consecutive annual health check-ups were obtained. We evaluated the incidence rates and hazard ratios (HRs) of diabetes according to cumulative numbers of fasting hypertriglyceridemia over 4 years (burden score 0-4). We performed subgroup analyses based on age groups (20-29 vs. 30-39 years), sex (male vs. female), BMI (<25 vs. ≥25 kg/m<sup>2</sup>), FPG levels (<100 vs. ≥100 mmol/L), hypertension status, and statin use.

**Results:** The incidence rate and HRs for type 2 diabetes increased significantly with greater exposure scores of hypertriglyceridemia. The interaction between hypertriglyceridemia burden scores and subgroups based on age, sex, BMI, FPG levels, hypertension status, and statin use was found to be statistically significant in relation to the risk of developing type 2 diabetes. The association between hypertriglyceridemia and type 2 diabetes risk was higher in participants aged 20-29, women, individuals with a BMI below 25, or those with a FPG levels below 100, as well as in individuals without hypertension or statin use (*P for interaction*<0.0001).

**Conclusion:** In this large-scale prospective cohort study of young adults, cumulative exposure to hypertriglyceridemia is significantly associated with an increased risk of type 2 diabetes. The results of exploratory subgroup analyses revealed significant interactions between cumulative exposure to hypertriglyceridemia and various subgroups. While the mechanism of specific differences in diabetes risk within specific subgroups is uncertain, these findings could aid in risk stratification and a tailored approach for high-risk individuals.

## PE287 Diabetes complications-clinical &amp; epidemiology

**Elevated frequency of MODY genetic variants in diabetes in pregnancy: insights from the UK biobank**

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**Objective:** To determine the prevalence of maturity-onset diabetes of the young (MODY)-related genetic variants, including GCK, HNF1A, and HNF4A in women diagnosed with gestational diabetes mellitus (GDM) within the UK Biobank, and to assess the potential misdiagnosis of MODY during pregnancy.

**Methods:** We analyzed whole exome sequence (WES) data from both the 200K interim release (n=200,643) and the latest release (n=469,835) of the UK Biobank. The study population included women with diabetes during pregnancy and was compared with the control group of women who had a history of childbirth but without diagnosis of GDM, type 1 diabetes, or type 2 diabetes (T2D). The frequency of pathogenic or likely pathogenic monogenic diabetes variants was compared across three distinct sets: 1) variants identified by the ClinGen group, 2) variants specified by the Exeter group (Mirshahi et al. 2022), and 3) pathogenic variants from the ClinVar database associated with 14 MODY genes, including GCK, HNF1A, and HNF4A.

**Results:** In the 200K interim WES dataset, MODY variants as specified by the Exeter group were detected in 2.3% out of 522 women diagnosed with GDM. For the women diagnosed with T2D and the control group, the detection rates were 0.62% and 0.06% respectively. In the latest release WES dataset, which included 1,129 women diagnosed with GDM, the percentages were 1.86% for GDM, 0.67% for T2D, and 0.05% for the control group. Notably, in both datasets, the detection rate was consistently higher in women with GDM compared to those with T2D. GCK was the most frequently identified MODY gene in women with GDM.

**Conclusion:** Our result demonstrates that as much as 2% of women diagnosed with GDM might actually have MODY. This underscores the need for an improved diagnostic approach to ensure accurate identification and appropriate management of monogenic diabetes during pregnancy.

## PE289 Others (basic &amp; translational)

**Investigating metabolic pathways and metabolite expression changes in obese individuals during a weight management program**

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**Objective:** Obesity is a major public health concern that predisposes individuals to several chronic diseases. Weight management programs have been proposed as a potential strategy to combat obesity. However, the underlying metabolic changes associated with these programs still need to be fully understood. This study aimed to identify the differentially expressed metabolites and metabolic pathways associated with obese individuals undergoing a weight management program.

**Methods:** A total of 30 obese individuals (BMI >30 kg/m<sup>2</sup>) were enrolled in the study, and blood samples were collected before and after the control/intervention period. The control/intervention program consisted of a diet and exercise plan. The samples were analysed using gas chromatography-mass spectrometry to identify differentially expressed metabolites. The metabolic pathways associated with these metabolites were identified using pathway analysis.

**Results:** The results showed that several metabolic pathways were significantly altered in response to the weight management program, including fatty acid, amino acid, and carbohydrate metabolism. Several differentially expressed metabolites, such as acetic acid and 2-hydroxybutyric acid, were identified as potential biomarkers of the weight management program.

**Conclusion:** This study provides new insights into the metabolic changes associated with weight management programs in obese individuals. The identified metabolic pathways and differentially expressed metabolites may be potential targets for future interventions to manage obesity and associated metabolic disorders.

**PE292** Others (basic & translational)

**A comparison of female students who live at home vs. in hostels based on chronotype for depression, anxiety, and stress**

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**Objective:** The current study's objective is to ascertain whether modern lifestyles have an impact on female students who live at home and in a hostel.

**Methods:** The DASS-21 and MEQ questionnaires were completed by 222 female students of the university.

**Results:** Findings showed that in the depression scale analysis, 33% were normal with 36% MM and 61% NT chronotype in the hostel whereas 40% were home-residing normal females with 25% MM and 73% NT chronotype. Other than the normal, nearly 23% were severe in the hostel with 35% MM and 61% NT chronotype whereas 21% were home-residing females with 00% MM and 88% NT chronotype. In anxiety, 21% were normal with 39% MM and 57% NT chronotype in hostel-residing students, similarly 21% of the population were normal with 39% MM and 57% NT chronotype in home-residing students. Nearly 48% were severe in the hostel with 30% MM and 64% NT chronotype whereas 44% were home-residing females with 04% MM and 86% NT chronotype. Interestingly, stress assessment showed 48% of females were normal in the home residing category with 25% MM and 73% NT chronotype and nearly 38% were in hostel-residing with 36% MM and 61% NT chronotype. Nearly 13% were severe in the hostel with 35% MM and 61% NT chronotype whereas 17% were home-residing females with 00% MM and 88% NT chronotype.

**Conclusion:** Incorporating students' particular chronotypes into the study session design, class schedules, and social events may increase their productivity and general happiness.

**PE295** Others (basic & translational)

**Exploring emerging threat of Non-Communicable Diseases (NCDs) with special focus on diabetes in tribal population in developing country: a community based study through health belief model**

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**Objective:** 1. To explore the perceptions of the tribal community regarding NCDs through Health Belief Model 2. To develop and suggest feasible recommendations based on Health Belief Model to improve positive community health behavior and outcome

**Methods:** Study type: Exploratory study design Health Belief Model (HBM) - a cognitive behavioural model to understand community's perceptions regarding uptake of services of interventions was used. Exploratory study methods like Free listing, Focus Group Discussion and In-depth interviews were used to understand community perceptions. A Tribal district from Southern Gujarat, India was selected first. From each block of district, one Primary Health Center (PHC) and from each PHC one Health and Wellness Center (HWC) was selected randomly as study sites to explore community's responses.

**Results:** As per constructs of Health Belief Model, Perceived susceptibility was inquired in various subdomains like awareness for NCDs like diabetes, its risk factors and susceptibility of tribal for diabetes. Participants did not perceive severity of NCDs as they were not aware of complications or did not consider NCD as cause of death. In nut shell, perceived threat was less due to lack of awareness. Screening for diabetes was increased by proactive efforts of health system but the perceived benefits by community were still questionable. They preferred traditional healers/quacks over government system for treatment. Perceived barriers included livelihood related barriers like seasonal migration, health system related like previous unsatisfactory experience at health center, financial issues and cultural barriers, transport barriers to avail services of HWCs. Continuum of care was also hampered due to these barriers. Cues of actions were awareness campaigns, use of counselling tools and involvement of social influencers to change the behaviour.

**Conclusion:** Behaviour change communication, awareness drives in community and tracking of diabetes cases during migration period are recommended for initiation and continuum of care of emerging serious NCDs like diabetes.

**PE294** Others (basic & translational)

**ATF5 modulates brown adipose tissue thermogenesis and differentiation under cold exposure**

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**Objective:** Obesity represents a significant global health challenge and is closely associated with an increased to diabetes. A key factor in the obesity is thermogenesis, which plays a role in regulating energy expenditure for maintaining body temperature. This study shows the mechanistic insights of brown adipose tissue (BAT) thermogenesis and specifically examines the influence of ATF5 (activating transcription factor 5), a regulator of mitochondrial stress response (MSR), in the modulation of heat generation during mitochondrial stress within BAT.

**Methods:** Male C57BL/6 mice at 6 weeks of age were exposed to a temperature of 6°C at specified time points. BAT, inguinal white adipose tissue (iWAT), and epididymal white adipose tissue (eWAT) were collected for further analysis. In vitro, BAT cells were cultured and allowed to differentiate for 7 days. Gene expression analysis using quantitative real-time PCR (qPCR) and protein level assessment via Western blot were performed. To inhibit ATF5 gene expression, BAT cells were subjected to siATF5 knockdown. Additionally, differentiated or undifferentiated BAT cells were measured by assessing the oxygen consumption rate (OCR).

**Results:** We observed that cold exposure triggered a notable increase in ATF5 expression and thermogenic genes within BAT. Moreover, acute cold exposure induced ATF5 expression not only in BAT but also in iWAT. Furthermore, under BAT cell differentiation conditions, ATF5, lipolysis, and MSR-related protein expression showed notable increments. To further elucidate the role of ATF5 in BAT, ATF5 knockdown experiments were conducted in BAT cells, resulting in reduced MSR-related gene expression. Additionally, ATF5 knockdown led to diminished mitochondrial function in both undifferentiated and differentiated BAT cells, as confirmed by measuring OCR.

**Conclusion:** Acute cold exposure induces ATF5 expression in BAT, with ATF5 playing a crucial role in brown fat preadipocyte in vitro differentiation. These findings highlight ATF5's potential as a key regulator in thermogenic control, suggesting therapeutic implications in mitigating obesity-related complications.

**PE296** Others (basic & translational)

**Biological potential and therapeutic effectiveness of paeonol against high blood pressure and Heart Failure (HF) in medicine with their underline molecular mechanism**

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**Objective:** Cardiovascular disease (CVD) is the leading cause of morbidity and mortality among all types of diseases in the world, affecting many millions of individuals every year. Paeonol is an active ingredient isolated from the dried roots of *Cynanchum paniculatum*, *Paeonia suffruticosa*, *Paeonia fruticosa* and *Paeonia lacti*. Paeonol has good anti-inflammatory, anti-allergy, anti-infection, anti-cancer and antioxidant potential.

**Methods:** Biological potential and therapeutic benefit of paeonol has been investigated in the present work in order to investigate their protective mechanism against high blood pressure and heart failure (HF) in medicine. Biological potential of paeonol in TAC-induced heart failure (HF) in mice has been investigated with underlying mechanisms through scientific data analysis of numerous research works. Further biological potential of paeonol for their protective mechanism against high blood pressure in spontaneous hypertension rats has been investigated in another scientific research work.

**Results:** Scientific data analysis revealed that paeonol improved cardiac function and alleviated myocardial injury. Further, paeonol also inhibited cardiac hypertrophy and regulated ERK1/2/JNK to improve cardiac function which signified its therapeutic effectiveness for the treatment of heart failure. Paeonol treatment reduced the diuresis and natriuresis and lowered blood pressure. Paeonol also improves renal and vascular functions through inhibition of oxidative stress.

**Conclusion:** Present work scientific data signified the biological potential of paeonol against high blood pressure and heart failure (HF) with their underline molecular mechanism.

## PE297 Others (basic &amp; translational)

**Effect of Ipeglimin on NLRP3 inflammasome activation in macrophages**

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**Objective:** Ipeglimin is a novel oral anti-diabetic drug for treatment of type 2 diabetes. However, the effect of imeglimin on the NLRP3 inflammasome activation has not yet been investigated.

Therefore, we aim to investigate whether imeglimin reduces LPS-induced NLRP3 inflammasome activation in THP-1 macrophages and examine the associated underlying mechanisms.

**Methods:** We analyzed the mRNA and protein expression levels of NLRP3 inflammasome components and IL-1 $\beta$  secretion. Reactive oxygen species (ROS) generation, mitochondrial membrane potential and mitochondrial permeability transition pore (mPTP) opening were measured by flow cytometry.

**Results:** Ipeglimin inhibited NLRP3 inflammasome-mediated IL-1 $\beta$  production in THP-1-derived macrophages stimulated with LPS. Ipeglimin reduced LPS-induced ROS production. LPS-induced loss of mitochondrial membrane potential and increase in mPTP opening were restored by imeglimin. Ipeglimin also inhibited LPS-induced activation of MAPK signaling pathways.

**Conclusion:** We demonstrated for the first time that imeglimin reduced LPS-induced NLRP3 inflammasome activation by inhibiting mPTP opening in THP-1 macrophages. These results suggest that imeglimin may be promising new anti-inflammatory agent for diabetic complications.

## PE299 Others (basic &amp; translational)

**The role of creatine during liver regeneration after partial hepatectomy**

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**Objective:** The objective of this study was to investigate the impact of creatine depletion on the process of liver regeneration, employing the oral administration of  $\beta$ -guanidinopropionic acid ( $\beta$ -GPA).

**Methods:** A two-thirds partial hepatectomy (PH) was performed, offering a strong mitogenic stimulus in the livers. 10-week old C57BL/6J mice were subjected to receive oral administration of 1%  $\beta$ -GPA, a well-established creatine analogue, both before and after the PH procedure. The collection of the remnant liver tissue enabled the comprehensive assessment of the effects of oral  $\beta$ -GPA administration, facilitating the elucidation of the underlying mechanisms of creatine's role in liver regeneration.

**Results:** In mice subjected to PH without  $\beta$ -GPA treatment, the expression of proliferating cell nuclear antigen (PCNA), a critical marker of cellular proliferation, exhibited a gradual increase at 24 hours, reaching its peak at the 48-hour time point. However, mice treated with 1%  $\beta$ -GPA prior to and after the PH procedure displayed a statistically significant decrease in PCNA expression. The investigation was extended to include immunohistochemical analyses, revealing not only the reduced expression of PCNA but also a concomitant decrease in Ki67 expression in  $\beta$ -GPA-treated mice after PH. Moreover, the exploration of the liver tissue transcriptome through RNA-Seq profiling yielded a compelling finding—there was a substantial increase in the expression of *Slc6a8*, a key creatine transporter, in the liver tissues following the PH procedure.

**Conclusion:** This study provides compelling evidence suggesting that creatine might indeed exert a pivotal role in the process of liver regeneration, possibly through its transportation into hepatocytes via the upregulated *Slc6a8* transporter. The insights garnered from this study contribute to a deeper understanding of the underlying mechanisms governing liver regeneration and offer potential avenues for further research and therapeutic interventions aimed at improving regenerative outcomes in liver pathologies.

## PE298 Others (basic &amp; translational)

**Serum/cord blood levels and mRNA expression of cytokines and adipokines in adipose tissue and placenta in pregnant women with GDM and mice with high fat diet**

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**Objective:** Gestational diabetes mellitus (GDM) is accompanied by sub-clinical inflammation. The present study aims to analyze systemic and adipose tissue inflammation in pregnant women and mouse model.

**Methods:** A total of 26 pregnant women with normal glucose tolerance (NGT) and 22 pregnant women with GDM were studied. Blood samples were taken just before delivery, and cord blood, visceral adipose tissue (VAT), placenta were taken immediately after cesarean delivery. 7-week-old mice divided into two groups: normal chow diet (NCD) and high fat diet (HFD) until 14 weeks of mating. From the 14th week of mating, the NCD group continued the normal chow diet (NCD-NCD), and the HFD group was divided into NCD and HFD (HFD-NCD, HFD-HFD), and euthanized 3 weeks later to obtain tissues. (3 groups : NCD-NCD, HFD-NCD, HFD-HFD)

**Results:** The serum adiponectin level was lower significantly in GDM group than NGT group (709.76 $\pm$ 98.15 vs 1762.27 $\pm$ 253.49 ng/mL, P=0.001). In visceral fat, leptin mRNA expression was higher in GDM group. (P=0.03) In the HFD-HFD group, body weight was higher on gestational day (GD) 6 and GD 10, and post-load plasma glucose in the OGTT (oral glucose tolerance test) performed on GD 10 was higher than the other two groups. In the HFD-NCD group, the diet was changed to NCD and the body weight tended to recover similarly to the NCD-NCD group, and the OGTT results too. Levels of mRNA expression were very different in sWAT (subcutaneous white adipose tissue) and eWAT (epididymal white adipose tissue). In the HFD-HFD group, TNFa mRNA expression was lower in sWAT but higher in eWAT. Adiponectin and leptin mRNA expression were higher in eWAT. In the placenta, resistin and IL6 mRNA expression were higher.

**Conclusion:** These adipokines and cytokines could have roles in local inflammation in GDM, but it is not yet known whether changes in expression level are the cause or by-product.

## PE300 Others (basic &amp; translational)

**Mitochondrial carrier, SLC25A33, mediates M1 macrophage polarization through mtDNA synthesis and cytosolic release**

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**Objective:** M1 macrophage polarization, integral to the innate immune system, is modulated by mitochondrial membrane integrity and the release of mitochondrial DNA (mtDNA). Particularly, the pyrimidine-transporting carrier SLC25A33, located in the mitochondrial inner membrane, has been linked to the cGAS-STING signaling pathway via mtDNA release. However, our understanding of SLC25A33's role in M1 macrophage polarization lacks detail. Here, we elucidate the intricate regulatory mechanism governing SLC25A33, thereby uncovering its consequential role in the M1 macrophage polarization.

**Methods:** We evaluated mRNA and protein levels of SLC25A33 and pro-inflammatory cytokines in LPS/IFN- $\gamma$ -stimulated peritoneal macrophages (PMs). Cytosolic mtDNA levels were measured utilizing 6-O-Propynyl-dG and click chemistry. The role of activating transcription factor 4 (ATF4) in SLC25A33 regulation was determined using a promoter luciferase assay. Furthermore, we undertook *in vivo* studies employing LPS-induced sepsis and cecal ligation and puncture models, and SLC25A33 levels were analyzed in the blood of septic patients with liver abscess to confirm its clinical relevance.

**Results:** We demonstrate that SLC25A33 is up-regulated by ATF4 through the MyD88-PI3K-mTORC1 pathway in LPS-stimulated PMs. Furthermore, the up-regulated SLC25A33 enhances mtDNA synthesis and its release into the cytosol, contributing to M1 macrophage polarization. Conversely, SLC25A33 knockdown and pyridoxal 5'-phosphate treatment mitigate mtDNA release and M1 polarization. These findings were consistent across *in vitro* and *in vivo* sepsis models, as well as in septic patients with liver abscess.

**Conclusion:** Our findings underscore the significant role of SLC25A33 in inflammation, suggesting that targeting SLC25A33 could represent a promising therapeutic strategy for managing M1 macrophage-mediated inflammatory diseases, including sepsis.

## PE301 Others (basic &amp; translational)

**Functional food seaweed caulerpa lentillifera as natural anti-diabetic agent**

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**Objective:** Diabetes was one of top killer in worldwide. The number of people with diabetes is increasing worldwide, 366 million of people have diabetes and 552 million people are expected to have diabetes by 2030, due to this, a lot of drugs was created to fight diabetes but unfortunately these drugs have their side effect. So instead of using these drugs to fight diabetes we using natural product to cure diabetes as it has no side effect. Our objective is to screening out bioactive peptide from natural product seaweed *Caulerpa lentillifera* (*C.lentillifera*) that could be use as natural treatment for diabetic patient.

**Methods:** Ribulose-1 5-bisphosphate carboxylase/oxygenase large subunit, Glycereraldehyde-3-phosphate dehydrogenase-chloroplastic, and Heat shock protein 70 was identified and screened their potential bioactive peptide by using BIOPEP<sup>®</sup> analysis tool (<http://www.uwm.edu.pl/biochemia>).

**Results:** Result in BIOPEP analysis tool has shown motifs that represent both of Angiotensin-converting enzyme (ACE) inhibitor and dipeptide peptidase IV (DPP-IV) inhibitor activity in Ribulose-1 5-bisphosphate carboxylase/oxygenase large subunit was high 110 motif and 161 motif, Glycereraldehyde-3-phosphate dehydrogenase-chloroplastic was 84 motif and 112 motif, and for Heat shock protein 70 was 52 motif and 99 motif respectively. Function of ACE inhibitor was to protect people from diabetic nephropathy, while DPP-IV inhibitor function was to blocking action of DPP-IV in body. In the other hand, we could say that ACE inhibitor and dipeptide peptidase IV inhibitor shows great potential due to higher amount of motif that present compared to the other bioactivities in three identified sequences that we screened.

**Conclusion:** We can conclude that *C.lentillifera* was functional food and could be used as natural anti-diabetic agent instead of using artificial drug, due to high amount of motif in dipeptide peptidase IV inhibitor and also ACE inhibitor that create great potential for fight diabetes without side effect.

## PE303 Others (basic &amp; translational)

**Effects of irisin on the islet stellate cells activation and its mechanisms**

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**Objective:** Pancreatic islet stellate cells (ISC) have a strong fibrogenic ability, and ISC activation may be an important biological event leading to islet fibrosis in type 2 diabetes mellitus (T2DM). However, the mechanism of ISC activation is still unclear. In this study, we will investigate the effect of irisin on ISC activation and explore its molecular mechanism.

**Methods:** 1. The ISCs from GK and Wistar rat islets were extracted and simulated by Transforming Growth Factor- $\beta$  (TGF- $\beta$ ). These cell models were divided into the control group and the irisin intervention group. Then, the TGF- $\beta$  receptor 2 (TGFBR2) overexpression plasmid was transfected in Wistar-ISCs. 2. Cell viability Migration rates and the disappearance rate of lipid droplets of the ISCs were detected by the CCK8, Wound Healing, and Oil red O staining. 3. RT-PCR, Western Blotting, and immunofluorescence experiments were applied to observe ISC activation marker  $\alpha$ -SMA and ECM components, and the phosphorylation levels of TGF- $\beta$ /Smad pathway-related proteins.

**Results:** 1. Irisin intervention reduce the activity, migration rate, and lipid droplet disappearance rate of ISC. 2. Irisin inhibits the increase of the Wistar-ISC migration rate induced by TGF- $\beta$  intervention and reduces the expression levels of  $\alpha$ -SMA and Col-I at the mRNA and protein levels. 3. Irisin inhibits the phosphorylation level of Smad2/3 protein in a concentration-dependent manner. 4. When TGFBR2 is overexpressed in Wistar-ISC, the inhibitory effect of irisin on the phosphorylation level of Smad2/3 is significantly weakened.

**Conclusion:** Irisin can inhibit the cell viability, migration and lipid droplet disappearance rate of activated ISCs. It can also prevent the TGF- $\beta$ -induced activation of ISCs. Irisin can suppress the activation of ISC by inhibiting the phosphorylation of Smad2/3 proteins by competing with TGFBR2.

## PE304 Others (basic &amp; translational)

**Considerations for mhealth intervention development: lessons learned from two diabetes education apps**

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**Objective:** Diabetes is a growing concern worldwide with around 10% of the adult population living with it. Diabetes education is a critical factor in improving lifestyle choices and overall health outcomes. The global pervasiveness of smartphone usage holds the potential for scalable, cost-effective, and impactful interventions employing mHealth apps. However, designing and developing such apps pose multifaceted challenges: planning and designing processes, stakeholders' relations and communication, timeline, and cost management.

**Methods:** Two mHealth apps were developed for people living with diabetes: *Glow* for comprehensive type two diabetes education and subsequently *Well Feet* for footcare education and self-care. Both apps have been created in collaboration with healthcare providers, mobile app developers, data specialists, cyber security specialists, researchers, and the target audience. The *Glow* app has been tested in a co-design study as well as a Randomized Controlled Trial (RCT), while the *Well Feet* app has been developed with a forthcoming feasibility study.

**Results:** The process of developing and testing the apps generated valuable insights in three areas: (re-) designing app features, stakeholder management, and developer synchronization. (Re-)designing app features included enhancing self-management tracking tools and personalizing the educational experience through co-design and further app testing. Stakeholders' management required extensive planning for an agile administrative environment and requirements. Developer synchronization required establishing timely and effective communication processes for quick decision-making amidst constant demands for changes and revisions in order to keep functional and up to date.

**Conclusion:** Digital health interventions are becoming more common. Although potentially scalable and cost-effective, mHealth apps are difficult to design and implement. It is thus imperative to prepare for potential pitfalls by gaining insights from other projects. Practice implications are discussed.

## PE308 Others (basic &amp; translational)

**Unexplored agro-industrial residues of Malaysian fruits as a potential sources for formulating nutraceuticals and functional food**

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**Objective:** Nowadays, we are facing on how to feed the world and how to overcome a growing epidemic of obesity and related disorders. Interest of modified oils and fats with unique and high nutritional properties, have received special attention, due to the importance of the diet on the promotion and maintenance of health. Malaysia rich in exotic fruits with their potential benefits to human wellbeing, however their by-products has been discarded without further utilized. So, the aims of this study to investigate the lipid composition, nutrition information, bioactive compounds from local seeds of duku, durian, duku langsung, langsung, manggis, rambutan and rambutan gading and to synthesize stereospecific modified lipids a MLM-type SL, which consists of triacylglycerols containing a medium-chain FA (M) at sn-1,3 positions and a long-chain FA (L) at sn-2 position.

**Methods:** Lipids composition, bioactive and nutrition properties of the seeds were analyzed using GC and HPLC. Interesterification and synthesize modified reactions were catalyzed by different immobilized commercial lipases (Lipozyme TL IM<sup>®</sup>, Lipozyme RM IM<sup>®</sup> and Novozym 435<sup>®</sup>) at different time for highest and best yields structured lipids. SL properties was analyzed using GC, then crystallization isotherms, compound characterization and conformation stereospecific fatty acid location were analyzed using NMR and FTIR. Oxidative stability and kinetic parameters of SLs were determined using DSC.

**Results:** Durian, duku, duku langsung and rambutan gading contained highest monounsaturated fatty acids (45.78%, 42.46%, 71.30% and 40.94%) respectively. HPLC showed phenolics compounds like Ferulic, p-coumaric, gallic acids and ellagic acid highest in duku langsung. Meanwhile, flavonoids like rutin, quercetin and catechin have been detected in duku. The synthesis of a MLM-type SL by Lipozyme RM IM<sup>®</sup> lipase was well succeeded with the best results 78.53  $\pm$  0.05%. Modified lipids showed the incorporation degree (ID) ranged from 33.12  $\pm$  1.34 to 78.53  $\pm$  0.05%, after 24 h reaction at 45  $^{\circ}$ C, using a molar ratio (MR) fatty acid:oil of 2:1.

**Conclusion:** Succeeded formulating SLs from seeds fruit will meet the growing need for healthier foods to combat metabolic syndrome and for special nutritional applications.

PE309 Others (basic & translational)

**Hepatoprotective effects of white sesame oil extract in cholesterol diet induced hyperlipidemia in male rats**

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**Objective:** The present study is an attempt to scrutinize the extent of effectiveness of white sesame seed Oil (WSSO) as a hypolipidemic agent in diet- induced hypercholesterolemic in heart and liver of male rats.

**Methods:** Forty eight Wistar albino rats were classified into six groups in which n=6, and fed a high-cholesterol (HC) diet for 30 Days. Group I Treated as normal control, Group II treated with high- cholesterol diet and administered a test dose (100,200,400 mg/kg) of WSSO for 30 days. Atorvastatin (1 mg/kg) were used as the standard drug and given to the last group of rats. The effects of WSSO on serum lipid profile, atherogenic index, and cardiac markers were examined in all rats. The effects of WSSO on serum lipid profile, atherogenic index, cardiac markers hepatic glucose homeostasis, lipogenic enzymes, serum aspartate aminotransferase (GOT), alanine aminotransferase (GPT),alkaline phosphatase (ALP) as well as bilirubin were examined in all rats.

**Results:** WSSO significantly showed significant reduction in the serum lipid profile, hepatic glucose homeostasis, lipogenic enzymes GOT, GPT, ALP in all rats as compared to normal control rats levels of lipids and lipoprotein with significant enhancement in HDL-C. There was significant downregulation in the atherogenic index and cardiac markers enzymes such as aspartate transaminase. WSSO was able to decrease the elevated serum lipids (TC, TG, LDL, and VLDL) and consequently increase the HDL levels in a dose-dependent manner.

**Conclusion:** The results of present study reveal that WSSO extract could be useful intervention in the treatment of liver disease and type-2 diabetes mellitus.

PE310 Others (basic & translational)

**Pandemic pressures: student stress and weight responses in the COVID-19 era**

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**Objective:** This study aimed to explore the potential relationship between stress levels and changes in body weight among university students in Mongolia during the COVID-19 quarantine period.

**Methods:** Amidst the COVID-19 quarantine, as part of the comprehensive Student Health Study encompassing the five major universities in Mongolia (n=1123), a distinct subset of students who had effectively completed the questionnaire were meticulously selected for a more thorough analysis (n=783). We employed self-reported body weight and height to calculate the Body Mass Index (BMI). Stress levels were assessed using the methods outlined by the WHO.

**Results:** The average age of the participants was 20.61±2.5 and BMI was 21.7±3.05. During the quarantine period, a notable 60.9% (n=377) of participants experienced weight gain. The entire students experienced a 67.1% (n=526) increase in appetite (p<0.05). Stress levels were heightened among a significant 76% (n=595) of participants. Interestingly, 77.4% (n=247) of overweight participants reported stress levels above the average range. Correspondingly, 77.3% (n=343) of individuals hailing from urban areas exhibited elevated stress levels (p<0.05), and intriguingly, 67.6% of overweight students were found to reside in urban settings. Additionally, the frequency of eating emerged as a notable risk factor for stress (OR=4.83, p-value=0.007). Within the study, a modest 6% (n=47) of students grappling with high stress levels maintained a healthy lifestyle and engaged in regular exercise during the quarantine period (p<0.05).

**Conclusion:** This study reveals a clear link between COVID-19 quarantine, stress, and weight fluctuations among university students. The findings emphasize the importance of addressing psychological factors, urban influences, and dietary behaviors to ensure student well-being during such crises.

PE311 Others (basic & translational)

**Enavogliflozin, an SGLT2 inhibitor, ameliorates high-fat high-cholesterol diet-induced nonalcoholic steatohepatitis**

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**Objective:** Non-alcoholic fatty liver disease (NAFLD), which is a progressive disease caused by a build-up of fat in the liver, onsets with simple steatosis and potentially advances to non-alcoholic steatohepatitis (NASH) in the presence of inflammation and fibrosis, severely leading to cirrhosis or hepatocellular carcinoma. There is increasing cumulative evidence indicating that sodium-glucose cotransport 2 (SGLT2) inhibitor agents efficaciously alleviate NASH in a novel mouse model, but there is no study mentioning the effect of Enavogliflozin on liver disease. Consequently, in this present study, we investigated the impact of this sodium-glucose cotransport 2 inhibitor on high-fat high-cholesterol diet (HFHCD)-induced NASH mice.

**Methods:** Male C57BL/6 mice were fed a normal chow diet, HFHCD, or HFHCD with Enavogliflozin for 12 weeks. Enavogliflozin was administered at a dose of 1.28 mg/kg/day in these experiments. *In vitro*, human hepatic stellate cells (LX-2 cells) were treated with transforming growth factor beta 1 (TGF-β1), with or without Enavogliflozin.

**Results:** HFHCD induced excessive hepatic lipid accumulation, immune cell infiltration, and severe fibrosis. Enavogliflozin administration not only ameliorated hepatic steatosis and fibrotic condition but also suppressed the production of inflammatory cytokines (IL-6, TNF-α). In the *in vitro* study, in addition to decreasing SGLT2 expression induced by TGF-β1, enavogliflozin inhibited hepatic stellate cell activation by reducing proliferation, wound healing migration and suppressed the expression of αSMA.

**Conclusion:** Our results suggest that enavogliflozin shows efficacy in a mouse model of NASH and liver fibrosis by attenuating hepatic steatosis, suppressing inflammation and inhibiting hepatic stellate cell activation *in vitro*.

PE312 Others (basic & translational)

**Taurine ameliorates diabetic complications by improving serum adiponectin levels and inflammation in ob/ob mice**

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**Objective:** Taurine, a non-essential amino acid, is reported to ameliorate diabetic complications and its induced inflammation in various mouse models. However, the mechanisms by which taurine causes the effects in ob/ob mice are yet to be explored. This study aimed to verify the beneficial effects of taurine in ob/ob mice and to highlight the mechanisms of the action.

**Methods:** Five-week-old male C57BL/6-Lep<sup>ob/ob</sup> mice (n=16) and C57BL/6J mice (n=8) as a normal control were fed chow *ad libitum* for 10 weeks. After 1-week adaptation period, C57BL/6-Lep<sup>ob/ob</sup> mice were randomly divided into two groups of negative control and taurine group. The taurine group mice were provided orally with taurine (2g/kg body weight) for 10 weeks. The serum level of adiponectin, insulin, as well as HOMA-IR and QUICKI indices were determined. White adipose tissue (WAT) was quantified and harvested for subsequent gene expression analyses pertaining to inflammatory markers.

**Results:** Taurine intake significantly reduced the serum insulin levels and a concomitant attenuation of HOMA-IR values. Furthermore, the taurine group exhibited a marked elevation in serum adiponectin concentrations, alongside a discernible augmentation in the QUICKI index (0.30 for the negative control vs. 0.45 for the taurine group) compared to that of the negative control. Moreover, taurine significantly reduced the expression of the inflammatory genes, including tumor necrosis factor, adhesion G protein-coupled receptors, and chemokine ligand 2, in the epididymal WAT compared to that of the negative control.

**Conclusion:** In light of these findings, it can be postulated that taurine exerts a salutary influence on diabetes by virtue of enhancing insulin sensitivity through elevating serum adiponectin concentrations. Furthermore, this benefit is complemented by the mitigation of inflammatory processes within the white adipose tissue of ob/ob mice, underscoring taurine's potential as an ameliorative agent in the context of diabetes.

## PE313 Others (basic &amp; translational)

**The Study of Thai people in the diabetes mellitus and overweight risk group and their health product literacy**

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**Objective:** Health literacy is an important skill for everyone. It assists everyone to recognize and be able to select an appropriate health product and service as well as how to take good care of their health. This study aimed to investigate a level of health product literacy which has an influence on self-management skill; particularly in a diabetes mellitus risk group, and an opportunity to improve consumption behavior.

**Methods:** This study is cross-sectional descriptive design. A sample of this research included a diabetes mellitus risk group who had blood sugar levels of 100-125 mg/dL and a body mass index (BMI) of 23-24.9. They participated in an activity of behavior change which was carried out by sub-district health promoting hospitals. The data collection included a survey based on health product literacy of Thai people. There were 563 participants engaging in the activity from October to December 2022. Chi-square was used for data analysis.

**Results:** The results showed that a level of health product literacy was adequate and excellent (63.3%). When considering the relationship of each component of the health product knowledge, to encourage the people to gain such knowledge required them to increase skills in accessing valid health information. This resulted in an individual's understanding, questioning, responding to public health personnel, and making decisions on purchasing and using the products.

**Conclusion:** The study shown that only increase health product literacy skill did not influence the change in health behavior and delivering accurate information. Lastly, promoting this knowledge could educate the risk group and assist them to make decisions on purchasing or using health service. Nevertheless, it is not yet able to change an individual's health behavior.

## PE315 Others (basic &amp; translational)

**Effects of sargassum miyabei yendo on the hepatic fibrosis in LX-2 cells**

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**Objective:** Nonalcoholic steatohepatitis (NASH), a severe subset of non-alcoholic fatty liver disease, is characterized by hepatic steatosis, inflammation and fibrosis. Activated hepatic stellate cells, the common feature of NASH, play a central role in the production of extracellular matrix that leads to hepatic fibrosis. Sargassum miyabei Yendo, a type of brown algae, has been known to have antibacterial, antioxidant, anti-inflammatory activities. Previously, we reported the protective effects of the ethanolic extract of *Sargassum miyabei Yendo* (SME) on lipogenesis, oxidative stress, and inflammation in hepatic steatosis. However, little is known about the effects and underlying mechanisms of SME on fibrogenesis in the liver. In the present study, we aimed to investigate the effects of SME on fibrogenesis induced by transforming growth factor  $\beta 1$  (TGF $\beta 1$ ) in hepatic stellate cells.

**Methods:** LX-2 cells, the immortalized human hepatic stellate cell line, were treated with TGF $\beta 1$  to induce hepatic fibrosis. The cytotoxicity and reactive oxygen species (ROS) levels were measured in the cells. In TGF $\beta 1$ -treated LX-2 cells, the mRNA and protein levels of fibrogenic genes and the activation of the Smad pathway were determined by quantitative Realtime PCR, western blot, and immunocytochemistry.

**Results:** The increased cellular ROS levels by TGF $\beta 1$  or tert-butyl hydrogen peroxide was attenuated by SME in LX-2 cells. SME significantly decreased the mRNA and protein levels of fibrogenic genes, i. e.  $\alpha$ -smooth muscle actin ( $\alpha$ -SMA) and procollagen type 1, alpha 1 (Col1A1) in TGF $\beta 1$ -treated cells. Furthermore, the mRNA abundance of TGF $\beta 1$ -mediated Smad2, Smad3, Smad7, TGF $\beta$  receptor 1 (T $\beta$ RI), and T $\beta$ RII were significantly decreased in LX-2 cells. Concomitantly, SME abolished the phosphorylation and nuclear translocation of Smad3, the major downstream regulator for the TGF $\beta 1$ -induced fibrogenesis.

**Conclusion:** SME attenuated the TGF $\beta 1$ -mediated fibrogenesis by blocking the activation of Smad3 pathway in hepatic stellate cells. These results suggest the potential of SME as a preventive agent for hepatic fibrosis.

## PE316 Others (basic &amp; translational)

**Effect of bee keeping and wild harvesting honey in anthropometrical, insulin resistance and also reversing metabolic changes in rats fed with high-fat diet: a comparative study**

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**Objective:** Metabolic syndrome (MetS) is composed of central obesity, hyperglycemia, dyslipidemia and hypertension that increase an individual's tendency to develop type 2 diabetes mellitus and other chronic diseases. Therefore, this study aim to evaluate the consumption of bee keeping honey (Acacia and pineapple) and wild harvesting honey (Gelang and Tualang) on nutritional status, anthropometrical, insulin resistance, adipocytokines, metabolic parameters, liver and renal function indices also histological evaluation in male fed with high fat diet. This is the first data on the comparative effects of the bee keeping and wild harvesting honey reported.

**Methods:** Rats were randomly divided into group of control, high fat diet, high fat diet fed with four different type of honeys. Physicochemical and bioactive polyphenols in honeys were analyzed by HPLC. Nutritional status was obtained based on food consumption, energy intake (EI) and food efficiency rate. Measurements of anthropometric parameters abdominal circumference, body length and body weight (BW), the BMI and the Lee Index. Biochemical parameters analyzed glucose level and blood lipid profile (TC, TG, LDL-C, HDL-C, adiponectin, leptin, resistin and liver function (AST, ALT and ALP) and renal function (urea, creatinine, total protein). The steatosis and inflammation in the liver were assessed and graded.

**Results:** Group fed with wild honey significant ( $p < 0.05$ ) decrease in body weight, body mass index, TG and leptin, as well as the area and perimeter of adipocyte cells. Analysis on anthropometric indicates a significant difference in mean BW between group of HFD and HFD+GH. Nutrition parameters indicates a significant difference in mean EI between HFD+GH and HFD+TH. Results showed wild honey effectively ameliorate HFD-induced MS by alleviating body weight gain and fat accumulation. A significant reduction in inflammation markers and liver damage and a notable improvement in liver morphology was observe. In addition, honey administration reduced fat deposition within hepatocytes, and prevented deterioration in renal glomerulus.

**Conclusion:** Studies reported the effects of honey in reversing metabolic syndrome and displayed a therapeutic potential to manage obesity and its associated pathologies, type 2 diabetes mellitus and other chronic diseases.

## PE317 Others (basic &amp; translational)

**Harnessing AI and digital innovations for enhanced diabetes management**

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**Objective:** The incorporation of Artificial Intelligence (AI) and digital technologies has brought about a transformative shift in Diabetes Singapore's patient care and operational strategies. Through the utilization of AI, the organization has harnessed the power of the Singapore Eye Lesion Analyser (SELENA+), a deep-learning software designed to rapidly and accurately identify potential ocular issues, specifically diabetic retinopathy. By analyzing retinal images, SELENA+ has significantly reduced diagnostic timeframes from hours to mere minutes, resulting in more efficient resource allocation for personalized care planning. The potential effectiveness of SELENA+ in reducing workload by 50% holds the promise of freeing up resources for comprehensive patient support initiatives. SELENA+'s capabilities extend beyond diabetic retinopathy, encompassing the detection of glaucoma and age-related macular degeneration. This AI-driven analysis not only expedites diagnoses but also enhances the precision of treatment strategies. In parallel, the adoption of Clinic Assist, an advanced clinic management software, exemplifies Diabetes Singapore's dedication to Singapore's Healthier SG initiative. By optimizing clinic operations, Clinic Assist empowers nurses to concentrate on patient care rather than administrative tasks. The software's API capabilities have revolutionized billing and invoicing processes, liberating nursing and finance personnel from monotonous paperwork. This newfound efficiency fosters heightened patient engagement and interaction, reinforcing meaningful connections between patients and healthcare providers. Clinic Assist's wide-ranging functionalities encompass practice management, electronic medical records, appointment scheduling, billing, claims processing, and the digitization of patient records. Its user-friendly interface facilitates a seamless transition to paperless operations, aligning with modern healthcare's emphasis on efficiency and environmental sustainability.

**Results:** Singapore's strategic integration of AI and digital advancements underscores its commitment to patient-centered care and operational excellence. The synergistic relationship between SELENA+ and Clinic Assist exemplifies the organization's adaptability to technological progress and unwavering dedication to optimizing healthcare services.

**Conclusion:** Position as a trailblazer in advancing diabetes management through state-of-the-art technologies.

## PE318 Others (clinical)

**Exploring role of newer anti diabetic drug terzepatide in management of obesity**

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**Objective:** New dual inhibitor terzepatide approved in 2022 for diabetes and have some role in obesity. So objective is to find role of terzepatide in obesity management.

**Methods:** In this study, randomised clinical trials database was searched with keywords "terzepatide" AND "Obesity" in clinical trials registered on www.clinicaltrials.gov, cochrane, pubmed till 30 June 2023. Trials with terzepatide in obesity management in all the age groups conducted globally were included. Narrative review was conducted on the extracted data.

**Results:** Out of 54 studies found, 18 clinical trials were matching to our research question. From these 7 RCT were completed and 11 trials are still going on. On further search it was found that only one clinical trial SURMOUNT-1 results were available. In this trial they compared terzepatide to placebo. There were 2539 overweight patients recruited who were randomly assigned to 5, 10 or 15 mg SC Terzepatide once week or Placebo injection. The use of tirzepatide once weekly provided substantial and sustained reductions in body weight in a dose-dependent manner from -15% (5 mg) reaching up to -20.4% (15 mg) versus -3.1% in the placebo group. Higher dose results are comparable to bariatric surgery. Other trials results are awaited that are studying Terzepatide in maximum tolerated dose, liraglutide and other clinical condition like sleep apnea. Results of these studies will clarify the picture. Proposed mechanism of anti-obesity effects were The GLP 1 and GIP agonism leads to glucose dependant insulin secretion, appetite suppression, slowing gastric emptying and satiety effect. Extra benefit of additional GIP agonist effect leads to increase post prandial adipose tissue blood flow and metabolic on fat metabolism.

**Conclusion:** This study showed promising picture of Terzepatide in obesity management and at higher doses it can have potential to replace bariatric surgery.

## PE321 Others (clinical)

**Enhancing type 2 diabetes diagnosis accuracy using learning vector quantization: a machine learning approach**

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**Objective:** Type 2 diabetes is a complex disease affected by factors like obesity, age, blood glucose levels, genetics, and diet. Accurate diagnosis is vital for effective treatment. This study utilizes Learning Vector Quantization (LVQ), a powerful machine learning technique, to improve diagnostic accuracy. Through rigorous experimentation, we aim to identify the best model configurations for superior type 2 diabetes diagnosis.

**Methods:** Our study utilized a comprehensive dataset encompassing crucial information related to type 2 diabetes, including obesity, age, blood glucose levels, genetic predisposition, and dietary patterns. Leveraging the LVQ algorithm, we employed the quantization vector learning method to train and evaluate the model. Rigorous experiments were conducted, testing the model on 40% of the dataset while varying the number of epochs from 1000 to 10,000 at 1000-epoch intervals. The model's performance was meticulously evaluated based on the attainment of minimum values across diverse learning levels.

**Results:** Our extensive experimental analysis revealed remarkable improvements in type 2 diabetes diagnosis accuracy through the application of LVQ. Notably, the optimal model configuration, exhibiting the minimum value, was achieved at 1000 epochs with an impressive learning level of 0.008, resulting in an accuracy of 92.5%. Additionally, we identified another highly effective model at 3000 epochs with a learning level of 0.004, yielding an accuracy of 91.2%. Moreover, a superior model with the minimum value was obtained at 9000 epochs with a learning level of 0.008, providing an accuracy of 93.8%. Noteworthy findings were observed when training the model on 70% and 80% of the data, where models with minimum values were available across a range of learning levels, achieving accuracies ranging from 89.6% to 94.1%.

**Conclusion:** Learning Vector Quantization (LVQ) enhances type 2 diabetes diagnosis. Optimized LVQ models with specific configurations improve accuracy, enabling personalized treatment strategies and better patient outcomes in diabetes management.

## PE320 Others (clinical)

**Robust deep learning method for early detection of diabetes using image-based representation**

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**Objective:** Early detection of diabetes is crucial for mitigating disease progression. This study presents a novel deep-learning method that leverages image-based representation to achieve early detection of diabetes, offering the potential to significantly improve patient outcomes.

**Methods:** This study utilized the Pima Indian Diabetes dataset, converting the numerical features into images to leverage the power of convolutional neural network (CNN) models. Three classification strategies were employed: (1) ResNet18 and ResNet50 CNN models were trained to identify diabetes patterns and features; (2) Deep features extracted from the ResNet models were fused and used as input for a Support Vector Machine (SVM) classifier; (3) The most distinguishing fused features were selected and classified using SVM to enhance accuracy.

**Results:** The experiment results showcased the effectiveness of our proposed method for early diabetes detection. Using ResNet18 and ResNet50 models, we achieved classification accuracies of 91.2% and 93.7% respectively, showcasing their strong ability to recognize diabetes patterns in the images. By combining the deep features extracted from the ResNet models and utilizing SVM classification, the accuracy improved to 94.5%. This demonstrates the combined approach's ability to further enhance the accuracy of diabetes detection. Furthermore, through careful selection of the most informative fusion features and employing SVM classification, we achieved an impressive accuracy rate of 96.1%. This underscores the effectiveness of feature selection in improving classification performance.

**Conclusion:** This study showcases the potential of deep learning and image-based representation for early diabetes detection. By converting data into images and employing advanced CNN models, we achieve accurate classification of diabetes cases. The fusion of deep features and SVM further enhances classification performance. This research represents a significant advancement in diabetes diagnosis, enabling timely intervention and reducing the global burden of the disease.

## PE322 Others (clinical)

**Gut microbiota and metabolites as mediators in the bidirectional relationship between sleep disturbances and insulin resistance in type 2 diabetes: a cross-sectional study**

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**Objective:** Growing evidence suggests a bidirectional association between sleep disturbances and insulin resistance in individuals with type 2 diabetes. However, the underlying mechanisms remain poorly understood. This cross-sectional study aims to investigate the potential role of gut microbiota composition and metabolites as mediators in the intricate interplay between sleep disturbances, gut microbiota, and insulin resistance, providing novel insights into the underlying mechanisms.

**Methods:** We included a total of 150 individuals with type 2 diabetes from a health center located in East Java, Indonesia. Validated questionnaires were utilized to evaluate sleep disturbances, encompassing sleep quality, duration, and daytime sleepiness. Fasting blood samples were collected to measure insulin resistance markers, including fasting glucose, insulin, and the Homeostatic Model Assessment of Insulin Resistance (HOMA-IR). Additionally, stool samples were obtained for gut microbiota analysis using high-throughput sequencing, and targeted metabolomic profiling was conducted to identify gut microbial metabolites. Statistical analyses, comprising mediation analysis and multivariate models adjusted for confounders, were employed to investigate the potential mediating role of gut microbiota composition and metabolites in the association between sleep disturbances and insulin resistance.

**Results:** Sleep disturbances were significantly associated with insulin resistance markers in individuals with type 2 diabetes. Higher fasting glucose levels ( $\beta=0.27$ ,  $p<0.05$ ), increased insulin levels ( $\beta=0.32$ ,  $p<0.05$ ), and elevated HOMA-IR ( $\beta=0.25$ ,  $p<0.05$ ) were linked to sleep problems. Changes in gut bacteria, particularly a decrease in SCFA-producing bacteria, were identified as potential mediators. Mediation analysis revealed that decreased SCFA-producing bacteria accounted for 15% ( $p<0.05$ ) of the overall effect, partially mediating the relationship between sleep disturbances and insulin resistance.

**Conclusion:** Sleep disturbances, gut microbiota, and insulin resistance are linked to type 2 diabetes. Modulating the gut microbiota through interventions may help manage sleep-related metabolic issues. Further research is needed to validate these findings and explore clinical applications.

## PE323 Others (clinical)

**Association between minority stress factors and diabetes risk among LGBTQ+ individuals in Jakarta: a cross-sectional study**Sahnaz Vivinda Putri<sup>1\*</sup>, Metta Permadi<sup>2</sup>,Sonya Algiabli Hamajaya<sup>1</sup>, Evita Rosi Zabidin<sup>1</sup>, Andi Tenri Ajeng<sup>2</sup>International University Semen Indonesia, Indonesia<sup>1</sup>, Trisakti University, Indonesia<sup>2</sup>

**Objective:** LGBTQ+ individuals face unique challenges and stressors that can adversely affect their health outcomes. This research aims to investigate the association between minority stress factors and diabetes risk among LGBTQ+ individuals in Jakarta, Indonesia. By focusing on stressors such as internalized stigma, concealment of sexual orientation, and anticipated discrimination, the study provides valuable insights into the relationship between minority stress and diabetes risk within this population.

**Methods:** A cross-sectional study was conducted, enrolling 500 LGBTQ+ individuals residing in Jakarta. Participants completed validated questionnaires assessing minority stress factors, including internalized stigma, concealment of sexual orientation, and anticipated discrimination. Diabetes risk was evaluated based on physical measurements (BMI, waist circumference) and blood parameters (fasting glucose levels, lipid profile). Statistical analyses, including correlation analysis, multiple regression models, and mediation analyses, were employed to assess the associations between minority stress factors and diabetes risk.

**Results:** The study revealed significant associations between minority stress factors and diabetes risk among LGBTQ+ individuals in Jakarta. Higher levels of internalized stigma ( $r=0.25$ ,  $p<0.001$ ), concealment of sexual orientation ( $r=0.18$ ,  $p<0.001$ ), and anticipated discrimination ( $r=0.21$ ,  $p<0.001$ ) were positively correlated with increased diabetes risk factors, including higher BMI, larger waist circumference, and unfavorable blood parameters. Mediation analysis indicated that the relationship between minority stress factors and diabetes risk was partially mediated by health behaviors, such as physical activity levels and dietary patterns.

**Conclusion:** Minority stress factors significantly increase diabetes risk in LGBTQ+ individuals in Jakarta. Targeted interventions are needed to reduce stress and promote resilience. Inclusive environments, addressing stigma, and providing support networks and mental health services are crucial. Comprehensive interventions addressing psychosocial factors and health behaviors are essential for improving well-being and reducing health disparities. Further research is needed to explore additional factors and develop effective interventions for health equity.

## PE324 Others (clinical)

**Lifestyle management is a non-pharmacological intervention against high fat diet induced obesity**

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King George's Medical University, India

**Objective:** Obesity is the most common problem in developing countries, which are the risk factors for the pathogenesis of diabetes, hypertension, cancer etc. It can be managed or cured by lifestyle modification. Time Restricted Feeding (TRF) is very important in today's scenario as changing the life pattern may protect from various diseases and improve quality of life.

**Methods:** In this study 15 Wistar rats were recruited and divided into two groups. Control group and High Fat diet (HFD) group which consist of six rats and nine rats respectively. HFD group was fed fatty diet for two months to developed obesity. These rats were shifted to TRF with HFD for three months, after which they were again put back on *ad lib* (24 hr feeding). These rats were sacrificed and samples collected. Body weight was measured monthly, with blood glucose, Insulin, melatonin and lipid profile estimated after sacrifice.

**Results:** The body weight and blood glucose level of HFD group were significantly increased. The level of insulin, melatonin and HDL were reduced in rats fed with HFD whereas total cholesterol, TG and LDL were increased. TRF intervention reduced body weight, blood glucose level, TG and LDL and elevated the level of insulin, melatonin, total cholesterol and HDL. TRF in HFD induced obesity showed its legacy effect when put on *ad lib*.

**Conclusion:** TRF is a potential behavioural intervention which is easily adaptable in lifestyle modification. TRF intervention can prevent and treat obesity and metabolic disorders.

## PE325 Others (clinical)

**Wearable technology and geo-fencing device are a boon for hypertension patients with type 2 diabetes**

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S N Medical College and Hospital, India

**Objective:** Aim of present study was to investigate the role of wearable (MI Band 8) and geo-fencing technology on nephrology data in relation to hypertension in type 2 diabetic patients in Gurugram City, India.

**Methods:** Total of 62 hypertension patients with type 2 diabetes were taken as subject with an equal ratio of male and female and age group between 50 to 70 years. Wearable monitoring devices like MI band-8 and Geo-Fencing device were put on the wrist of patients for 30 days and a questionnaire was filled out by each patient. In all subjects, blood pressure, blood glucose was measured on daily basis with day to day data of their monitoring of step count, calorie burnt, motion time, sleep monitoring, calorie consumption, monitoring heart rate to know daily routines and recording them for health purpose. Wearable bands, automatically provides a cueing sound with sensing alert when patients move out of the geo-fenced area and which stays until the subject resumes walking in virtual boundary.

**Results:** Present results shown that both wearable device reading showed that there was a significant normal heart rate ( $p<0.05$ ), increase calorie burnt with a significant decrease of blood glucose and blood pressure levels ( $p<0.01$ ), and increased significantly ( $p<0.01$ ) sleep duration in active physically workout, include walking in hypertension patients with type 2 diabetes compared to less physically workout hypertension patients with type 2 diabetes, identified by professional physiotherapists. Both device reading showed that after changing lifestyle routine among less physically active patients, their memory loss and wandering events normalize with less requirement of drug dose.

**Conclusion:** Wearable devices and technology have introduced a new way for caregivers and families to prevent the dangers of wandering in senior loved ones with hypertension patients with type 2 diabetes.

## PE326 Others (clinical)

**Medical nutrition therapy provision improves clinical outcomes in a patient with type 2 diabetes at district hospital: a case study**Haneef Fakhrurazi<sup>1\*</sup>, Barakatun-nisak Mohd Yusof<sup>2</sup>Hospital Kulim, Malaysia<sup>1</sup>, Universiti Putra Malaysia, Malaysia<sup>2</sup>

Medical nutrition therapy (MNT) is essential to type 2 diabetes (T2D) management. While the evidence has been established, translating it to daily clinical practices is challenging, especially among patients in the district area. This presentation reported a case study of MNT provision to a patient who attended a routine dietetics clinic in Kulim Hospital, a district hospital in Kedah State on clinical outcomes. Mdm A, 46-years old, with Malay ethnicity, was referred to a dietitian for the first time after 4 years of T2DM diagnosis with overweight (BMI=27.1 kg/m<sup>2</sup>) and sub-optimal lipid profiles, which puts her at risk of cardiovascular diseases. She adhered to diabetes medication, but the dietary intake does not align with MNT recommendations. Thus, MNT aimed to achieve 5-10% weight loss within six months and to improve glycemic control. A dietitian provided an energy-restricted diet within 1200-1500 kcal/day with moderate carbohydrates (45% from TEI) with appropriate nutrition education components. That included carbohydrate and basic calorie counting, reading product labels and meal planning. She was encouraged to self-monitor by recording her dietary and physical activity levels. After 6 months, Mdm A achieved 10.1% weight loss and reduced HbA1c by 1.6%, which was clinically significant. She adhered to MNT recommendations, with a current energy intake was 1316 kcal/day, lower in carbs (41%), and appropriate protein (18%) but high in fats (41%). However, her lipid profiles, except total cholesterol and triglycerides, were not optimal (LDL Cholesterol=2.92 mmol/L), suggesting a high intake of dietary fats of > 40% TEI. While MNT provision has achieved the clinical targets for weight and glycemic control, the sub-optimal lipid profiles warrant further evaluation regarding the appropriate type of dietary fat, commonly from saturated fat among Asian patients with T2D.

## PE327 Others (clinical)

**Relationship between physical activity frequency, obesity, and diabetes risk: a population-based mon-timeline study**

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**Objective:** This study aims to explore the relationship between the frequency of physical activity (PA) and the risk of obesity and diabetes, with a focus on its potential as a preventive factor

**Methods:** A cross-sectional study was conducted within the framework of the "Mon-Timeline" cohort study, involving a randomly selected sample of 2004 participants (mean age of 41.7±13.6 years, with 29.2% men) from various regions in Mongolia. Self-reported data on PA frequency were analyzed, and body mass index (BMI) was calculated based on participants' weight and height. Obesity was defined as a BMI over 30 kg/m<sup>2</sup>, and diabetes was identified using WHO criteria.

**Results:** The study revealed that 61.9% of the participants were classified as overweight or obese, and 4.5% had diabetes. 51.0% of the participants did not engage in active PA or sports at all. Regression analysis demonstrated that higher PA frequency was associated with lower BMI and reduced obesity risk, but it showed no significant association with diabetes risk. The unstandardized beta-coefficients (95%CI) from the linear regression analyses were -1.298 (-1.909; -0.687), -1.623 (-2.348; -0.898), -1.876 (-2.875; -0.876), and -1.650 (-2.765; -0.535) kg/m<sup>2</sup> BMI for the "several times monthly," "1-2 times weekly," "3-5 times weekly," and "daily or almost daily" activity groups, respectively, compared to the reference group of "less than once monthly." After adjusting for age, gender, socioeconomic and lifestyle characteristics the associations were attenuated by 10 to 50% (p<0.05). The analysis revealed that the association between obesity and diabetes became slightly stronger when adjusted for PA (OR=3.55, p=0.001) compared to unadjusted (OR=3.31, p=0.001). However, no significant interactions were observed when testing for interaction effects between PA and obesity in relation to diabetes.

**Conclusion:** Obesity increases diabetes risk, while PA alone does not significantly impact diabetes risk. However, PA frequency plays a crucial role in preventing obesity.

## PE329 Others (clinical)

**Diabetes visits in endomed hospital, Ulaanbaatar, Mongolia**

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Endomed Hospital, Mongolia

**Objective:** The aim of study was to determine the proportion of visits of people with diabetes mellitus in outpatient department of Endocrinology, Metabolism and Diabetes specialized clinic.

**Methods:** We analyzed one year (in 2022) outpatient registration of Endomed - Endocrinology, Metabolism and Diabetes specialized clinic, Ulaanbaatar, Mongolia. We used international classification disease 10 (ICD10) for registration of morbidity.

**Results:** A total 4330 outpatient visits were registered. First and follow up visits were 60.3% (2611) and 39.7% (1719), respectively. Among them women were 68.9% (2986). The mean age of the patients was 42.4±13.7 years old. Visits due to diabetes mellitus were 34.2% (1480), thyroid disease 30.0% (1297), obesity 3.4% (148), pituitary disorders 0.7% (29), adrenal disease 0.1% (6), dyslipidemia 0.2% (9), vitamin D deficiency 0.1% (5), other endocrine disease 0.3% (13) and non-endocrine disease was 31% (1343) by the ICD10. Among the diabetes visit T2DM, T1DM, Prediabetes, GDM and Other type DM was 85.8% (1270), 4.1% (60), 7.6% (112), 2.3% (34) and 0.3% (4), respectively.

**Conclusion:** 1 of 3 visits of endocrine clinic is due to diabetes mellitus. Type 2 diabetes mellitus is common among the diabetes visits.

## PE331 Others (clinical)

**Preoperative skeletal muscle quality as a predictor of metabolic status change following bariatric surgery**

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Soonchunhyang University Seoul Hospital, Korea

**Objective:** We tried to investigate the differences in quantity and quality of skeletal muscle between participants with and without metabolic abnormality after bariatric surgery using abdominal CT.

**Methods:** Eighty-five morbidly obese individuals who underwent bariatric surgery and preoperative abdominal CT were enrolled in a retrospective study. After surgery, we divided the obese individuals into metabolically healthy obese (MHO) and metabolically unhealthy obese (MUO) individuals using the new criteria published in the JAMA network Open. CT evaluation of muscle quantity (at the level of the third lumbar vertebra [L3]) was performed by calculating muscle cross-sectional area (CSA), which was normalized to patient height to produce skeletal muscle index (SMI). Muscle quality was assessed as skeletal muscle density (SMD), which was calculated from CT muscle attenuation. To characterize the intramuscular composition, muscle attenuation was classified into three categories using Hounsfield unit (HU) thresholds: -190 HU to -30 HU for intermuscular adipose tissue (IMAT), -29 to +29 HU for low attenuation muscle (LAM), and +30 to +150 HU for normal attenuation muscle (NAM). The Paired t-test was used to compare the continuous variables. Statistical significance was set at p<0.05.

**Results:** Before bariatric surgery, all morbidly obese participants were MUO individuals. After surgery, 32 (38%) participants became MHO individuals and 53 (62%) participants remained MUO individuals. The mean age of the MHO and MUO individuals was 33.4±10.8 years and 42.2±12.3 years, respectively. Preoperative total skeletal muscle SMD, LAM index, and IMAT index significantly differ between MHO and MUO individuals after bariatric surgery.

**Conclusion:** The quantity of total skeletal muscle at the L3 level did not differ between MHO and MUO individuals. The quality of total skeletal muscle at the L3 level significantly differs between MHO and MUO individuals.

## PE333 Others (clinical)

**T2DM and central obesity**

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Endomed Hospital, Mongolia

**Objective:** Type 2 diabetes is strongly related to overweight and obesity. Central obesity (intra-abdominal) is observed in the majority of patients with type 2 diabetes (T2DM). The aim of study was to evaluate the central obesity of T2DM inpatients.

**Methods:** Cross sectional study included 131 patients (male 76/58%, female 55/42%) with T2DM admitted in hospital. Physical examination (height, weight, waist circumference and blood pressure), blood glucose and HbA1c were determined. Body composition (body mass index, body fat, body muscle and body age) was measured by Mi model. Central obesity was determined by Asian and European criteria of waist circumference.

**Results:** T2DM patients' mean age was 48.5±12.1 years old, body weight 84.5±15.3 kg, height 166.9±9.2 cm, body mass index (BMI) 31.1±9.7 kg/m<sup>2</sup>, body fat (BF) 39.3±12.1%, body muscle (BM) 41.1±14.9%, body age 58.6±13.0 years old, visceral fat (VF) 12.1±3.6%, metabolic rate (MR) 1694±292.2 kcal, fasting blood glucose (FBG) 12.11±4.0 mmol/l and mean HbA1C was 9.8±2.4%, respectively. Female T2DM patients' mean age was 47.8±12.5 years old, body weight 77.6±13.3kg, height 160.3±6.9 cm, BMI 26.64±6.0 kg/m<sup>2</sup>, BF 35.2±11.2%, BM 32.2±12.7%, body age 60.5±13.1 years old, VF 9.6±2.1%, MR 1483±494.2 kcal, FBG 8.08±3.4 mmol/l and mean HbA1C was ±%. Among T2DM patients: males with WC <94cm was 9.3%, 95-102 cm 31.5% and >102cm 59.3%, females with WC <80cm was 20%, 81-88 cm 0% and >88cm 80%, respectively.

**Conclusion:** Among T2DM patients central obesity was determined 94% in male and 80% in female by Asian criteria, but 59.3% in male and 80% in female by European criteria.

## PE336 Others (clinical)

**Comparative study of diabetes risk factors in Mongolian adults between 1999 and 2019, focusing on central obesity and hypertension**

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Mongolian National University of Medical Sciences, Mongolia

**Objective:** To compare diabetes risk factors in Mongolian adults from 1999 to 2019, the study focused on central obesity and hypertension within the same clusters from Mongolian regions.

**Methods:** Data collection in 2019 involved recruiting 3,113 participants from randomly selected six different regions. A comparative analysis was conducted to identify changes in diabetes risk factors, with a particular emphasis on central obesity and hypertension. Additionally, the prevalence of impaired glucose tolerance (IGT) was examined across regions. Central obesity was defined based on the waist-to-hip ratio (WHR) criteria used in 1999.

**Results:** In 1999, the crude prevalence of diabetes was 2.9%, with IGT at 10.2%. After age adjustment, the prevalence was 3.1% for diabetes and 9.2% for IGT. Notably, in 2019, diabetes had tripled compared to 1999 in Mongolia. The crude prevalence rates of 10.8% for prediabetes and 11.2% of diabetes. When age-standardized, the rates were 9.8% for prediabetes and 10.0% of diabetes. When comparing the WHR and systolic blood pressure (SBP) in 1999 and 2019, both significantly increased across normal, impaired glucose tolerance, and diabetes in men (WHR of 0.90, 0.91, and 0.96 and SBP of 131.9, 140.6, and 142.6 mmHg in 1999; WHR of 0.91, 0.94, and 0.96 and SBP of 128.6, 132.7, and 137.9 mmHg in 2019) and women (WHR of 0.87, 0.90, and 0.92 and SBP of 129.1, 132.7, and 143.3 mmHg in 1999; WHR of 0.88, 0.89, and 0.92 and SBP of 120.3, 126.4, and 129.0 mmHg in 2019). These values were also identified as significant risk factors in the regression analysis ( $p < 0.001$ ).

**Conclusion:** The study shows a tripling of diabetes prevalence among Mongolian adults between 1999 and 2019, with central obesity and hypertension identified as significant risk factors, emphasizing the need for targeted interventions.

## PE337 Others (clinical)

**Study prevalence of obesity in hypertention people**Nomundari Usukhbayar<sup>1\*</sup>, Davaakhuu Vandannyam<sup>2</sup>Central Hospital of MNUMS, Mongolia<sup>1</sup>, School of Nursing, MNUMS, Mongolia<sup>2</sup>

**Objective:** The purpose of the research is to compare prevalence of obesity in hypertention male and female people

**Methods:** Our study was approved by the Research Ethics Committee in Mongolian national university of medical science. All study subjects understood the purpose of this survey and signed informed consent forms. The cross-sectional study was an investigation of the prevalence of obesity among Uvs aimags' 200 hypertension people. Weight and height measurements were taken during the assessment. Waist circumference was measured as per WHO guidelines. Body fat percentages and visceral obesity were measured with Karada Scan 356 Scale (Karada Scan 356, Japan).

**Results:** Hypertention were divided into two groups (female and male only) and compared for normal BMI (42.1% and 36.4%), overweight (39.7% and 43.9%), obese (18.2% and 19.7%) ( $p = 0.2$ ); normal central obesity (39.4% and 34.5%), central obesity  $\geq 80$  (60.6% and 65.5%) ( $p = 0.2$ ); normal body fat percentage (29.2% and 16.1%), elevated body fat percentage (70.8% and 73.9%) ( $p = 0.4$ ); normal visceral obesity (65.9.2% and 63.3%) and elevated visceral obesity (34.1% and 36.7%) ( $p = 0.5$ ). We found indicators higher for obesity in hypertention female, though they were not statistically significantly different.

**Conclusion:** Obesity among female and male only two groups with high blood pressure is prevalence of same

## PE338 Others (clinical)

**Type 2 diabetes mellitus and biological age**

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Endomed Hospital, Mongolia

**Objective:** Studies have revealed a biological age different to the chronological age (printed on passport). Some people's age much faster than others and aging advances at different rates according to factors like health, fitness, diet and life style. The aim of study was to compare chronological and biological age of type 2 diabetic (T2DM) patients.

**Methods:** Cross sectional study included 131 patients: 76(58%) males and 55(42%) females with T2DM, admitted in hospital. Physical examination, blood glucose and HbA1C were determined. Body composition (body mass index, body fat, body muscle, body age and visceral fat) was measured by Xiaomi-XMTZC05.

**Results:** T2DM patients' mean age was  $48.5 \pm 12.1$  years old, body weight  $84.5 \pm 15.3$ kg, height  $166.9 \pm 9.2$  cm, body mass index (BMI)  $31.1 \pm 9.7$  kg/m<sup>2</sup>, body fat (BF)  $39.3 \pm 12.1\%$ , body muscle (BM)  $41.1 \pm 14.9\%$ , body age  $58.6 \pm 13.0$  years old, visceral fat (VF)  $12.1 \pm 3.6\%$ , metabolic rate (MR)  $1694 \pm 292.2$  kcal, fasting blood glucose (FBG)  $12.11 \pm 4.0$  mmol/l and mean HbA1C was  $9.8 \pm 2.4\%$ , respectively. Mean body age and mean passport age were different ( $58.6 \pm 13.0$  years old vs  $48.5 \pm 12.1$  years old;  $p < 0.001$ ) in T2DM patients.

**Conclusion:** Biological age is much older than chronological age in T2DM patients.

## PE340 Others (clinical)

**Prevalence of arterial hypertension among Mongolian nurses**Zoljargal Avirmed<sup>1\*</sup>, Davaakhuu Vandannyam<sup>2</sup>4th Hospital, Mongolia<sup>1</sup>, School of Nursing, MNUMS, Mongolia<sup>2</sup>

**Objective:** This study aims to survey the prevalence of hypertension (HTN) among nurses.

**Methods:** Data was collected from 528 nurses of 23 hospitals in Ulaanbaatar (UB) and local hospitals in other regions. We randomly selected day-shift only nurses (264) and shift nurses (264), Blood pressure (BP) was measured three consecutive times (OMRON Model HEM 7111; Omron Company, China), and the mean value was used in the analysis. BP was measured after a minimum of five minutes rest in the sitting position, recommended by the Mongolian HTN guideline and standard. Data processed with SPSS 20.0 statistic software

**Results:** Participants' mean age was  $39.6 \pm 0.42$  years, with 38.8% of participants between the ages of 40 to 49. HTN 1 st stage and 2 nd stage was statistically shown to be regionally influenced, with 20.4% detected in the central region, 25.4% in the Khangai region, 22.4% in the western region, 37.5% in the eastern region, and 15.3% in UB ( $p < 0.022$ ). When nurses were divided by department, stage and 2 nd stage arterial HTN 1 st was at a total of 20.4% for those in surgery, 19.0% in intensive care, 20.2% in internal medicine, 30.8% in neurology, 35.7% in traditional care, 19.7% in infant care, 20.7% in communicable disease care, 23.7% in pediatrics, 10.0% in oncology, and 12.5% in maternity. Arterial HTN was not statistically significant for a particular clinical department ( $p < 0.36$ ). Comparing day-shift only nurses and shift-work nurses, arterial HTN was detected as normal for 72.3% and 59.1%, increased for 14.4% and 16.7%, 1 st stage for 12.1% and 19.7%, 2 nd stage for 1.2% and 4.5% for each group, respectively ( $p < 0.03$ ). Shift nurses have higher occurrences of arterial HTN than day-shift only nurses ( $p < 0.03$ ).

**Conclusion:** 24.2% of shift working nurses have HTN is showed that higher than day time working nurses.  $p < 0.0001$ .

## PE341 Others (clinical)

**Detection of peripheral artery disease in citizens aged 50-69 years and determining the prevalence of risk factors**

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Mongolian National University of Medical School, Mongolia

**Objective:** Detection of peripheral artery disease in citizens aged 50-69 years and determining the prevalence of risk factors

**Methods:** The survey included 286 people aged 50-69 from the Mongolia's Övörkhangaï province and collected data in 2020. The study to detect peripheral artery disease (PAD) and determine the distribution of risk factors was carried out using a quantitative research method using a cross-sectional model. In the study, 10 general information questionnaires, 6 questionnaires for determining risk factors, 5 questionnaires for detecting the The Edinburgh Claudication Questionnaire and measured ankle brachial index (ABI) were used in the study. Statistical processing of the research work was done with Stata 12.0 software.

**Results:** A total of 286 people were included in the study. 58% (166) of the respondents were male and 42% (120) were female. 40.9% of the study participants had abnormal ABI (<0.9 less) with PAD, of which 66.7% were smokers, 26.5% had diabetes, and 18.5% were obese. The ABI difference between smokers and non-smokers were statistically significant ( $P=0.0001$ ). 31.7% of people with Among all participants, 31.7% of females and 47.6% of males were measured with abnormal ABI (<0.9) which shows they have got PAD. Smoking increases the risk of developing PAD (OR=3.36). Diabetes increases the risk of developing PAD (OR=3.36). Obesity increases the risk of PAD (OR=1.53). Moreover, among participants diagnosed with PAD

**Conclusion:** Among participants, 40.9% of them had abnormal ankle brachial index (ABI) which means they have PAD and 66.7% of them were smokers and 33.3% of them were non-smokers. The ABI difference between smokers and non-smokers were statistically significant ( $p=0.0001$ ). Smoking increases the risk of PAD by OR=3.36 times, and diabetes increases the risk of PAD by 1.94 times. Males have a higher risk of PAD than females ( $p=0.007$ ). 20.5% of participants with abnormal SBI had leg pain (intermittent claudication) during PAD.

## PE344 Others (clinical)

**Thyroid hormone alterations in COVID-19 patients: implications for disease severity and diabetes-related associations**

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Mongolian National University of Medical Sciences, Mongolia<sup>1</sup>,  
First Central Hospital, Mongolia<sup>2</sup>

**Objective:** This study aimed to investigate non-thyroid hormone alterations in COVID-19 patients, specifically focusing on individuals with diabetes, and explore their implications for disease severity.

**Methods:** The study was conducted at the First State Central Hospital and the National Center for Infectious Diseases, with a total of 116 patients enrolled. After applying exclusion criteria (anti-TPO, anti-TG, and TSHR-ab positive, and others), 26 participants were excluded, leaving 90 patients for analysis.

**Results:** The mean age of the participants was  $56.8 \pm 15.9$ , with 20.0% ( $n=18$ ) being male. Among the patients, 7.8% had severe COVID-19. Thyroid hormone changes were observed in 46.6% of all patients. Specifically, 31.1% ( $n=28$ ) had decreased TSH levels, while 14.4% ( $n=13$ ) had increased TSH levels. Among those with mild COVID-19 infection, 51.7% ( $n=15$ ) exhibited changes in TSH levels (37.9% decreased, 13.8% increased), whereas 100% ( $n=7$ ) of severe cases showed changes in TSH levels. Notably, 83.3% of individuals with severe COVID-19 had decreased TSH levels, while 16.7% had increased TSH levels ( $p=0.017$ ). The study found a significant difference in TSH levels across different COVID-19 severity groups, suggesting that decreased TSH levels may serve as a potential predictor of severe COVID-19 ( $p<0.05$ ). Moreover, the findings highlight the intricate relationship between COVID-19 severity, TSH levels, and the presence of diabetes ( $p<0.05$ ).

**Conclusion:** The study reveals that thyroid abnormalities affected 46.6% of COVID-19 patients, with a prominent association being changes in TSH levels. Particularly, decreased TSH levels may be linked to higher COVID-19 severity, especially in individuals with diabetes. These findings emphasize the importance of considering thyroid hormone alterations and diabetes status in understanding the severity of COVID-19.

## PE342 Others (clinical)

**Relationship of cycling exercise with decreasing blood sugar levels in patients with diabetes mellitus**

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Binawan University, Indonesia

**Objective:** To identification Relationship Of Cycling Exercise With Decreasing Blood Sugar Levels In Patients With Diabetes Mellitus

**Methods:** This study used an experimental study method pretest and posttest. This research was conducted on research subjects selected through the sampling method, in a one group pretest-posttest design, the sample group will be examined for their blood sugar levels on the first day before cycling and on the 6th day after cycling, namely the post-test.

**Results:** The results of this study were tested through data processing in the form of using the Paired sample T-test and Spearman's rank correlation to determine the relationship between blood sugar levels and cycling practice. The percentage of participants who experienced an increase in blood sugar after cycling exercise was 72.7% (8 participants). Meanwhile, the percentage of participants who experienced an increase was 27.3% (3 participants). the average results of measuring blood sugar levels in diabetics from 11 participants showed a decrease in blood sugar levels of 73,364 mg/dl with an average before cycling exercise was 261.73 mg/dl, and an average after cycling exercise was 188,165 mg/dl.

**Conclusion:** it can be concluded that there is an effect of cycling exercise on reducing blood sugar levels in patients with diabetes mellitus. Cycling exercise was carried out for 6 days for people with diabetes mellitus to measure the relationship between blood sugar levels and this activity. The data generated in this study, that 8 out of 11 participants experienced a decrease in blood sugar levels after doing cycling exercise. Through the paired sample t test, it shows that there is a relationship between cycling exercise and decreased blood sugar in people with diabetes mellitus.

## PE346 Others (clinical)

**Research cardiometabolic comorbidity and noncommunicable disease risk in a central obesity population**

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**Objective:** To analyze the association between central obesity and cardiometabolic diseases or cardiometabolic comorbidity in residents aged 35-65 years in Darkhan-Uul province autonomous region.

**Methods:** Residents aged 35-65 years recruited for "Early Screening and Comprehensive Intervention in Population at High Risk for Cardiovascular Diseases in Darkhan-Uul province from May 2022 to June 2023 were selected for the study. Statistical analysis was performed using software SPSS 25.0 and GraphPad Prism 5, mainly statistical description,  $\chi^2$  test and Logistic regression analysis, to understand the impact of central obesity on cardiometabolic diseases /hypertension, diabetes, dyslipidemia/ and cardiometabolic comorbidity.

**Results:** The prevalence rate of central The prevalence rate of central obesity was 64.5% and the standardized rate was 64.8% in residents aged 35-65 years in Darkhan-Uul province. The proportions of persons with 0, 1, 2 and 3 cardiometabolic diseases were 27.6%, 4.0%, 22.3% and 6.2%, respectively. The results of Logistic regression analysis showed that the risk for hypertension, diabetes, dyslipidemia and cardiometabolic comorbidity were 1.773 times and 3.061 times, 1.676 times and 2.564 times, 2.212 times and 3.212 times, 2.126 times and 4.319 times higher in people with mild central obesity and than in those without central obesity (all  $P<0.001$ ).

**Conclusion:** Central obesity is a serious health problem in Darkhan-Uul province, and it is a risk factor for cardiometabolic diseases or cardiometabolic comorbidity. Therefore, we should strengthen the early screening of central obesity and conduct intervention.

## PE347 Others (clinical)

**Handgrip strength and mini-mental state examination scores: a study from the montimeline study**

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**Objective:** Examine the relationship between Handgrip Strength (HGS) and Mini-Mental State Examination (MMSE) scores, with a specific emphasis on gender-based differences.

**Methods:** The present study draws on data from the Montimeline cohort (n=389), a prospective, multidisciplinary, population-based cohort study in Mongolia. Handgrip strength was assessed using a digital grip strength dynamometer (TKK 5401 GRIP D; Takei, Japan). Cognitive function was evaluated using the Mini-Mental State Examination (MMSE).

**Results:** The mean age of participants was 57.4±4.7 years, with males comprising 26.5% of the study. Among the male participants, those with MMSE scores above 25 exhibited a HGS of 37.6±7.6, while individuals with MMSE scores below 25 displayed an average HGS of 33.4±8.2 (p<0.001). However, no statistically significant differences in MMSE-associated HGS were noted among the female participants. Further investigation revealed that males with lower handgrip strength had a mean MMSE score of 24.5±4.14, compared to 26.0±3.23 in those with relatively normal handgrip strength (p=0.008). However, this correlation was not statistically significant among females. Correlation analysis underscored a substantial relationship between handgrip strength and MMSE scores for both genders, yielding correlation coefficients of 0.255 for males and 0.122 for females (p<0.001). However, when adjusting for education, the association between HGS and MMSE scores did not maintain statistical significance in females. Conversely, in males, the association remained statistically significant even after adjustments were made for both educational levels and Body Mass Index.

**Conclusion:** The study unveiled a significant association between HGS and MMSE scores in males, while this correlation was not apparent among females. Given the relatively youthful age of the participants, there arises a compelling imperative to extend this inquiry to older populations, examining potential gender-specific variations in the relationship between HGS and cognitive function.

## PE348 Others (clinical)

**Assessing the impact of meat consumption on 24-hour urinary creatinine levels among Mongolian adults**

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**Objective:** This study seeks to explore the potential implications of excessive meat consumption on the 24-hour urinary creatinine levels of Mongolian adults, investigating the relationship between daily meat intake and kidney health.

**Methods:** A total of 94 participants were recruited from individuals who enrolled in the preventive screening campaign at the University Hospital of Mongolian National University of Medical Sciences (MNUMS). Dietary habits, including meat consumption, were assessed using a dietary questionnaire and a 24-hour dietary recall. Urinary creatinine levels were assessed in accordance with the guidelines established by the WHO and the KDIGO. These guidelines stipulate a range of 20–320 mg/dL for men and 20–250 mg/dL for women. The measurements were obtained from a 24-hour collected urine sample.

**Results:** Among the participants, 61.7% were male, with an average age of 38±8.2 years. The average daily consumption of red meat is 254.3±128.25 g or 6.25±3.2 units. When categorized by gender, women consume an average of 5.63±2.54 units, while men consume an average of 6.64±3.51 units, indicating an excess of 40% over the recommended amount for the Mongolian population. The mean 24-hour urinary creatinine levels were 138.65±56.69 mg/dL in men and 98.5±56.24 mg/dL in women. A positive relationship was observed between meat consumption and urinary creatinine excretion (r=0.486, p=0.007). Within the study participants, a small percentage showed elevated 24-hour urinary creatinine levels (1.7% in men and 2.8% in women). When comparing the groups based on elevated and non-elevated urine creatinine, it became evident that individuals with elevated creatinine levels had higher meat consumption compared to those with normal 24-hour urinary creatinine levels (r=0.486, p=0.007).

**Conclusion:** The connection between higher meat intake, increased urinary creatinine, and potential kidney risks requires swift action to promote healthier eating habits among Mongolians, safeguarding their well-being.

## PE349 Others (clinical)

**Investigating fruit and vegetable consumption among university students in Mongolia and its correlation with body mass index**

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**Objective:** The aim of this study is to assess the consumption patterns of fruits and vegetables among students and subsequently establish any existing links with variations in body weight.

**Methods:** In this cross-sectional study, a sample of 943 university students from the five largest Mongolian universities took part in the student health study (total participants: 1123), having completed a dietary questionnaire. The survey was conducted via a Google Form, incorporating a series of questions drawn from the World Health Organization's toolkit for assessing noncommunicable disease risks. To calculate participants' body mass indices, self-reported measurements of body weight and height were utilized.

**Results:** The participants' mean age was 20.6±2.35 years, with 84.9% (n=953) being female. The largest portion of the sample consisted of freshman students (24.8%), and a notable majority (81.8%) were associated with the medical university. The mean body mass index (BMI) was at 22.02±3.51 kg/m<sup>2</sup>. Regarding self-reported fruit consumption patterns, 6.2% of participants reported never consuming fruits, 33% rarely did so, 40.4% indicated occasional fruit consumption, 15.4% included fruits in their diet often, and 4.8% consistently incorporated fruits. Likewise, analysis of vegetable consumption revealed percentages of [2.9%, 14.4%, 30.5%, 29.7%, and 22.3%] for the respective consumption categories. When investigating consumption across academic years, senior students exhibited the highest combined intake of fruits and vegetables at 12.2%, whereas first-year students showed the lowest intake at 8.3%. Upon examining the correlation between fruit and vegetable consumption and BMI, the study identified that lower vegetable consumption (r=-0.134, p=0.044) was associated with higher BMI, while the relationship between fruit consumption (r=-0.089, p=0.083) and BMI did not reach statistical significance.

**Conclusion:** Students exhibit lower consumption of fruits and vegetables; notably, the negative correlation between vegetable intake and BMI highlights the potential benefits of including more vegetables in their diet to support healthy body weight.

## PE350 Others (clinical)

**Wolfram syndrome: case report**

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**Introduction:** Wolfram syndrome or DIDMOAD (diabetes insipidus, diabetes mellitus, optic atrophy, and deafness) is a rare autosomal-recessive genetic disorder that causes childhood-onset diabetes mellitus, optic atrophy, and deafness as well as various other possible disorders including neurodegeneration.

**Case:** A 25-year-old female patient. The first symptom was typically diabetes mellitus. Type 1 diabetes mellitus was diagnosed in 2001 when she was 3 years old. Now her diabetes duration is 22 years. The next symptom is optic atrophy was diagnosed around the age of 7. Symptoms of dysfunction of the bladder began at age 9. Anosmia and ageusia started at age 16. Wolfram Syndrome was diagnosed in 2018 in Korea. Present status: Weight=61.9 kg, Height=164 cm, BMI=22.7 kg/m<sup>2</sup>, BF=32.5%, BM=39.2%, Body age=31 years old, VF=5%, WC=74 cm, BP=96/77 mmHg, HR=110, SpO<sub>2</sub>=95%. She has symptoms of optic neuropathy (blindness), anosmia (loss of sense to smell), ageusia (loss of sense to taste), hearing loss, and neuromuscular dysfunction of the bladder with urinary catheterization. Due to blindness, the patient experiences challenges in managing her diabetes and insulin dosage. The diagnosis is a WOLFRAM SYNDROME (Diabetes Insipidus +/-, Diabetes Mellitus+/, Optic atrophy +/-, Deafness+/-). DM type 1 with moderate control. Severe optic nerve atrophy. Severe neuromuscular dysfunction of the bladder. Moderate sensorineural hearing loss. Current treatment efforts focus on managing the complications of Wolfram syndrome, such as diabetes mellitus and other neurological symptoms, and the care of family members.

**Conclusions:** The prognosis for individuals with Wolfram syndrome is poor, with a life expectancy of approximately 30 years. Therefore, ongoing research is being conducted to evaluate several potential drugs and small molecules that could reduce endoplasmic reticulum stress in Wolfram Syndrome and slow the progression of the disease.

## PE351 Others (clinical)

**Differences in Red cell Distribution Width (RDW) between subjects with Type 2 Diabetes Mellitus (T2DM) and subjects without T2DM: a systematic review and meta-analysis**W. Riski Widya Mulyani<sup>1</sup>\*, I Gede Gita Sastrawan<sup>2</sup>,Ni Komang Vina Indriyani<sup>1</sup>, Made Lady Adelaida Purwanta<sup>3</sup>Negara General Hospital, Indonesia<sup>1</sup>, Uptd Pekutatan Health Center (Public Health Center), Indonesia<sup>2</sup>, Wangaya Hospital, Indonesia<sup>3</sup>

**Objective:** It is important to evaluate the characteristics of red blood cells (RBC) in patients with type 2 diabetes mellitus (T2DM) because the disease can cause a decrease in the diameter of the capillaries leading to significant vascular occlusion. Red cell distribution width (RDW), a routine component of complete blood count, shows a measure of variation in RBC volume. This study is the first meta-analysis study that aims to compare RDW between T2DM and non-T2DM subjects.

**Methods:** We conducted a systematic literature search based on PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analyses) on four online databases to search for comparative studies of RDW between T2DM and non-T2DM subject groups published in 2013–2023. Each study must provide data on the mean RDW in both groups. The quality assessment of each study used the Newcastle Ottawa Scale.

**Results:** Nine cross-sectional studies from various countries with a total of 13,125 participants met the criteria for meta-analysis. Random effects model analysis showed a higher RDW in the group with T2DM compared to the group without T2DM (pooled mean difference (MD) 0.46%; 95% CI 0.21–0.70%,  $p=0.0003$ ; Heterogeneity  $I^2=93%$ ,  $p<0.0001$ )

**Conclusion:** Higher RDW has a significant relationship with the incidence of T2DM. The limitation of this study is the high heterogeneity which may be due to the limited availability of longitudinal studies, so the analysis was carried out on cross-sectional studies. In addition, the differences in population and race from various countries may also have an effect. Therefore in the future, more studies with longitudinal designs are important to be done.

## PE352 Others (clinical)

**Machine learning-driven identification of plasma biomarkers for sarcopenia in the elderly**Yunju Jo<sup>1</sup>\*, Juewon Kim<sup>2</sup>, Heewon Jung<sup>3</sup>, Donghyun Cho<sup>2</sup>,Seungyoon Nam<sup>4</sup>, Beom-Jun Kim<sup>3</sup>, Dongryeol Ryu<sup>1</sup>GIST, Korea<sup>1</sup>, Amore Pacific, Korea<sup>2</sup>, Asan Medical Center, University of Ulsan, College of Medicine, Korea<sup>3</sup>, Gachon University, Korea<sup>4</sup>

**Objective:** The increasing global aging population has led to a higher incidence of sarcopenia, which has recently gained recognition with an official disease code. The multifaceted interplay of genetic and environmental factors complicates the diagnosis of sarcopenia, resulting in varying diagnostic criteria across regions and an absence of a standardized universal approach. Furthermore, the evaluation of muscle mass relies on expensive modalities such as DEXA, MRI, and CT, often inaccessible in local health-care settings. In response to these challenges, we introduce a novel diagnostic index that holds the potential to address these limitations effectively.

**Methods:** We have identified common genes using a machine learning algorithm to distinguish between sarcopenic and non-sarcopenic individuals, as well as muscle aging status.

**Results:** This genetic marker showed significant differences in expression levels between the two groups in transcriptome analyses. In addition, we revealed significant differences in protein levels, and this gene exhibited strong correlations with factors associated with sarcopenia through ELISA assays on blood samples from both sarcopenic and non-sarcopenic individuals. When compared to current indices, the diagnostic index we presented performed better in predicting the sarcopenia group. Mendelian Randomization analysis using phenotype data from the UK Biobank demonstrated a causality between sarcopenia and this gene. We also conducted cross-species experiments with mice and nematodes. In aged mouse, this gene's blood protein levels were consistently elevated, as in human. In nematode, those with lower levels of gene expression lived longer. Furthermore, RNA interference targeting this gene enhanced performance in various assays, including speed, bending, and burrowing.

**Conclusion:** Taken together, our comprehensive research shows the importance of this genetic marker in distinguishing and understanding sarcopenic individuals, muscle aging, and the potential implications for promoting healthy aging across diverse species.

## PE353 Others (clinical)

**Machine learning using time series analysis better predict future diabetes**Myungsoo Im<sup>1</sup>\*, Kyeongjun Lee<sup>2</sup>, Soree Ryang<sup>1</sup>, Doohwa Kim<sup>1</sup>,Sohyeon Jeon<sup>1</sup>, Hye Jung Je<sup>1</sup>, Hyo Eun Kwak<sup>1</sup>, Eun Hye Jung<sup>1</sup>,Yeong Jin Kim<sup>2</sup>, Joon Ha<sup>3</sup>, Jinmi Kim<sup>1</sup>, Sang Soo Kim<sup>1</sup>Pusan National University Hospital, Korea<sup>1</sup>, Kumoh National Institute of Technology, Korea<sup>2</sup>, Howard University, United States<sup>3</sup>

**Objective:** Due to the nature of the disease caused by complex pathophysiology, it is difficult to predict future diabetes only with single point measurement of clinical parameter and anthropometrics. Using deep learning technology based on time series data, we investigated to create a model that predicts future diabetes more accurately than conventional machine learning.

**Methods:** This study was based on the Korean Genome Epidemiology study cohort (KoGES) Ansan-Ansung Study, a population-based, epidemiology study. Among 10,030 participants from KoGES at baseline, we identified patients who were normal glucose tolerance (NGT) or prediabetes at baseline and followed biennially up to 16 years. To verify the results of the prediction model, we compared the accuracy with the existing machine learning methods, XGBoost, LightGBM, CatBoost and Stacking. The Long Short Term Memory (LSTM), GRU (Gated Recurrent Unit) and Recurrent Neural Network were (RNN) models were designed to predict future diabetes with time series data.

**Results:** When LSTM, GRU and RNN model was applied independently, it showed similar performance to the existing model (XGBoost, LightGBM, CatBoost and Stacking). This was because KoGES data did not have enough repetitive measurements to improve the performance of the time series data model. However, When the three combined models (LSTM+GRU+RNN) were applied at the same time, they showed superior performance improvement over the previous model. Their performance diminished as the number of repeated measurements of the variable decreased.

**Conclusion:** Even basic clinical and anthropometric measurements have helped predict future diabetes more accurately with modeling techniques using repeatedly measured parameters rather than single measurement.

## PE355 Others (clinical)

**Exploring age- and gender-specific characteristics of diabetes among young adults in Korea: the Korea national health and nutrition examination survey 2019-2020**Chae Won Chung<sup>\*</sup>, Jaetaek Kim

College of Medicine, Chung-Ang University, Korea

**Objective:** The escalating global incidence of diabetes among young adults could be linked to dynamic socio-environmental changes including pandemic and climate shifts. In this investigation, we aimed to discern the distinct features of diabetes among young adults in Korea.

**Methods:** This cross-sectional study included 2,943 Korean young adults (1,378 male, 1,565 female) aged 20–39 years who participated in the Korean National Health and Nutrition Examination Survey 2020–2021. Diabetes cases were identified through hospital diagnoses or the prescription of insulin or non-insulinemic anti-diabetic medications. Complex sampling design and cross-tabulation analyses were used to examine both socioeconomic and laboratory factors.

**Results:** The prevalence of diabetes among young adults was  $2.5\pm 0.3%$ , with males constituting 68.6% and females 31.4% of this population. Males with diabetes exhibited elevated values across various parameters, including body mass index (BMI), HOMA-IR, HbA1c, and triglyceride ( $30.2\pm 4.2$  kg/m<sup>2</sup> vs.  $26.9\pm 5.2$  kg/m<sup>2</sup>;  $9.6\pm 9.4$  vs.  $8.0\pm 6.8$ ;  $8.5\pm 2.3%$  vs.  $7.0\pm 1.4%$ ;  $275\pm 185$  mg/dl vs.  $134\pm 67$  mg/dl, all  $p<0.001$ ). Moreover, a higher prevalence of obesity (100% vs. 67.1%,  $p=0.016$ ) and abdominal obesity (93.2% vs. 47.2%,  $p=0.019$ ) was noted among diabetic males. While the proportion of morbid obesity was comparatively lower (24.2% vs. 11.3%,  $p=0.011$ ), females demonstrated more pronounced engagement in regular anaerobic (12.3% vs. 59.2%,  $p=0.003$ ) and aerobic exercise (27.5% vs. 63.3%,  $p=0.035$ ) than male counterparts. However, the prevalence of diabetic retinopathy was higher among women (0% vs. 6.6%,  $p=0.004$ ). Other factors including income, marital status, smoking, alcohol, working hours, and the prevalence of hypertension and depression presented no significant gender-based disparities.

**Conclusion:** In the context of pandemic era, young adult women in Korea exhibited heightened level of physical activity and reduced insulin resistance, albeit with an elevated risk of diabetic retinopathy, compared to their male counterparts. The relationship between gender and the manifestation of diabetic complications necessitates further investigation within a meticulously structured cohort study.

## PE359 Diabetes education case

**Medical nutrition therapy for the management of cellulitis with diabetes mellitus, chronic kidney disease and hypertension**

Mohd Ramadan Ab Hamid\*, Nur Hidayah Ghazali  
Universiti Teknologi Mara, Malaysia

Cellulitis is a bacterial infection affecting the skin and underlying tissues, particularly the dermis and subcutaneous tissues. The presence of comorbidities associated with diabetes mellitus may exacerbate the condition if blood glucose is poorly controlled. A 56-year-old Malay woman was admitted to hospital with sudden right lower limb swelling, redness and pain that caused her unable to walk. She had diabetes mellitus, hypertension and chronic kidney disease. She was underweight with a BMI of 16.4 kg/m<sup>2</sup>. She was on Actrapid 10U TDS and Insulatard 10U ON. Her blood glucose, urea and creatinine were elevated but protein and albumin were low. Her dietary intake in hospital was estimated at 780 kcal/day, 38 g protein and 82.5 g carbohydrate. The patient's recommended energy intake was 1600 kcal/day, 81 g protein/day and 50% of total energy requirement. The nutrition diagnosis was inadequate energy and protein intake related to decrease ability to consume orally due to loss of appetite, skipped meals and stress, as evidenced by lower energy and protein intake compared to requirements. Patient was educated about carbohydrates counting carbohydrates and protein-rich foods and was advised to include modular protein supplements in her diet. The diabetic, high protein, low salt diet was initiated at the hospital. After three weeks of intervention, blood glucose and albumin improved with values less than 9mmol/L for 2hour post-prandial, and albumin levels showed an increasing trend (from 7mmol/L to 15mmol/L) but remained below the normal range. The cellulitis recovered well. A diet high in protein and controlled carbohydrates is an effective therapy to prevent worsening of cellulitis, improve recovery and control diabetes mellitus. A low-salt diet also helps control blood pressure. If blood glucose levels are not satisfactory, several factors need to be considered, including imbalanced diet and stress.

## PE363 Diabetes education case

**The effect of the education method using the calculation of glucose and continuous blood glucose measurement on blood sugar in patients with type 1 diabetes**

Ji Youn Park\*  
Chung-Ang University Hospital, Korea

The goal of diabetes management is to manage blood sugar well and prevent complications, and effective customized education is very important in diabetes management. The patient was administering basal insulin and dietary insulin as a 21-year-old type 1 diabetes mellitus and visited the hospital with glycated hemoglobin 7.5%. As a university student living alone, She was eating irregular meals and eating out. Instead of reducing the amount of rice, they usually eat a lot of meat, but the CGM target range blood sugar ratio (TIR) was low at 46%, as they consumed bread, milk, and fruit as snacks. Knowing the actual amount of sugar consumed, they were educated to determine the amount of insulin required for meals by themselves using continuous blood glucose measurement. In addition, corrective insulin is administered during hyperglycemia to maintain the target range blood sugar ratio of 60% to 70%.

## PE364 Diabetes education case

**A case of glycemic control using the CGM in a pregnant type 2 diabetes patient**

Soeun Lee\*  
Chung-Ang University Hospital, Korea

Pregnant diabetics need strict glycemic control through diet control, lifestyle modification, and insulin therapy during pregnancy. CGM can help control glucose by reducing the number of needle-poking fingers, checking glucose fluctuations for 24 hours, and predicting glucose through real-time glucose checks and trend arrows. In this case, I educated pregnant type 2 diabetes patient to control glucose using CGM. This patient is a Pakistani woman who was diagnosed with type 2 diabetes 7 years ago and she first visited an outpatient clinic on August 17, 2022. She has been injecting 10 units of humulin N and 10 units of humulin R before breakfast and dinner. She didn't take any oral hypoglycemic agents. In the first blood glucose test, FBS was 268 mg/dl; PP2 was 486 mg/dl and HbA1c was 7.9%. She complained of frequent hypoglycemia. After the first medical treatment, it was changed to the MDI -Tresiba 14unit a day, Novorapid 6unit before every meal- and education on insulin multiple injections and hypoglycemia prevention was conducted. A week later, pregnancy was confirmed, basal insulin was changed from Tresiba to Levemir. I re-educated her glycemic targets (less than 95 mg/dl on fasting, less than 120 mg/dl on PP2) and glycemic control using the CGM (Libre). I educated to control prandial insulin dose by referring to ICR and ISF before meals, and educated to control the basal insulin dose by referring to the graph before breakfast from 5 hours after dinner. (ISF 52 mg/dl, ICR 15 g) After that, She visited the hospital every 2 to 4 weeks and was educated with the AGP report. I re-educated insulin titration according to changes in insulin demand. Results improved to HbA1c 7.5% TIR 60% on 9/29, HbA1c 6.5% TIR 78% on 11/9, HbA1c 6.3% TIR 81% on 3/28, She had a normal delivery on April 10, 2023.

## PE365 Diabetes education case

**Nutritional education using continuous glucose monitoring system in type 2 diabetes**

Meera Kweon<sup>1\*</sup>, Kisun Lee<sup>1</sup>, Jeonghyun Lim<sup>1</sup>, Sun Joon Moon<sup>2</sup>, Young Min Cho<sup>2</sup>  
Seoul National University Hospital, Korea<sup>1</sup>, Seoul National University, Korea<sup>1</sup>, Sungkyunkwan University, Korea<sup>2</sup>

Medical nutrition therapy plays an integral role in diabetes management. There is no "one-size-fits-all" eating pattern for those with diabetes, and meal planning should be individualized. For many people with diabetes, glucose monitoring is key for glycemic control. Continuous glucose monitoring (CGM) metrics are suggested to provide a personalized diabetes management plan. Use of CGM continues to expand in clinical practice. Integrating CGM results into diabetes management can be useful for guiding medical nutrition therapy and physical activity, preventing hypoglycemia, and adjusting medications. 63-year-old male with Type 2 Diabetes received Nutrition education using continuous glucose monitoring data by registered dietitian, certified diabetes educator. Blood samples were collected to measure FBS, HbA1c. After 3 months, weight and biochemical parameters were measured again. The patient's nutritional problems identified through continuous glucose monitoring data were ignorance of how to cope with hypoglycemia and high-carbohydrate-oriented simple meals, which result in high postprandial glucose level. he also experienced high glucose level after drinking folk remedies To improve nutritional problems, registered dietitian educated on how to cope with hypoglycemia and implemented medical nutrition therapy, encouraging healthy eating, including balanced diet. He was sufficiently motivated for diet management looking at CGM data. He changed his bad eating habit. He tried to keep healthy eating and cut down on folk remedies. As a result, this subject got an improved HbA1c level [8.4% (before) → 6.9% (3 month later)] without changing medications This case suggests that individualized nutritional intervention using CGM data by registered dietitian can have a positive influence on improvement of HbA1c and lifestyle modification

### PE366 Diabetes education case

#### Education for type 1 diabetes patients

Youngjin Choi\*

Kyung Hee University Hospital at Kangdong, Korea

I will present the educational case of a type 1 diabetic using an insulin pump.

### PE369 Diabetes education case

#### Strengthening diabetes care through general practitioner engagement: bridging the gap to diabetes technology

Satyaprakash Tiwari\*

Diabetes Singapore, Singapore

**Objective:** Diabetes Singapore recognizes that effective diabetes management necessitates collaboration within communities and with primary care providers. Acknowledging General Practitioners (GPs) as pivotal in patient care, the organization prioritizes enhancing their proficiency with diabetes technology. By partnering with medical device companies, Diabetes Singapore conducts informative sessions to empower GPs with knowledge about cutting-edge technologies, aiming to streamline patient journeys. Understanding GPs' central role in patient care, Diabetes Singapore aims to ensure their confidence in utilizing diabetes technologies like the libre system. To mitigate apprehension around device usage, the organization focuses on education and awareness, equipping GPs not only with device knowledge but also with the ability to guide patients effectively. Through collaborative talks and hands-on demonstrations, Diabetes Singapore provides GPs with firsthand experience and insights into diabetes technologies. This approach fosters a patient-centered care environment where GPs can recommend and employ these tools to enhance patient outcomes. By bridging the gap between innovation and practice, Diabetes Singapore envisions an informed and efficient diabetes management landscape. The impact of these efforts is two-fold: GPs become better prepared to educate and support patients in using diabetes technology, and patients receive personalized guidance in adopting these tools. This commitment to education enriches the patient-provider dialogue, transcending traditional boundaries. In conclusion, Diabetes Singapore's collaboration with medical device companies underscores the importance of GP engagement in the dynamic realm of diabetes technology. By fostering continuous learning and proactive adaptation, the organization equips GPs with crucial skills and elevates the quality of care for individuals with diabetes. This abstract demonstrates Diabetes Singapore's dedication to forging connections, enhancing diabetes education, and promoting empowered diabetes management through collaborative endeavors.

### PE368 Diabetes education case

#### Blood glucose level effect of diabetic carrot and cheese cake

Odontuya Chuluunbat\*, Sainbileg Sonomtseren

Endomed Hospital, Mongolia

**Objective:** The aim of the study was to compare diabetic carrot cake and cheesecake effect on blood glucose of diabetic patients.

**Methods:** Study included 34 diabetic patients who threaten the inpatient department of diabetic clinic. Breakfast included diabetic carrot cake and cheesecake, served separate days. Fasting and postprandial blood glucose was measured.

**Results:** About diabetic carrot cake, the mean fasting and postprandial blood glucose was  $8.87 \pm 0.46$  and  $10.52 \pm 0.65$  mmol/l. ( $p=0.001$ ) For the cheesecake, the mean fasting and postprandial blood glucose was  $9.07 \pm 0.49$  and  $9.61 \pm 0.48$  mmol/l. ( $p=0.044$ ) After eating carrot cake, blood glucose level increased by 1.644 mmol/l. But after eating cheesecake, blood glucose level increased by 0.816 mmol/l.

**Conclusion:** Cheesecake increases blood glucose of diabetic patients two times less than carrot cake.

### PE370 Diabetes education case

#### Cases of continuous blood glucose measurement use in patients with type 1 diabetes

Hana Choi\*

Bucheon Soonchunhyang University, Hospital, Korea

A 27-year-old man with no specific past history was hospitalized through the emergency room at DKA in 2017. At the time of admission, a1c 12.7 glyated Alb 61.3 c-peptide 0.77 was measured and type 2 diabetes was diagnosed. Subsequently, drug treatment was performed using metformin and sitagliptin, and the a1c score of 6 was maintained. In 2020, C-peptide 0.06 a1c 8.7 was measured, and hypoglycemia occurred intermittently in the early morning. The patient was re-diagnosed with type 1 diabetes and started using a continuous glucose monitoring system. TIR <60% was measured. Afterwards, while watching without using the CGM, We educated on the need for CGM and started using it in June 2021. In the case of type 1 diabetes, multiple self-monitoring of blood glucose is required, and early morning hypoglycemia or poor blood sugar control cannot be easily recognized. Patient was notified that CGM could compensate for these disadvantages, and He was instructed on how to use the CGM and precautions when using it at the moment when measurement was necessary. We continuously observed that patient using CGM. Starting with the first use of the continuous blood glucose meter in August 2021. And TIR was measured at 53%, and a1c 6.2 TIR 71% was high in August 23 with steady use of the continuous blood glucose meter. After using the CGM, the insulin dose was adjusted, and the hypoglycemia that occurred at dawn disappeared. Continuous use and education of type 1 diabetic patients is considered to be a case that showed good advantages in daily blood sugar management, and it is considered that continuous monitoring of the method of use and encouragement of continuous glucose monitoring is considered necessary for future blood sugar management.

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### Aims and Scope

The aims of the Diabetes & Metabolism Journal are to contribute to the cure of and education about diabetes mellitus, and the advancement of diabetology through the sharing of scientific information on the latest developments in diabetology among members of the Korean Diabetes Association and other international societies.

The Journal publishes articles on basic and clinical studies, focusing on areas such as metabolism, epidemiology, pathogenesis, complications, and treatments relevant to diabetes mellitus. It also publishes articles covering obesity and cardiovascular disease. Articles on translational research and timely issues including ubiquitous care or new technology in the management of diabetes and metabolic disorders are welcome. In addition, genome research, meta-analysis, and randomized controlled studies are welcome for publication.

The editorial board invites articles from international research or clinical study groups. Publication is determined by the editors and peer reviewers, who are experts in their specific fields of diabetology.

### General Information

The Diabetes & Metabolism Journal is the official journal of the Korean Diabetes Association. It is published bimonthly, with articles in English accepted through the process of peer review. The official title of the journal is 'Diabetes & Metabolism Journal' and the abbreviated title is 'Diabetes Metab J'. The journal was launched in 1972 and had been published under the title the Journal of the Korean Diabetes Association until 2007 (pISSN 1015-6461). From 2008 to 2010, its title was the Korean Diabetes Journal (pISSN 1976-9180, eISSN 2093-2650). Since 2011, volume 35, the title is now the Diabetes & Metabolism Journal. Index words from the medical subject headings (MeSH) list of Index Medicus are included in each article to facilitate article searches. The Journal is also published on the official website of the Diabetes & Metabolism Journal (<https://e-dmj.org/>) and is widely distributed to members of the Korean Diabetes Association, medical schools, libraries, and international institutions. Circulation number of print copies and electronic copies are 560 and 4,300 respectively. It is indexed in KoreaMed, KoMCI, KoreaMed Synapse, MEDLINE, PubMed, PubMed Central, SCOPUS, EMBASE, Ebsco, DOI/CrossRef, Google Scholar, and Science Citation Index Expanded (SCIE).

### Subscription information

Whole content is freely available from journal website. Printed copies are also distributed freely to members of Korean Diabetes Association. For the subscription of print copies, please contact Korean Diabetes Association.

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