DNSG

Diabetes and Nutrition Study Group

40th International Symposium on Diabetes and Nutrition

www.dnsg2023.com

15 – 18 JUNE 2023 | PULA, CROATIA

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SCIENTIFIC COMMITEE

Prof. Cyril WC Kendall, PhD.
Prof. Dr. John L Sievenpiper, MD, PhD, FRCPC
Prof. Dario Rahelic, MD, PhD, FACE, FACN, FRCP Edin.
Prof. Jordi Salas Salvadó, MD, PhD.
Prof. Hana Kahleova, M.D., Ph.D., M.B.A.
Prof. Dr. Charilaos Dimosthenopoulos, MedSci., PhD.

DNSG2023 is organised by:

DNSG – Diabetes Nutrition Study Group

Croatian Society for Diabetes and Metabolic Diseases of Croatian Medical Association

And co-organised by:

Department of Medical Sciences of the Croatian Academy of Sciencesand Arts

Under the patronage of:

Ministry of Health of the Republic of Croatia

WELCOME NOTE

Dear colleagues,
We would like to welcome You at the 40th International Symposium on Diabetes and Nutrition, organized by Diabetes and Nutrition Study Group (DNSG), due to be held in Pula, Croatia 15-18 June 2023.

Diabetes and Nutrition Study Group (DNSG) annual meeting will present the latest advances in nutrition and diabetes, stimulate scientific debate in this area of knowledge and bring together clinicians, dietitians and researchers. Every year the scientific program includes plenary sessions, panel discussions, debates, oral presentations and posters.

We hope you will have a nice time on the south of Istrian peninsula.
Welcome in Pula,

Sincerely,

The organizing program committee

Prof. Dario Rahelić, MD, PhD, FACE, FACN, FRCP Edin.
President of Croatian Society for Diabetes and Metabolic Diseases of Croatian Medical Association

Prof. Cyril W.C. Kendall, PhD.
Chairperson of Diabetes and Nutrition Study Group (DNSG)

PROGRAMME

Thursday June 15th, 2023

HALL ULIKA

10:00 – 14:00	**Registration**
13:00 – 13:15	**Welcome** Professor Dario Rahelić (President of Croatian Society of Diabetes and Metabolic Diseases of Croatian Medical Association)
13:15 – 14:00	**Session 1: Diet, nutrition and cardiometabolic health in Croatia** **Chairs: Dario Rahelić, (Croatia), Cyril Kendall (Canada), Sanja Klobučar (Croatia)**
13:15 – 13:30	Obesity in Croatia (Sanja Musić Milanović, Croatia)
13:30 – 13:45	Diabetes in Croatia (Dario Rahelić, Croatia)
13:45 – 14:00	Cardiovascular disease in Croatia (Davor Miličić, Croatia)
14:00 – 16:00	**Session 2: Nuts for the maintenance of normal blood glucose and reduction of diabetes risk: what are the opportunities and research needs for health claims substantiation?** **Chairs: Hana Kahleova (Czech Republic/USA), John Sievenpiper (Canada)**
14:00 – 14:20	Scientific substantiation of health claims in Europe: Established fasting and postprandial markers of blood glucose control and other research design considerations (Hans Verhagen, [former EFSA], Netherlands)
14:20 – 14:40	Nuts for control of fasting and postprandial blood glucose: Current evidence and research needs (Cyril Kendall, Canada)
14:40 – 15:00	Nuts for diabetes prevention: Current evidence and research needs (Jordi Salas-Salvado, Spain)
15:00 – 15:20	Lessons learned from the FDA approval of a health claim for nuts and coronary heart disease risk reduction (Joan Sabate, USA/Spain)
15:20 – 15:30	Premeal load of almonds in people with prediabetes for amelioration of glycemia and remission – (Anoop Misra, India)
15:30 – 15:40	The effect of adding protein to a carbohydrate meal on postprandial glycaemic responses: a systematic review and meta-analysis (SRMA) of acute controlled feeding trials – (Tom Wolever, Canada)
15:40 – 16:00	Panel discussion (All speakers)
16:00 – 16:30	**Coffee break (POSTERS)**

PROGRAMME

Thursday June 15th, 2023

HALL ULIKA

16:30 – 18:00	**Session 3: Meal replacements for diabetes prevention, management, and remission** **Chairs: Charilaos (Haris) Dimosthenopoulos (Greece), Ursula Schwab (Finland)**
16:30 – 16:50	Diabetes Specific nutrition formulas in the management of diabetes (Jeffrey Mechanick, USA)
16:50 – 17:10	Meal replacements high in monounsaturated fatty acids in stress induced hyperglycemia (Alejandro Sanz-París, Spain)
17:10 – 17:30	Meal replacements for diabetes remission: Lessons from DIRECT (Mike Lean, Scotland)
17:30 – 17:40	Weight loss induced by low caloric formula diets is associated with improvements of liver outcomes independent of formula diet type - Bettina Schuppelius (Germany)
17:40 – 18:00	Panel discussion (All speakers)
18:00 – 19:00	**Session 4: PLENARY LECTURE** **Chairs: Jordi Salas-Salvado (Spain), Maria Lankinen (Finland)**
18:00 – 19:00	Precision nutrition for diabetes: is it ready for prime time? (Frank Hu, USA)
19:30 – 23:00	**Presentations, Opening ceremony, Welcome drink, Dinner (Hotel)** **Chairs: Dario Rahelić, (Croatia), Jeffrey Mechanick (USA)**
19:30 – 19:45	Salt reduction program in Croatia (Bojan Jelaković, Professor of Medicine, University of Zagreb, School of Medicine, President of the Croatian Society for Hypertension of the Croatian Medical Association, Full Member of the Croatian Academy of Science and Art)
19:45 – 20:00	Evolution of education (Tatjana Milenković, Professor of Medicine, University of Skopje, President of the Diabetes Education Study Group - DESG)
20:00 – 20:15	The mission and vison of the IDF Europe (Nebojša Lalić, Professor, University of Belgrade, Dean of the School of Medicine, Full Member of the Serbian Academy of Science and Art, President of the International Diabetes Federation - IDF Europe)

Thursday June 15th, 2023

HALL ULIKA

Opening ceremony

Prof. Dario Rahelić, MD, PhD, FACE, FACN, FRCP Edin (President of Croatian Society of Diabetes and Metabolic Diseases of Croatian Medical Association)

Prof. Cyril W.C. Kendall, PhD (President of Diabetes and Nutrition Study Group)

Prof. Davor Miličić, MD, PhD, FESC, FAAC (Vice President of the Croatian Academy of Sciences and Arts)

Prof. Nebojša Lalić, Md, PhD, FRCP (President of the International Diabetes Federation Europe)

Marija Bubaš, MD, PhD, State Secretary of the Ministry of Health of Republic of Croatia

PROGRAMME

Friday June 16th, 2023

HALL ULIKA

08:00 – 9:00	**Session 5: PLENARY LECTURE** **Chairs: Jennie Brand Miller (Australia), Tom Wolever (Canada)** Carbohydrate quality and human health: Does glycemic index deserve a place at the table with whole grains and fibre? (David Jenkins, Canada)
09:00 – 10:30	**Session 6: Carbohydrate quality metrics for defining "healthy" foods: An opportunity for further harmonization?** **Chairs: Anne Raben (Denmark), Anne-Marie Aas (Norway)**
09:00 – 09:20	How important are sugars as a marker of carbohydrate quality? Lessons learned from the PREVIEW study (Jennie Brand-Miller, Australia)
09:20 – 09:40	Glycemic index and load and causal relations (Geoff Livesey, UK)
09:40 – 10:00	Can we integrate whole grains, fiber, and glycemic index and load in a single carbohydrate quality scoring system? (Simin Liu, USA)
10:00 – 10:10	Association between carbohydrate quality and gut microbiota in a Mediterranean population at high cardiovascular risk - Alessandro Atzeni (Spain)
10:10 – 10:30	Panel discussion (All speakers)
10:30 – 11:00	**Coffee break (Posters)**
11:00 – 13:00	**Session 7: Low calorie sweeteners in people with or at risk for diabetes: Reconciling the clinical, public health, and safety assessments** **Chairs: Dan Ramdath (PAHO/Canada),** **Per Bendix Jeppesen (Denmark)**
11:00 – 11:20	WHO draft guideline: Main takeaways (Tauseef Khan, Canada)
11:20 – 11:40	International guidelines on non-sugar sweeteners and health: Disentangling the sources of disagreement (John Sievenpiper, Canada)
11:40 – 12:00	Long term public health, safety, and sustainability implications in switching to non-sugar sweeteners: Updates from the SWEET project (Anne Raben, Denmark)
12:00 – 12:20	Safety of non-sugars sweeteners: Reconciling public health and safety assessments (Hans Verhagen, [former EFSA], Netherlands)
12:20 – 12:30	Displacing sugar-sweetened beverages with non-nutritive sweetened beverages or water: Per-protocol analysis of the Strategies To OPpose SUGARS with Non-nutritive sweeteners Or Water (STOP Sugars NOW) trial - Sabrina Ayoub-Charette (Canada)

Friday June 16th, 2023

HALL ULIKA

12:30 – 12:40	Glycemic response to meals with a high glycemic index differs between morning and evening: a randomized controlled trial among students with early or late chronotype – Anette Buyken (Germany)
12:40 – 13:00	Panel discussion (All speakers)
13:00 – 14:00	**Lunch**
14:00 – 15:30	**Session 8: Has the time come to recommend plant-based diets to all our patients with diabetes?** **Chairs: David Jenkins (Canada), Joan Sabate (USA/Spain)**
14:00 – 14:20	Plant-based diets for the management of type 2 diabetes (Neal Barnard, USA)
14:20 – 14:40	Plant-based diets for the management of type 1 diabetes (Hana Kahleova, Czech Republic/USA)
14:40 – 15:00	Healthy plant-based diet index and other plant-based dietary pattern scores for diabetes prevention and cardiovascular risk reduction (Andrea Glenn, USA/Canada)
15:00 – 15:10	Evaluating Plant Protein in US Diets using 3 cycles of NHANES (2013-2018): Considerations for protein quality and Nutritional Adequacy- Chris Marinangeli (Canada)
15:10 – 15:30	Panel discussion (All speakers)
15:30 – 16:00	**Coffee Break (Posters)**
16:00 – 17:30	**Session 9: Short Oral Abstracts** **Chairs: Vladimir Vuksan (Canada/Croatia), Mike Lean (UK), Anette Buyken (Germany)**
16:00 – 16:05	Are plant-based alternatives healthier? A two-dimensional evaluation from nutritional and processing standpoints. - Sara de las Heras-Delgado (Spain)
16:05 – 16:10	Vitamin D exposure and COVID-19 susceptibility in older adults with metabolic syndrome: a prospective case-control study – Stephanie K. Nishi 1 (Spain/Canada)
16:10 – 16:15	Effect of gamification in health behaviour applications for cardiometabolic health: A systematic review and meta-analysis of randomized controlled trials – Stephanie Nishi 2 (Spain/Canada)
16:15 – 16:20	Health 4.0: PROTEIN mobile application for Type 2 diabetes – Elena Lalama (Germany) (presented by Elena Csanalosi Artigas)
16:20 – 16:25	Evaluation of the usability and adherence of the PROTEIN App – Marta Csanalosi Artigas (Germany)

Friday June 16th, 2023

HALL ULIKA

16:25 – 16:30	NEFA dynamics in adults with severe obesity and insulin resistance: no coupling to the rs9939609 FTO risk allele – Ingrid Løvold Mostad (Norway)
16:30 – 16:35	The effect of alginate encapsulated supplements on substrate utilization, performance and health – Lotte Lina Nielsen (Denmark)
16:35 – 16:40	Undesired side effects of formula diets on erythropoietic parameters – data from three randomized controlled trials – Stefan Kabisch (Germany)
16:40 – 16:45	The Portfolio Dietary Pattern and Risk of Cardiovascular Disease: Findings from Three Prospective Cohort Studies – Andrea J Glenn (USA/Canada)
16:45 – 16:50	Feasibility of a Web-Based Health Application (PortfolioDiet.app) to Translate Nutrition Therapy for Cardiovascular Disease Risk Reduction in High-Risk Adults: A Pilot Study – Meaghan Elizabeth Kavanagh (Canada)
16:50 – 16:55	The possible role of breakfast and sleep quality in the glycemic control of patients in type 2 diabetes – Charilaos Dimosthenopoulos 1 (Greece)
16:55 – 17:00	Adherence to healthy lifestyle behaviors, and cardiometabolic risk factors in the CORALS children cohort. – Nancy Babio (Spain)
17:00 – 17:05	Validation of a web-based program used for diet registration in adults with type 1 diabetes – Afroditi Alexandra Barouti (Sweden)
17:05 – 17:10	Relation of Food Sources of Fructose Containing Sugars with Adiposity Outcomes: A Systematic Review and Meta-Analysis of Prospective Cohort Studies – Andreea Zurbau 1 (Canada)
17:10 – 17:15	Association Between Dietary Phytosterols and Risk of Cardiovascular Disease Mortality in US Adults: Findings from the Third National Health and Nutrition Examination Survey (NHANES III), 1988–1994 – Andreea Zurbau 2 (Canada)
17:15 – 17:20	Short-chain fatty acids in plasma after the intake of fermentable cereal fibres- An extended postprandial study (FiFerM) –Giuseppina Costabile 1 (Italy) (presented by Marilena Vitale)
17:20 – 17:25	Effect of Soy Protein on Blood Pressure: A systematic review and meta-analysis of randomized controlled feeding trials - Diana Ghidanac (Canada)
17:25 – 17:30	Impact of polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) on human semen quality. - María Ángeles Martínez Rodríguez (Spain)
19:30 – 23:00	**DINNER (Hotel)**

Saturday June 17th, 2023

HALL ULIKA

09:00 – 10:30	**Session 10: Short Oral Abstracts** **Chairs: Søren Gregersen (Denmark), Stefan Kabisch (Germany), Geoff Livesey (UK)**
09:00 – 09:05	The role of sex in the modulation of the daily plasma glucose and insulin profiles during a low or a high glycemic index diet: the MEDGI-Carb trial– Marilena Vitale (Italy)
09:05 – 09:10	Dairy consumption and incident prediabetes: prospective associations and network models in the large population-based Lifelines study – Isabel Slurink (Netherlands)
09:10 – 09:15	Interplay of olive oil, gut microbiota, and cognitive performance in older adults with overweight/obesity and metabolic syndrome and at high cardiovascular disease risk – Jiaqi Ni (Spain)
09:15 – 09:20	Plasma metabolite signature associated with a healthy lifestyle score and risk of type 2 diabetes and cardiovascular disease – Jesús Francisco García Gavilán (Spain)
09:20 – 09:25	Decreased serum level of vitamin D imply increased cardiovascular risk in diabetes – Spomenka Ljubic (Croatia)
09:25 – 09:30	Beneficial effects of freeze-dried kale bar on type 2 diabetes patients: A randomized, double-blinded, placebo controlled clinical trial – Per Bendix Jeppesen (Denmark)
09:30 – 09:35	Effect of liquid meal replacements on cardiometabolic risk in pre-diabetes and features of metabolic syndrome: a systematic review and meta-analysis of randomized controlled trials –Jarvis Clyde Noronha (Australia/Canada) (presented by Stephanie Nishi)
09:35 – 09:40	Beneficial glycaemic effects of high-amylose barley bread compared to wheat bread in type 2 diabetes – Mette Bohl Larsen (Denmark)
09:40 – 09:45	The Association of GI, Fiber and Whole Grains with Type 2 Diabetes in Mega Cohorts of over 100,000 participants: A Systematic Review and Meta-analysis – Fei Yi Teenie Siu (Canada)
09:45 – 09:50	100% fruit juice consumption and body weight in children and adults: a systematic review and meta-analysis of prospective cohort studies and randomized controlled trials – Michelle Nguyen (Canada)
09:50 – 09:55	Specific impact of different macronutrient components and weight loss on improvement of liver fat within the 12 month-randomized controlled NutriAct trial – Knut Mai (Germany)
09:55 – 10:00	The association between inadequate protein intake and presence of sarcopenic obesity in diabetic patients - Haris Dimosthenopoulos (Greece)

Saturday June 17th, 2023

HALL ULIKA

10:00 – 10:05	The effect of rare sugars in honey on postprandial blood glucose response: as systematic review and meta-analysis – Tauseef Khan (Canada)
10:05 – 10:10	Impulsivity is associated with higher risk to develop type 2 diabetes and cardiovascular disease over 8 years of follow-up in the NutriNet-Santé cohort. – Carlos Gómez-Martínez (Spain)
10:10 – 10:15	Adherence to the Portfolio Diet is associated with improvements in LDL-C and other established cardiovascular risk factors in a younger multiethnic low-risk population – Victoria Chen (Canada)
10:15 – 10:20	Substitution of sweetened soymilk for unsweetened cow's milk and cardiometabolic health: A systematic review and meta-analysis of randomized controlled feeding trials – Madeline Erlich (Canada)
10:20 – 10:25	Estimated dietary intake of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzo-p-furans, adiposity and obesity status in an elderly population – Nadine Khoury (Spain)
10:25 – 10:30	Cafestol and Kahweol Acutely Improve Glucose Metabolism in Humans with Impaired Glucose Tolerance and Type 2 Diabetes: A Randomized Crossover Trial – Fredrik Drews Mellbye (Denmark)
10:30 – 11:00	**Coffee break (Posters)**
11:00 – 13:00	**Session 11: Scientific rigor in nutrition research and evidence assessment: Are there lessons for future nutrition guidelines development?** **Chairs: John Sievenpiper (Canada), Cyril Kendall (Canada)**
11:00 – 11:20	Reducing error and strengthening causal inferences in nutrition research (David Allison, USA)
11:20 – 11:40	GRADE for evaluation of nutrition research (Dena Zeraatkar, Canada)
11:40 – 12:00	Why do meta-analyses of the same nutrition evidence lead to divergent conclusions? (Frank Hu, USA)
12:00 – 12:20	AACE/ACE process as a model for clinical practice guidelines development (Jeffrey Mechanick, USA)
12:20 – 12:30	Rationale and Design of a Pragmatic Randomized Controlled Trial: Coronary Heart Effectiveness Assessment of the Portfolio diet in primary care (CHEAP) trial- Laura Chiavaroli (Canada)
12:30 – 12:40	Effect of a 3-year lifestyle intervention on telomere length in an older Mediterranean population at cardiovascular risk - María Fernández de la Puente Cervera (Spain)
12:40 – 13:00	Panel discussion (All speakers)
13:00 – 14:00	**Lunch**

Saturday June 17th, 2023

HALL ULIKA

14:00 – 15:30	**Session 12: The interplay between technology and nutrition in diabetes management: what are the opportunities?** **Chairs: Andreas Pfeiffer (Germany), Simin Liu (USA)**
14:00 – 14:20	Assessing the benefits of nutritional interventions using continuous glucose monitoring in patients with type 1 diabetes (Charilaos (Haris) Dimosthenopoulos, Greece)
14:20 – 14:40	Integration of nutrition and technology for the management of diabetes remission (Patrizio Tatti, Italy)
14:40 – 15:00	Continuous glucose monitoring: Clinical targets for continuous glucose monitoring for improving outcomes in diabetes (Tadej Battelino, Slovenia)
15:00 – 15:10	Lifestyle intervention in the T2D-GENE trial - Ursula Schwab (Finland)
15:10 – 15:30	Panel discussion (All speakers)
15:30 – 16:00	**Coffee Break (Posters)**
16:00 – 16:30	**DNSG updates** **Chairs: Cyril Kendall (Canada),** **Hana Kahleova (Czech Republic/USA),** **Jordi Salas-Salvado (Spain),** **Charilaos (Haris) Dimosthenopoulos (Greece)**
16:00 – 16:10	DNSG Updates
16:10 – 16:20	Invitation to the 41ST International Symposium on Diabetes and Nutrition in Sweden - (June 2024) (Ulf Risérus, Sweden)
16:20 – 16:30	Close of the symposium (Dario Rahelic, Croatia)
16:30 – 17:30	**General assembly** **Chair: Cyril Kendall (Canada)**
18:00	**Dinner (Circolo)**

SPEAKERS

Alejandro Sanz Paris
Head of the Endocrinology and Nutrition Service. Miguel Servet University Hospital of Zaragoza (SPAIN). Professor of Medicine on Faculty of Medicine of Zaragoza. President of the Aragonese Society of Endocrinology, Diabetes and Nutrition.

Prof Anoop Misra
Dr Misra is chairman, fortis-cdoc center of excellence for diabetes, metabolic diseases, and endocrinology, new delhi, and director, national diabetes, obesity and cholesterol foundation, and diabetes foundation (india). After doing undergraduate and postgraduation from all india institute of medical sciences, new delhi, he has worked in royal free hospital in london, uk and at department of medicine and endocrinology at southwestern medical center at dallas, texas, usa as who fellow and later, as a faculty. In india, dr misra has been participant of top advisory committees relating to diabetes, cardiovascular diseases, and nutrition in india. He has been advisor to ministry of health, indian council of medical research and department of biotechnology on several issues related to diabetes and other non-communicable diseases.
Prof. Misra has more than 40 years of experience in teaching, service, research, and community health intervention programs and has published more than 350 scientific papers/chapters in the national and international journals (citations till feb, 2023; ~ 39, 181, h-index 100 and i10 index: 410) and books. In 2021, an analysis of stanford university, he is among top 2% of scientists in diabetes research from india to be ranked globally. He is Editor-in-Chief of “Diabetes and Metabolic Syndrome: Clinical Research and Reviews” (Elsevier), and Clinical Keys (Elsevier), and Associate Editor of “Journal of Diabetes” (USA), and European Journal of Clinical Nutrition (UK). He is member, member Editorial Advisory Board of British Medical Journal, member, BMJ’s Regional Advisory Board for South Asia and member, Lancet Obesity Commission, 2023. Dr Misra has received numerous awards and 31 named orations. He has been awarded highest award for medicine in India Dr BC Roy award (2006) and India’s prestigious National Honor, Padma Shree (2007). He has received “Outstanding Investigator Award” from World India Diabetes Foundation in 2013. His current interest include research on nutrition, metabolism, and diabetes in relation to liver fat, pancreatic fat, lean skeletal muscle mass and vitamin D.

Charilaos Dimosthenopoulos

Dr Charilaos Dimosthenopoulos received his PhD from the Medical School of the Kapodistrian University, Athens. He holds a Bachelor degree on Biology from the School of Biology of the Aristotle University of Thessaloniki, a Postgraduate Diploma (PostDip in Dietetics) in Dietetics from Leeds Metropolitan University and a Master of Medicine and Science in Human Nutrition (MMedSci) from Sheffield University, UK. He holds a HACCP Inspector Certificate from the Agricultural University and TUV AUSTRIA. He works as Chief Dietitian of the Department of Clinical Nutrition, at the General hospital of Athens "Laiko" being responsible for the dietary monitoring and treatment of patients of various clinical conditions (Diabetes Mellitus, Obesity, Lipids, IBD, enteral and parenteral nutrition in ICU), since 2002. He is Board member of the Society for the Study of Risk Factors for Vascular Diseases (EMPAKAN) and was Board member of the Hellenic Diabetes Society (EDE). He is Scientific Secretary of the Board of the Diabetes and Nutrition Study Group (DNSG) and he was the Leader of the EFAD's European Specialist Dietetic Networks (ESDNs) Diabetes (2018-2022). He is teaching in 5 different postgraduate programs of the Kapodistrian University and the University of West Attica, Athens. He has numerous publications and numerous participations in Greek and International congresses with oral presentations, abstracts and posters. He participated in numerous studies and research protocols of the first Department of Propaedeutic Internal Medicine, Diabetes Centre, Medical School, National and Kapodistrian University of Athens, Laiko General Hospital, Athens.

Chris Marinangeli

Chris Marinangeli has a PhD in human nutrition sciences and is a registered dietitian. He is a scientist and food industry professional across consumer-packaged goods and the Canadian agricultural sector. He is currently Director of the Regulatory Centre of Excellence at Protein Industries Canada. He has held senior positions at Pulse Canada, and Kellogg Canada. Chris is experienced at leveraging human nutritional sciences to address knowledge gaps that create new opportunities for sectoral differentiation and growth. He is also a recognized expert in national and international food regulations.

Professor Cyril WC Kendall, PhD
Dr. Kendall is a Senior Research Associate in the Department of Nutritional Sciences, Temerty Faculty of Medicine, University of Toronto, and the Clinical Nutrition and Risk Factor Modification Center, St. Michael's Hospital, and an Adjunct Professor in the Division of Nutrition and Dietetics, College of Pharmacy and Nutrition at the University of Saskatchewan. He was educated at the University of Toronto, where he obtained his Honors BSc, MSc and PhD. His primary research interest is the role of diet in the prevention and treatment of chronic disease. Dr. Kendall has over 200 publications in peer-reviewed medical journals. His research on the Portfolio Diet, which combines cholesterol-lowering food components, has been included in the US National Cholesterol Education Program (ATP III) and the Canadian Cardiovascular Society guidelines as an effective dietary strategy for cholesterol reduction. He has also conducted much research on the role of healthy dietary patterns, including low glycemic index diets, in the control of type 2 diabetes. To make therapeutic diets more accessible, he has worked with the food industry to develop products for the supermarket with specific health attributes. Dr. Kendall is a founding member of the International Carbohydrate Quality Consortium (ICQC), Chair of the Diabetes and Nutrition Study Group (DNSG) and is a Director of the Toronto 3D Knowledge Synthesis and Clinical Trials foundation.

Prof. Dario Rahelic, MD, PhD, FACE, FACN, FRCP Edin.
Associate professor Dario Rahelic, MD, Ph.D., FACE, FRCP Edin. is a specialist of internal medicine, endocrinologist and diabetologist. He is the director of Vuk Vrhovac University Clinic for Diabetes, Endocrinology and Metabolic Diseases, Merkur University Hospital, Zagreb, Croatia. Dr. Rahelic served as a Board member and Secretary of IDF Europe in biennium 2015-2017 and chair of IDF Young Leaders in Diabetes Programme. He is a president of Croatian Society for Diabetes and Metabolic Disorders of Croatian Medical Association, Executive committee member of Diabetes and Cardiovascular Disease Study Group of EASD, Croatian Endocrine Society, Croatian Society for Obesity and Croatian Society for Endocrine Oncology. Dr. Rahelic published several chapters in Croatian and international books. He was an invited speaker at many Croatian and international conferences. He is an associate professor at Catholic University of Croatia School of Medicine and associate professor at Josip Juraj Strossmayer University of Osijek School of Medicine. He also participates in the teaching of students at the Faculty of Food Technology and Biotechnology. He was visiting scientist at St. Michael's Hospital

in Toronto, Canada, Mayo Clinic in Rochester, USA, and Motol Clinic, Prague, Czech Republic. Ass. prof. Rahelic is a Fellow of American College of Endocrinology (FACE), Fellow of American College of Nutrition (FACN) and Fellow of Royal College of Physicians of Edinburgh (FRCP Edin). He is a visiting professor at the Faculty of Medicine at the University of Skopje, Republic of North Macedonia. He received Young Investigator's award by Diabetes and Nutrition Study Group of EASD, Etzwiller Rising Star Award, Croatian Endocrine Society award, Award for International collaboration by Macedonian Scientific Association of Endocrinologists, and IDF Award for outstanding service.

David J.A. Jenkins

David J.A. Jenkins is an University Professor, and a professor in the Departments of Nutritional Sciences and Medicine, University of Toronto, a staff physician in the Division of Endocrinology, Director of the Clinical Nutrition and Risk Factor Modification Center, and a Scientist in the Li Ka Shing Knowledge Institute, St. Michael's Hospital. He was educated at Oxford University. He has served on committees in Canada and the United States that formulated nutritional guidelines for the treatment of diabetes and recommendations for fiber and macronutrient intake under the joint US-Canada DRI system (RDAs) of the National Academy of Sciences. He also served as a member of Agriculture Canada's Science Advisory Board (2004-2009) on the future direction of Canada's agriculture and agricultural research. He has spent much time working with the food industry to develop products for the supermarket shelf and, for example, helped to initiate Loblaw's (Canada's largest supermarket chain) 'Too Good To Be True' and most recently their popular "Blue Menu" line of products (for cardiometabolic health). His research area is the use of diet in the prevention and treatment of hyperlipidemia and diabetes. He has over 400 original publications on these and related topics. His team was the first to define and explore the concept of the glycemic index of foods and demonstrate the breadth of metabolic effects of viscous soluble fiber, including blood glucose and cholesterol lowering. His group developed the cholesterol-lowering concept of the dietary portfolio that has entered guidelines in many jurisdictions (e.g. CCS, Heart UK etc.). He is co-chair of the International Carbohydrate Quality Consortium (ICQC) that promotes research and recommendations on the use of carbohydrate foods and their components. He believes in the therapeutic value of plant-based diets and their components and the diets that are advocated have to be environmentally sustainable and reduce the human footprint on the planet.

Dr. Dan Ramdath

Dr. Dan Ramdath is an Adjunct Professor at the University of Saskatchewan. He has a PhD in Human Nutrition with postdoctoral training in Clinical Biochemistry. His research focuses on clinical trials for regulatory approval of health claims and knowledge translation for health policy. Dan's early research led to the development of F100 therapeutic feed for severe malnutrition; he also contributed to a standardized method for measuring Glycemic Index of foods. He was involved in preparing clinical practice guidelines for diabetes and hypertension, and prepared the working draft of the Caribbean DRI Guidelines. Dan has served on several WHO/PAHO Technical Committees for healthy eating, is a Scientific Advisor to the Caribbean Public Health Agency and was Vice Chair of WHO/PAHO Expert Committee to establish a Nutrient Profiling Model for the Americas. He is a Commonwealth Medical Fellowship winner and University of the West Indies Distinguished Alumni.

David B. Allison, Ph.D.

David B. Allison, Ph.D., is Dean, Distinguished Professor, and Provost Professor at Indiana University–Bloomington School of Public Health. Continuously NIH-funded as a PI for over 25 years, he has authored more than 600 scientific publications. Awards include the Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring (2006); the Friends of Albert (Mickey) Stunkard Lifetime Achievement Award (The Obesity Society, 2021); and the Harry V. Roberts Statistical Advocate of the Year Award (American Statistical Association, 2018). In 2022 he was named a Distinguished Lecturer by Sigma Xi, and received the Hoebel Prize for Creativity (Society for the Study of Ingestive Behavior). He received the 2023 Bodil M. Schmidt-Nielsen Distinguished Mentor and Scientist Award (American Physiological Society). Elected to the National Academy of Medicine in 2012, he also serves as co-chair of the National Academy of Sciences' Strategic Council on Research Excellence, Integrity and Trust. Dr. Allison is a staunch advocate for rigor in research methods and the uncompromisingly truthful communication of research findings.

Dena Zeraatkar

Dena Zeraatkar is a research methodologist and Assistant Professor in the Departments of Anesthesia and Health Research Methods, Evidence, and Impact at McMaster University (Canada). Her research centers on evidence synthesis and evaluation to guide complex healthcare and public health questions. She often works in areas in which the evidence is complex or conflicting or in areas in which the evidence is of low quality, examples of which include COVID-19 therapeutics and nutrition.

Frank Hu, MD, MPH, PhD

Frank Hu, MD, MPH, PhD, is the Fredrick J. Stare Professor of Nutrition and Epidemiology and Chair of the Department of Nutrition at the Harvard T.H. Chan School of Public Health. He is also Professor of Medicine at Harvard Medical School and Brigham and Women's Hospital. His major research interests include epidemiology and prevention of cardiometabolic diseases through diet and lifestyle; gene-environment interactions and risk of obesity and type 2 diabetes; nutritional metabolomics in type 2 diabetes and cardiovascular disease; and nutrition transition, metabolic phenotypes, and cardiovascular disease in low and middle-income countries. Dr. Hu serves as Director of Dietary Biomarker Development Center at Harvard University. He has published a textbook on Obesity Epidemiology (Oxford University Press) and >1400 peer-reviewed papers with an H-index of 300. Dr. Hu served on the 2015 Dietary Guidelines Advisory Committee, USDA/HHS. He has served on the editorial/advisory board of The Lancet Diabetes & Endocrinology, Diabetes Care, and Clinical Chemistry. Dr. Hu was elected to the National Academy of Medicine in 2015.

Geoffrey Livesey B.Sc., Ph.D., RNutr., FRSM.
Geoff is a nutritional biochemist now in consultancy worldwide as Director of Independent Nutrition Logic Ltd (UK). Formerly he was at the Universities of Surrey (B.Sc 1st. Biochem), Keele (Ph.D. Cell & tissue biology.), Oxford (Post-doc clinical metabolism) and East Anglia (lecturer) in the UK. His first post was with the Marie Curie Memorial Foundation Cancer Research (Surrey, UK). His research interests have seen him associate with several university hospitals, Radcliff (Oxford), Addenbrooke's (Cambridge) and Norfolk and Norwich (Norfolk), and he was Principal Scientist at the Institute of Food Research (Norwich, UK). Geoff's interest in metabolic research began while at the MRC Metabolic Research Laboratory (Oxford) led by Sir H. A. Krebs. Geoff had grants and commissions from various organisations (EC, FAO, MRC, AFRC/BBSRC, MAFF, ILSI, EPA, CCC) and has contributed to the work of several expert groups (BNF, LSRO, ILSI, FAO, WHO, HC, DNSG DGC). Current memberships include AfN, ASN, NS, Diabetes UK, Alzheimer's UK, RSM, ICQC, SENSE, Acumentia, DNSG . Geoff's interests have seen him publish numerous research papers on energy, carbohydrate fibre, lipid and protein metabolism in health and disease.

Hana Kahleova, M.D., Ph.D., M.B.A.
Dr. Kahleova is director of clinical research for the Physicians Committee for Responsible Medicine. She has conducted several clinical trials, using a plant-based diet in the treatment of obesity, diabetes, and metabolic disease. Her research showed that a plant-based diet leads to a greater weight loss and improvement in metabolism, and addresses multiple mechanisms behind diabetes.
Her research proved that eating a large breakfast and lunch is more beneficial than eating six smaller meals a day for patients with type 2 diabetes. Her research on meal frequency and timing showed that eating less frequently, no snacking, consuming breakfast, and eating the largest meal in the morning may be effective methods for preventing long-term weight gain.
As a member of the American Diabetes Association and as a board member of the Diabetes and Nutrition Study Group of the European Association for the Study of Diabetes, Dr. Kahleova is directly involved in the process of updating the nutritional recommendations for patients with diabetes.

Prof Dr Hans Verhagen

Prof Dr Hans Verhagen has over 39 years of experience in food safety and nutrition. He is a certified toxicologist and nutritionist. He worked at Universities (Nijmegen, Maastricht, Ulster, Copenhagen), in contract research (TNO), in industry (Unilever), for the national government (RIVM), and EFSA from 2015-2020. From 2006-2015 he was a member of the EFSA-NDA panel, working on health claims and novel foods. He is a professor at the University of Ulster (Northern Ireland) and at the Technical University Denmark (DTU, Denmark). Since 2020, he is owner and consultant of Food Safety & Nutrition Consultancy in the Netherlands (https://www.fsnconsultancy.nl/).
cholesterol reduction. He has also conducted much research on the role of healthy dietary patterns, including low glycemic index diets, in the control of type 2 diabetes. To make therapeutic diets more accessible, he has worked with the food industry to develop products for the supermarket with specific health attributes. Dr. Kendall is a founding member of the International Carbohydrate Quality Consortium (ICQC), Chair of the Diabetes and Nutrition Study Group (DNSG) and is a Director of the Toronto 3D Knowledge Synthesis and Clinical Trials foundation.

Jeffrey I. Mechanick, M.D., Ph.D.(hc), F.A.C.P., F.A.C.N., M.A.C.E., E.C.N.U., F.A.S.P.E.N.

Dr. Mechanick is Professor of Medicine and Medical Director of The Marie-Josée and Henry R. Kravis Center for Cardiovascular Health at Mount Sinai Heart, and in the Cardiovascular Institute and Division of Cardiology, and Director of Metabolic Support in the Division of Endocrinology, Diabetes and Bone Disease, Icahn School of Medicine at Mount Sinai. He received his M.D. degree from the Icahn School of Medicine at Mount Sinai, completed Internal Medicine residency at Baylor College of Medicine, and completed Endocrine Fellowship at The Mount Sinai Hospital. Dr. Mechanick authored over 400 publications in Endocrinology, Metabolism, and Nutrition Support with 292 PubMed citations, over 90 chapters, and 11 books currently. He is the 2016-2017 Past President of the American College of Endocrinology, 2013-2014 Past President of the American Association of Clinical Endocrinologists, and 2005-2006 Past President of the American Board of Physician Nutrition Specialists. Dr. Mechanick was appointed as a member of the President's Council on Fitness, Sports and Nutrition (PCFSN) Science Board for 2010-2013 and was the 2013-2015 Editor-in-Chief and currently Editor-in-Chief Emeritus of the PCFSN quarterly publication Elevate Health. Dr. Mechanick currently

serves as Chair of the Board of Visitors for the College of Computer, Mathematics, and Natural Sciences at the University of Maryland at College Park and was the 2011 recipient of the University of Maryland Industry Impact Award and 2011 University of Maryland Biology Alumnus Award. In 2016, Dr. Mechanick was honored as the Yogesh C. Patel Memorial lecturer at McGill University and in 2023, received an Honoris Causa Doctorate from Carol Davila University of Medicine and Pharmacy in Bucharest, Romania. Dr. Mechanick is a Fellow of the American College of Physicians, American College of Nutrition, and American Society for Parenteral and Enteral Nutrition, as well as Master of the American College of Endocrinology. Dr. Mechanick's research interests are in the fields of nutrition and metabolic support, obesity and lifestyle medicine, and network analysis of complex systems. Dr. Mechanick is responsible for training cardiology fellows at Mount Sinai in lifestyle medicine, nutrition, and metabolic support.

Joan Sabaté

Joan Sabaté MD, Ph.D., is a Professor of Nutrition and Epidemiology at Loma Linda University School of Public Health and a board-certified physician in Internal Medicine. He was the principal investigator of a nutrition intervention trial that directly linked the consumption of walnuts to significant reductions in serum cholesterol, published in the New England Journal of Medicine in 1993. He is a co-investigator of the Adventist Health Studies, the largest cohort of vegetarians relating dietary intake with health outcomes. For the past 25 years, he has been the principal investigator of many human nutrition intervention trials investigating the health effects of nuts, avocados, and other plant foods. Dr. Sabaté has authored >200 high-impact research articles (h-index 65, >15,000 citations) and has contributed to public health and nutrition policy, including being a member of the US 2020 Dietary Guidelines Advisory Committee and providing scientific testimony to FDA for the approval of the nuts Health Claim. Dr. Sabaté directs the Environmental Nutrition research program at the Loma Linda University School of Public Health, which focuses on sustainable diets, explores the interrelationships between food choices' environmental and health impacts, and ultimately seeks to improve food systems' sustainability, health, and equity.

Dr. Sievenpiper

Dr. Sievenpiper is a Clinician Scientist who holds appointments as an Associate Professor in the Departments of Nutritional Sciences and Medicine and the Lifestyle Medicine Lead in the MD Program at the University of Toronto. He is also a Staff Physician in the Division of Endocrinology & Metabolism, Lead of the Toronto 3D Knowledge Synthesis and Clinical Trials Unit, and Scientist in the La Ka Shing Knowledge Institute at St. Michael's Hospital. Dr. Sievenpiper completed his MSc, PhD and Postdoctoral Fellowship training in the Department of Nutritional Sciences at the University of Toronto. He completed his MD at St. Matthew's University followed by Residency training in Medical Biochemistry at McMaster University leading to his certification as a Fellow of the Royal College of Physicians of Canada (FRCPC). He has established an internationally recognized research program focused on using randomized controlled trials and epidemiological approaches to address questions of clinical and public health importance in relation to diet and cardiometabolic disease prevention with a particular interest in the role of sugars, carbohydrate quality, and plant-based dietary patterns. He is directly involved in knowledge translation with appointments to the nutrition guidelines' committees of Diabetes Canada, European Association for the study of Diabetes (EASD), Canadian Cardiovascular Society (CCS), and Obesity Canada. He is the recipient of numerous awards including an Insulin 100 Emerging Leader Award, Khursheed Jeejeebhoy Award, CNS Young Investigator Award, PSI Foundation Graham Farquharson Knowledge Translation Fellowship, Diabetes Canada Clinician Scientist Award, Banting & Best Diabetes Centre Sun Life Financial New Investigator Award, and CIHR-INMD/CNS–New Investigator Partnership Prize. He has authored > 250 scientific papers and 17 book chapters.

Kevin Miller, MS, Ph.D

Kevin Miller is Principal Scientist at General Mills' Bell Institute of Health and Nutrition. In his role, Kevin provides guidance on nutrition topics including grains, fiber, protein, and fortification. Kevin is the current Chair of the Whole Grain Initiative, a consortium of professional associations, academic and industry organizations, and non-profit groups dedicated to improving dietary lifestyles for public health through science and advocacy. Previously, Kevin worked in healthcare nutrition studying nutrition interventions to improve patient outcomes in sarcopenia and cancer cachexia.

Maria Camprubi Robles

Maria Camprubi Robles completed her bachelor's degree in Biology at the University of Alicante in Spain. While at University Miguel Hernandez (in Alicante), she earned her PhD in Molecular and Cellular Biology. Her research explored the mechanism involved in inflammatory and neuropathic pain. Maria then completed a postdoctoral fellowship at the Medical University of Innsbruck (Austria) before joining Abbott Nutrition. Maria is a research scientist at Abbott Nutrition (R&D) and is responsible for Europe and Middle East. Maria is a subject matter expert in specialized adult nutrition to support muscle health during aging and under disease conditions and has many scientific publications related to the role of specialized nutrition to counteract disease related malnutrition and sarcopenia, the role of protein to support muscle-related outcomes in healthy aging and key nutritional intervention to support good glucose management. Maria has particular interest in the impact of key functional ingredients on improving muscle mass and strength and supporting an optimal glucose control.

Mike Lean, MA, MB, BChir, MD (Cambridge), FRCP (Edinburgh), FRCPS (Glasgow), FRSE

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• Established the first Department of Human Nutrition in a Scottish Medical School, 1990- initially funded 10 years by Rank Prize Funds.
• 'Broad-focus' strategy: translational, integrative, research and teaching, across all scientific disciplines within Human Nutrition.
• Main focusses are on obesity, diabetes, metabolic syndrome and health promotion.
• The only doctor in Scotland (and UK?) on the GMC Specialist Register for Human Nutrition, as well as for Diabetes and Endocrinology and General Internal Medicine
• Awards include Diabetes UK Rank Prize Lecture (2014) and Banting Memorial Lecture (2020-21); Tenovus Medal for Research (2017)
• Visiting professor at University of Otago, and University of Sydney.
• Elected Fellow of Royal Society of Edinburgh, the National Academy of Scotland (2018).
• Over 400 Original Research articles: Google Scholar H-Index =120
• Outside of work: plays and makes violins, cycles, climbs mountains.

Neal D. Barnard, MD, FACC

Neal Barnard, MD, FACC, is an Adjunct Professor of Medicine at the George Washington University School of Medicine in Washington, DC, and President of the Physicians Committee for Responsible Medicine. Dr. Barnard has led numerous research studies investigating the effects of diet on diabetes, body weight, hormonal symptoms, and chronic pain, including a groundbreaking study of dietary interventions in type 2 diabetes, funded by the National Institutes of Health, that paved the way for viewing type 2 diabetes as a potentially reversible condition for many patients. Dr. Barnard has authored more than 100 scientific publications and 20 books for medical and lay readers, and is the editor in chief of the Nutrition Guide for Clinicians, a textbook made available to all U.S. medical students.

As president of the Physicians Committee, Dr. Barnard leads programs advocating for preventive medicine, good nutrition, and higher ethical standards in research. His research contributed to the acceptance of plant-based diets in the Dietary Guidelines for Americans. In 2015, he was named a Fellow of the American College of Cardiology. In 2016, he founded the Barnard Medical Center in Washington, DC, as a model for making nutrition a routine part of all medical care. Working with the Medical Society of the District of Columbia and the American Medical Association, Dr. Barnard has authored key resolutions, now part of AMA policy, calling for a new focus on prevention and nutrition in federal policies and in medical practice. In 2018, he received the Medical Society of the District of Columbia's Distinguished Service Award. He has hosted four PBS television programs on nutrition and health.

Originally from Fargo, North Dakota, Dr. Barnard received his M.D. degree at the George Washington University School of Medicine and completed his residency at the same institution. He practiced at St. Vincent's Hospital in New York before returning to Washington to found the Physicians Committee.

Patrizio Tatti

Prof Patrizio Tatti is actually the chief of Endocrinology and Diabetes at the INI Institute – Rome. Throughout his career, he filled the same role in the Italian NHS. and was senior consultant in the UK, He also had academic positions in Italy and abroad. He is the Author of more than 180 papers. He Is the Past President of the Italian Society of Diabetes, Metabolism and Obesity

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Distinguished Professor of Nutrition and Director of the Human Nutrition Unit - Rovira i Virgili University (URV), and ICREA Academia Investigator; CIBERobn Investigator and coordinator of its Nutrition Program (Spanish Carlos III Institute of Health). Currently, is the Director of the Centre Català de la Nutrició (CCNIEC), Chairman of the World Forum for Nutrition Research and Dissemination (INC); Member of the Executive Committee of the Diabetes and Nutrition Study Group (DSNG) of the European Association for the Study of Diabetes (EASD).

Prof. Salas' research has focused on clinical trials in humans to evaluate the effect of food, dietary compounds and dietary patterns on obesity, diabetes, metabolic syndrome and cardiovascular diseases. Since 2005, he is one of the leaders of the PREDIMED Study (n=7447 participants), and is currently Coordinator and Chairman of the Steering Committee of the PREDIMED-Plus study (n=6874 participants), two large clinical trials for the primary prevention of cardiovascular disease and mortality. PREDIMED-Plus is a multi-collaborative project involving 30 research groups, and had received National, European & USA grants. With all these projects and collaborations, the group has developed skills in precision medicine using different OMIC´s methodologies, especially metabolomics and metagenomics, which we are now implementing in epidemiologic and clinical studies. He is also involved in two prospective cohort studies: CORALS and LEDFERTYL.

He has published more than 750 scientific articles, adding more than 37000 citations with an SCI H-index 93, and has published 14 books and directed 32 Doctoral Theses.

Dr. Simin Liu

Dr. Simin Liu is an epidemiologist and physician-scientist whose work unites molecular genetics, nutrition, clinical medicine, and public health. He is currently a Professor of Epidemiology, Medicine, and Surgery at Brown University. Dr. Liu also serves as director of the Center for Global Cardiometabolic Health (CGCH) and holds an adjunct professorship at the Harvard T.H. Chan School of Public Health. Dr. Liu's research is mainly concerned with the etiology of complex diseases with special emphasis on identifying strategies for their prevention and control. His group conducts both experimental and observational research that has been supported by government funding bodies, private foundations, and industries. Dr. Liu's research has led to identifying and confirming several novel genetic and biochemical markers and gene-nutrient interactions for a series of cardiometabolic outcomes such as obesity, diabetes, and cardiovascular diseases. In 2015, he was listed as one of the most highly cited scholars with an H-index>100. He has developed and taught eight courses and directly supervised >100 trainees at Harvard, UCLA, and Brown. Dr. Liu is an elected fellow of the American Heart Association (FAHA), American Society of Clinical Investigation (ASCI), American Epidemiological Society (AES), and a permanent member of the Epidemic Intelligence Service Alumni Association (EISAA). He has also served as a member and chair on committees/study sections/advisory boards for federal and international agencies, including the Canadian Institutes of Health Research and Canadian Foundation for Innovation, the European Union, the British Medical Research Council (MRC), and the World Health Organization (WHO) providing consultations on issues related to pharmaceuticals, nutrition, and global health.

Vladimir Vuksan

Dr. Vuksan is professor emeritus of the Department of Nutritional Sciences and the Department of Medicine within the Temerty Faculty of Medicine at the University of Toronto. He was also associate director of the Centre for Clinical Nutrition and Risk Factor Modification at St. Michael's Hospital. Over the past 30 years, Dr. Vuksan has made significant research contributions within a unique multidisciplinary group investigating the physiological effects of nutritional and plant-based treatments. His research has identified several therapies focused on translational impact, including a proprietary blend of viscous fibres (U.S. and Canada patented), an ancient whole grain

(Salba/Chia) now marketed worldwide, various species of ginseng and their chemical fractions, and dietary nitrate interventions. He has published over 200 original research publications, including many in leading medical journals. Dr. Vuksan has received numerous awards for his unique contribution to nutrition, including three national awards: the Canadian Diabetes Association's Charles H. Best Award in 2010 for his translational work in diabetes, the Korean National, World Science Award in 2012 for his studies on ginseng, and the Yugoslav Diabetes Research Award in 1984. He also received the Graduate Teaching Award from the University of Toronto Temerty Faculty of Medicine in 2014 in recognition of excellence in mentoring graduate students.

Professor Jennie Brand-Miller AO, FAA, PhD
Jennie Brand-Miller is a leading nutrition scientist in the Charles Perkins Centre at the University of Sydney. She is recognised around the world for her research on carbohydrates, particularly the glycemic index of foods. She has written ~350 publications with over 20,000 total citations and H-index of 71. She was elected a Fellow of the Australian Academy of Science in 2019. Her popular science books were the first best-selling diet books achieved sales of 3.5 million copies. She is Member of the Order of Australia in 2011, Sir Kempson-Maddox Diabetes Australia Award in 2009 and finalist in Australian of the Year Awards 2006. In 2003, she was awarded a Clunies Ross Medal for her contributions to science and technology in Australia. She is a Fellow of the Nutrition Society of Australia and the Australian Institute of Food Science and Technology. She is also a proud recipient of bilateral cochlear implants for sensorineural deafness.

Dr John Miller
Dr John Miller is retired Medical Director of Novo Nordisk Australasia with continuing interests in obesity and diabetes having been involved in the clinical development of GLP-1 agonists, including liraglutude and semaglutide, and insulin analogues.

Anne Raben (AR) Ph.D.
Anne Raben (AR) is Ph.D. in Human Nutrition and Professor in the section for Preventive and Clinical Nutrition, Department of Nutrition, Exercise and Sports, SCIENCE, University of Copenhagen. AR is also Senior Researcher in Clinical and Preventive Research, Copenhagen University Hospital - Steno Diabetes Center Copenhagen, Denmark. AR has solid experience with small, short–term and large, long-term clinical intervention studies within obesity, diabetes and related diseases. Especially, the role of different dietary compositions, macronutrients, and hereunder carbohydrates (glycemic index, sucrose/starch) and non-caloric sweeteners) have been in focus.
Currently, AR is co-coordinator and work package leader of a 1-y intervention study in the Horizon-2020 project "SWEET" (www.sweetproject.eu, 2018 – 2023) focusing on the impact of sweeteners and sweeteners enhancers on health, obesity, safety and sustainability. AR has published 215 scientific papers and has an H-index of 57.

ABSTRACTS

SESSION 2: NUTS FOR THE MAINTENANCE OF NORMAL BLOOD GLUCOSE AND REDUCTION OF DIABETES RISK: WHAT ARE THE OPPORTUNITIES AND RESEARCH NEEDS FOR HEALTH CLAIMS SUBSTANTIATION?
ORAL ABSTRACT 1

Anoop Misra

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Seema Gulati

Premeal load of almonds in people with prediabetes for amelioration of glycemia and remission

Introduction:
Rapid conversion from prediabetes to diabetes and postprandial hyperglycemia (PPHG) is seen in Asian Indians. Novel dietary strategies are needed to arrest this progression, by targeting postprandial hyperglycemia (PPHG).
Objectives:
Effect of dietary intervention of preloading (30 min before) major meals with 20 g almonds on overall glycemia and PPHG.
Methods:
The study included three phases. 1) In an oral glucose tolerance test (OGTT)-based crossover randomized control study, the effect of a single preload of almonds (20 g) given before OGTT was evaluated (n=60, 30 each period). 2) The continuous glucose monitoring system (CGMS)-based study for three days including preload of almonds before three major meals, was a free-living, open-labeled, crossover randomized control trial, where control and premeal almond load diets were compared for glycaemic control (n=60, 30 each period). 3) Chronic study, free-living randomized controlled open-label parallel arm, (n=60, 30 each arm completed the study), where participants were followed up for a period of 3 months. The study was registered at clinicaltrials.gov (registration no. NCT04769726).
Results:
In the OGTT-based study phase, the overall AUC for blood glucose, serum insulin, C-peptide, and plasma glucagon post-75 gm oral glucose load was significantly lower for treatment vs. control diet ($p<0.001$). The CGMS data showed that premeal almond load significantly improved AUC blood glucose ($p<0.001$), parameters of glucose variability, and glucose control.
In the chronic phase study, overall additional mean in the treatment arm vs. control arm was statistically significant for fasting and post-75 g oral glucose-load blood glucose, postprandial insulin, HOMA-IR, HbA1c, and proinsulin ($p<0.001$.) Most importantly, we observed a reversal to normoglycemic state (fasting blood glucose and 2h post-OGTT glucose levels) in 23.3% (7 out of 30) of participants in the treatment arm which is comparable to that seen with Acarbose (25%).
Conclusions: Premeal load of almonds leads to a significant decrease in PPHG, serum insulin, C-peptide, and glucagon levels and decreased several glycaemic parameters (as revealed in OGTT-based and CGMS-based study phases) and shows potential for reversal of prediabetes to normal glucose regulation over 3 months (chronic phase study)
Funding: Almond Board of California

ORAL ABSTRACT 2
Thomas Wolever

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The effect of adding protein to a carbohydrate meal on postprandial glycaemic responses: a systematic review and meta-analysis (SRMA) of acute controlled feeding trials

Introduction: it is unknown if the effect of protein on glycaemic response varies by protein source and health status.
Objective: to synthesize the evidence on the effect of adding protein to available carbohydrate (avCHO) on the primary endpoint of glucose incremental area under the curve (GiAUC).
Methods: we conducted a SRMA following Cochrane and PRISMA guidelines. We included acute, crossover, single-meal, controlled trials in overnight-fasted humans regardless of health status. The control and protein-containing test-meals contained equivalent amounts of avCHO. Data were pooled using generic variance method with DerSimonian and Laird random effects model. Pooled effect estimates were expressed as ratio-of-means (RoM). Inter-study heterogeneity, study methodology quality, risk of bias and publication-bias were assessed.
Results: 67 studies were included, providing 151 comparisons in subjects without diabetes (WD), 24 in type 2 diabetes (T2DM) and 5 in type 1 diabetes (T1DM). 86% of comparisons had good methodology quality, 91% had low risk of bias, there was no evidence of publication-bias. Overall, protein reduced GiAUC RoM by 26%, with substantial residual heterogeneity (I^2 = 89.7%, p<0.01). The effect of protein (RoM) was significantly modified by health status [WD (0.71)a, T2DM (0.82)b, T1DM (1.40)c] (values not sharing the same letter differ p<0.05), follow-up time, study quality, protein-source and protein-dose (grams protein per gram avCHO). In WD the regressions of RoM on protein-dose by protein-source were (slope, significance): mixed (0.90a, n=5, p<0.001); milk (-0.84ab, n=30, p=0.029); plant (0.54b, n=33, p<0.001); dairy (0.49b, n=59, p<0.001); animal (-0.29b n=22, p=0.30). In T2DM slopes for dairy (0.37, n=13, p=0.095) and animal (-0.17 n=8, p=0.30) proteins were similar to each other and to those in WD. There were no data for mixed, plant or milk sources in T2DM.
Conclusions: adding protein to avCHO reduces GiAUC in WD and T2D but increases GiAUC in T1D. There was evidence that the magnitude of the effect depends on protein source, but there are insufficient data to determine whether the effects of individual protein sources within categories differ from each other or between WD vs T2DM.
Supported by: General Mills, Inc. Study registration: Prospero ID=CRD42022322090.
Key words: protein, glycaemic response

SESSION 3: MEAL REPLACEMENTS FOR DIABETES PREVENTION, MANAGEMENT, AND REMISSION
ORAL ABSTRACT 3
Bettina Schuppelius

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Weight loss induced by low caloric formula diets is associated with improvements of liver outcomes independent of formula diet type

Introduction: Non-alcoholic fatty liver disease (NAFLD) is the most common liver disease worldwide and closely linked to other metabolic disorders such as obesity and type 2 diabetes. As weight loss is currently the most effective known treatment for NAFLD, potent and feasible weight-loss programs are urgently needed.
Objective: We investigated how the consumption of very low caloric formula diets for 3 months affected liver enzymes and fatty liver scores in patients with type 2 diabetes. Moreover, we analyzed whether the type of formula diet had an influence on the liver outcomes.
Methods: Participants (n=31) with overt T2D and BMI over 27 kg/m² were studied before (V1), one week (V2) and 3 months after (V3) consuming an 800 (males) or 600 kcal/day (females) formula diet. All subjects were randomly assigned to either HEPAFAST® or OPTIFAST®. At all visits fasting blood samples were drawn and clinical routine blood analysis and anthropometric measurements were performed. Mixed meal tolerance tests (MMTTs) were done at V1 and V3. We calculated established liver fat scores according to their first publication: the fatty liver index (FLI), NAFLD-liver fat score (NAFLD-LFS) and NAFLD ridge score.
Results: After 3 months of very low caloric diet the participants reduced their body weight on average by 17.0 kg compared to V1. This body weight loss was associated with strong improvements of glucose metabolism including insulin sensitivity (HOMA-IR, Matsuda index) and insulin secretion (disposition index). The liver enzymes alanine aminotransferase (ALT) and aspartate aminotransferase (AST) both increased after one week of formula diet (ALT: p=0.014, AST: p=0.009) but decreased significantly after three months (V2 vs. V3, ALT and AST p<0.001). In contrast, the γ-glutamyl transferase slightly decreased already after one week of intervention (ns) and even further after 3 months (V2 vs. V3, p=0.001). All three calculated fatty liver scores improved significantly after 3 months. In terms of liver outcomes, we found no differences between the two formula diets.
Conclusions: In the present study we confirmed rapid weight loss of about 15 kg through formula diets as very effective approach to improve all three metabolic disorders: obesity, type 2 diabetes and NAFLD.

SESSION 6: CARBOHYDRATE QUALITY METRICS FOR DEFINING "HEALTHY" FOODS: AN OPPORTUNITY FOR FURTHER HARMONIZATION?
ORAL ABSTRACT 4
Alessandro Atzeni

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Co-authors:
Stephanie Nishi, Jordi Salas-Salvadó

Association between carbohydrate quality and gut microbiota in a Mediterranean population at high cardiovascular risk

It has been demonstrated that carbohydrate quality index (CQI) represents a useful tool to evaluate micronutrient intake adequacy, suggesting the usefulness of measuring carbohydrate quality considering fibre and proportion of whole grains and liquid carbohydrates. Positive changes in the quality of carbohydrate lead to short-term improvements in cardiovascular disease risk factors and these improvements are maintained or even enhanced over time in a Mediterranean population at high cardiovascular disease risk within the frame of the Predimed-Plus trial.
Considering the lack of literature describing the association between CQI and gut microbiota, the aim of this study is to assess this relationship cross-sectionally and longitudinally, in a subsample of Predimed-Plus participants.
For the cross-sectional assessment population was stratified by tertiles of baseline CQI, weather for the longitudinal assessment population was stratified according to tertiles of CQI change after one-year of follow up. Gut microbiota profiles were obtained from 16S sequencing of microbial DNA from stool samples.
Interestingly, results shown that higher CQI was associated with lower waist circumference and higher adherence to Mediterranean diet at baseline. Furthermore, higher CQI was associated with increased weight loss and Mediterranean diet adherence, and decreased waist circumference, BMI, and glycated hemoglobin after one-year of follow up.
The analysis of the fecal microbiota shown alpha diversity indices, Chao1 and Shannon positively associated with higher CQI at baseline. Furthermore, specific genera were associated with the highest tertile of baseline CQI and with the highest tertile of CQI change after one-year of-follow up.
These findings suggest that a better quality of carbohydrate intake is associated with improved metabolic health but also with increased gut microbiota richness and abundance of genera such as Feacalibacterium, Christensenellaceae and Butyrivibrio, linked with beneficial metabolic outcomes.

SESSION 7: LOW CALORIE SWEETENERS IN PEOPLE WITH OR AT RISK FOR DIABETES: RECONCILING THE CLINICAL, PUBLIC HEALTH, AND SAFETY ASSESSMENTS
ORAL ABSTRACT 5
Sabrina Ayoub-Charette

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Displacing sugar-sweetened beverages with non-nutritive sweetened beverages or water: Per-protocol analysis of the Strategies To OPpose SUGARS with Non-nutritive sweeteners Or Water (STOP Sugars NOW) trial

Introduction: Excess intake of sugars via sugar-sweetened beverages (SSBs) increases weight and cardiometabolic risk. Health authorities recommend the replacement of SSBs with water, but not non-nutritive sweetened beverages (NSBs) due to concerns that they do not have the intended benefits and may induce glucose intolerance through changes in the gut microbiome.

Objective: We undertook the STOP Sugars NOW trial, a pragmatic "head-to-head" crossover randomized controlled trial of the effect of NSBs ("intended substitution") versus water ("standard of care") as a replacement strategy for SSBs on glucose tolerance and gut microbiome diversity.

Methods: We recruited participants with overweight or obesity who regularly consume ≥1 SSBs/day. Each participant underwent a ≥2-week run-in period followed by three 4-week treatment phases in random order (usual SSBs, equivalent NSBs, or water) with each phase separated by a ≥4-week washout phase. The two primary outcomes are change in glucose tolerance (75g oral glucose tolerance test derived iAUC) and gut microbiome beta-diversity. Secondary outcomes include change in waist circumference, body weight, fasting plasma glucose, 75g-OGTT derived 2-hour plasma glucose and Matsuda whole body insulin sensitivity index. Adherence outcomes include objective biomarkers of added sugars (13C/12C isotopic ratio in serum fatty acids and urinary fructose and sucrose) and non-nutritive sweeteners (urinary sucralose and acesulfame-potassium) as well as self-reported beverage logs. The per-protocol sample was defined as completers adhering to at least 60% of their prescribed beverage intake with SSB contamination on <20% of treatment days.

Results: Recruitment for the trial began June 1, 2018, and the last randomized participant completed the trial October 15, 2020. We screened 1,086 participants, of whom 80 were randomized and 66 completed the trial (83% retention). Adherence was strong across all interventions (mean monthly beverage adherence was 100% for all three treatment phases). In the 46 participants included in the per-protocol analysis, there were no changes in glucose tolerance (iAUC) in all pairwise comparisons. However, fasting plasma glucose decreased in the substitution of SSB for water ("standard of care") (-0.19 mmol/L [95% CI, -0.35 to -0.02], p=0.027), and for NSBs ("intended substitution") (-0.18 mmol/L [95% CI, -0.35 to 0.01], p=0.036), with no change in the substitution of water for NSBs ("reference substitution").

Conclusions: Under pragmatic conditions per-protocol analysis show neither that water ("standard of care") nor NSBs ("intended replacement") in substitution for SSBs reduce glucose tolerance, but water and NSBs both reduce fasting plasma glucose. Both NSBs and water may provide helpful replacement strategies for SSBs reduction to reduce the risk of diabetes.

ClinicalTrials.gov registration: NCT03543644
Keywords: Food, Omics
Funding: The Canadian Institute of Health Research (CIHR); Province of Ontario Early Research Award program, Canadian Foundation for Innovation, Ontario Research Fund, Nutrition Trialists Research Fund at the University of Toronto, Loblaw Food as Medicine Graduate Award program, St. Michael's Hospital Research Training Centre, Mitacs, Toronto 3D Knowledge Synthesis and Clinical Trials foundation, Banting and Best Diabetes Centre, PSI Foundation, Diabetes Canada.

ORAL ABSTRACT 6
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Glycemic response to meals with a high glycemic index differs between morning and evening: a randomized controlled trial among students with early or late chronotype

INTRODUCTION
Eating meals late in the evening may affect postprandial (pp) glucose responses more adversely than consuming identical meals at earlier daytimes. Yet it is not clear whether this also applies to persons with a later chronotype for whom an early breakfast could entail circadian misalignment.
OBJECTIVE
To examine whether the 2-h pp and diurnal glycemic response to a meal with a high glycemic index (GI) differ when consumed early or late in the day among students with either an earlier or a later chronotype.
RESEARCH DESIGN AND METHODS
From a screening of 327 students aged 18–25 years, those with earlier (n=22) or later (n=23) chronotype were invited to participate in a 4-day randomized controlled cross-over nutrition trial. On intervention days, participants received a high GI meal (GI=72) either in the morning (7 a.m.) or evening (8 p.m.), all other meals had a medium GI. Continuous glucose monitoring was used to measure 2-h and diurnal pp glycemic responses.
RESULTS
Among students with an earlier chronotype 2-h glucose responses to the high GI meal tended to be higher in the evening than in the morning (iAUC: 234 (±92) vs. 195 (±91) mmol/L, p=0.051). Similarly, mean diurnal glucose values tended to be higher when the high GI meal was consumed in the evening (p=0.06). Participants with a later chronotype show comparably high 2-h (iAUC: 211 (±110) vs. 207 (±95), p=0.8) and mean diurnal (p=0.9) glycemic responses to the high GI meal consumed in the morning and in the evening.
CONCLUSIONS
Diurnal differences in response to a high GI meal are discernible among young adults with an earlier chronotype only. By contrast, young adults with a later chronotype may be vulnerable to both a very early and late high GI meal.
FUNDING The study was supported by the German Research Foundation (DFG), BU1807/3-2, HE4510/5-2, AL 1794/1-2
KEYWORDS food, personalized nutrition

SESSION 8: HAS THE TIME COME TO RECOMMEND PLANT-BASED DIETS TO ALL OUR PATIENTS WITH DIABETES?
ORAL ABSTRACT 7
Evaluating Plant Protein in US Diets using 3 cycles of NHANES (2013-2018): Considerations for protein quality and Nutritional Adequacy

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Introduction
Increased use of plant foods in dietary patterns has been demonstrated to reduce the risk factors of non-communicable diseases, including diabetes, as well as facilitate environmental benefits. Dietary guidelines are increasingly promoting a "recalibration" of dietary patterns to include more plant protein foods as a focal point for reducing consumption of saturated fat, and facilitating consumption of protein, fibre, and micronutrients, while reducing potential effects of diet on metrics of environmental sustainability. However, given that nutrient, and amino acid composition of plant foods can differ considerably from animal protein foods, an understanding of diets that index higher in plant protein is required to develop effective strategies for alignment with dietary recommendations.
Objectives
The objective of this study was to evaluate the effect increasing levels of plant protein on the protein quality, nutrient density and nutritional adequacy of adults ≥ 19 years of age.
Methods
Three cycles of NHANES (2013–2018) were used to assess protein intake, protein quality (protein digestibility-corrected amino acid score; PDCAAS), and proportion of adults meeting recommended nutrient intakes across defined quartiles of plant protein intake (DFQ1: 0-24.9%; DFQ2: 25-49.9%; DFQ3; 50-74.9%; DFQ4: >75%) over a 24 h period (≥19 years).
Results.
Results demonstrated that absolute protein intake (99.7 g/day) and protein quality (PDCAAS 0.91) of diets were progressively lower from DQ1 to 46 g/day and 0.0.68 in Q4, respectively. Grains represented the primary source of plant protein across defined quartiles and increased from 4.81% (Q1) to 21.4% (Q4). Legumes, nuts, and seeds represented 21% of the protein from the "protein foods" group (25% of protein intake) consumed DFQ4. Although 35% of adults in Q4 had fibre intakes higher than the AI level, 33.1, 59, 11.5, 99.3, 62.9, and 15.6% of adults (19-51 years) had protein, vitb12, vitD, zinc, and riboflavin, respectively, below estimated average requirements.
Conclusions
Results from this study demonstrate that protein quality, protein complementary, and micro-nutrient adequacy require consideration to effectively adopt dietary patterns that promote plant protein as a strategy for enhancing health and reducing risk of non-communicable diseases.
Keywords: Dietary patterns, protein quality, plant protein

SESSION 9: SHORT ORAL ABSTRACTS
SHORT ORAL ABSTRACT 1
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Are plant-based alternatives healthier? A two-dimensional evaluation from nutritional and processing standpoints.

Background: Plant-Based Alternative Products (PBAPs) to meat and dairy are increasingly available. Their relative nutritional quality in comparison to animal-based homologs is poorly documented.
Objective: To characterize and evaluate the plant-based alternatives available on the market in Spain in comparison to animal products in terms of their nutritional composition and profile, and degree of processing.
Methods: Nutritional information for PBAPs and homologs were obtained from the Spanish 'Veggie base', branded food composition database. Five PBAPs categories (cheese, dairy products, eggs, meat, and fish, n=922) were compared to animal-based processed (n=922) and unprocessed (n=381) homologs, using the modified version of the Food Standard Agency Nutrient Profiling System (FSAm-NPS score) and NOVA classification criteria.
Results: Compared to processed or unprocessed animal food, PBAPs contain significantly higher sugar, salt, and fiber. PBAPs for fish, seafood, and meat were lower in protein and saturated fatty acids. Overall, 68% of PBAPs, 43% of processed and 75% of unprocessed animal-homologs had Nutri-Score ratings of A or B (most healthy). About 17% of PBAPs, 35% of processed and 13% of unprocessed animal-based food were in Nutri-Score categories D or E (least healthy). Dairy, fish, and meat alternatives had lower FSAm-NPS scores (most healthy), while cheese alternatives scored higher (least healthy) than animal-based homologs. Unprocessed fish and meat were healthier than similar PBAPs based on FSAm-NPS criteria. Approximately 37% of PBAPs and 72% of processed animal-based products were ultra-processed food (NOVA group 4). Within the ultra-processed food group, Nutri-Score varied widely.
Conclusions: Most PBAPs had better nutrient profile than animal-based homologs. However, cheese, fish and meats PBAPs had poorer nutrient profile and were more processed. Given the high degree of processing and variable nutritional profile, PBAPs require a multi-dimensional evaluation of their health impact.
Keywords: Food; Dietary patterns; Vegan food and alternatives; Plant-based; meat; dairy products; nutritional analysis; Nutri-Score; NOVA criteria; Nutritional profile

SHORT ORAL ABSTRACT 2
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Vitamin D exposure and COVID-19 susceptibility in older adults with metabolic syndrome: a prospective case-control study

Introduction: Impact of COVID-19 infection worldwide is well known with ≥4.9 million cases and nearly 90,000 deaths in Spain alone. Vitamin D has been suggested to be beneficial in patients with COVID-19, however, it is unknown if vitamin D intake affects susceptibility.
Objective: To assess the impact of vitamin D exposure from both medication and dietary sources in COVID-19 susceptibility in older Spanish individuals with overweight/obesity and metabolic syndrome.
Methods: A paired-matched nested prospective case-control (1:2 ratio) study was conducted within the framework of PREDIMED-Plus. Eligible participants were community-dwelling Spanish adults (55-75 years) with overweight or obesity and metabolic syndrome, without cardiovascular disease or COVID-19 infection at baseline. Cases were defined as participants who had tested positive for COVID-19. Cases and controls were matched by age, sex, body mass index, and study visit date. Vitamin D exposure was considered from both dietary and medication/supplement sources. Dietary vitamin D exposure was assessed using a validated 143-item semi-quantitative FFQ, administered by trained dietitians. Medication/supplement-based vitamin D exposure was assessed according to participant self-response to questionnaires administered by trained staff.
Results: The final sample size for the present analysis included 352 cases and 704 matched controls. COVID-19 cases and controls were not observed to have significant differences in exposure to vitamin D from medication and dietary sources.
Conclusion: Vitamin D exposure from medication or dietary sources does not appear to impact COVID-19 susceptibility, despite the possible benefit seen with treatment. Due to the importance of vitamin D for immune status and chronic disease, a well-known risk factor for COVID-19, more research is needed to establish further medical recommendations regarding vitamin D levels.
Funding: This trial was supported by the Instituto Carlos III (ISCIII), Madrid, Spain, through the Fondo de Investigación para la Salud (FIS), FEDER funds and Consorcio CIBER, M.P. Fisiopatología de la Obesidad y Nutrición (CIBEROBN), ISCIII, Madrid, Spain.

SHORT ORAL ABSTRACT 3
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Effect of gamification in health behaviour applications for cardiometabolic health: A systematic review and meta-analysis of randomized controlled trials

Introduction: Health behaviour applications (apps) on web and phone platforms can support improved health and well-being through evidence informed approaches. Gamification, which is the use of game elements in a non-game situation, shows promise within apps and has proven effective in many fields. However, key questions remain concerning gamification in apps to modify health behaviours and reduce cardiometabolic risk.
Objective: To conduct a systematic review and meta-analysis investigating if apps with gamification compared to those without would have greater beneficial effects on cardiometabolic risk factors in adults.
Methods: MEDLINE, EMBASE, and Cochrane library databases were searched (through December 5, 2022). Randomized controlled trials of ≥8 weeks duration were included that assessed the effect of gamification on cardiometabolic risk factors (i.e., glycemic control, lipid profile, blood pressure, body weight) in adults (≥18 years). Three independent reviewers extracted relevant data and assessed risk of bias. Data were pooled using random or fixed effects models and expressed as mean differences (MDs) with 95% confidence intervals (CIs). Heterogeneity was assessed (Cochran Q statistic) and quantified (I2 statistic). Certainty of the evidence for each outcome was assessed using GRADE.
Results: No statistically significant differences were observed for the use of an app with gamification compared to without for glycemic control (fasting glucose: n=367, MD 0.05, 95% CI -0.19 to 0.28 mmol/L; HbA1c: n=156, MD 0.53, 95% CI -0.19 to 1.12), lipid profile (n=523, LDL: MD 0.05, 95% CI -0.08 to 0.17 mmol/L; HDL: MD 0.04, 95% CI -0.01 to 0.09 mmol/L, total cholesterol: MD 0.07, 95% CI -0.06 to 0.20; triglycerides: MD 0.02, 95% CI -0.15 to 0.18 mmol/L), blood pressure (n=523, systolic: MD -1.01, 95% CI -3.19 to 1.17 mmHg; diastolic: MD -0.98, 95% CI -2.37 to 0.42 mmHg), nor body weight (n=1619, MD 0.31, 95% CI -0.12 to 0.74 kg). Overall certainty of evidence for all assessed outcomes was low to very low owing to imprecision and inconsistency.
Conclusion: Inclusion of gamification in apps was not shown to have an additional beneficial effect on cardiometabolic risk factors. Longer duration studies in at risk populations are needed to further assess the effectiveness of gamification.
Funding: None

SHORT ORAL ABSTRACT 4
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Health 4.0: PROTEIN mobile application for Type 2 diabetes

Introduction
The Internet of things (IoT) is revolutionizing the healthcare sector by giving innovative solutions to the management of non-communicable diseases (NCDs). Artificial intelligence (AI) and IoT are strategically used to enable better management of NCDs, such as type 2 diabetes. The PROTEIN project embraced health 4.0 principles in our pilot study by integrating wearables with a personalized nutrition and physical activity application.
Objectives
We aim to customize meal plans according to data from the PROTEIN health expert team, the subjects' preferences, and their continuous glucose monitor (CGM) data. Our primary objective is to improve the time in range (TIR) of the study participants by 5%. Our secondary objective is to guide the participants towards a healthier lifestyle.
Methods PROTEIN, an RCT, has a 3-month intervention period. Here, the subjects will use our application, a CGM and an activity tracker as interacting tools to collect essential data to provide personalization. The AI advisor is responsible for providing biweekly meal plans. The researchers onsite uploaded CGM data that were used to provide customized plans according to postprandial glucose excursions during the intervention period. We analysed the TIR of the participants while and without using the PROTEIN-app. To analyse if the participants (n=23) were led to a healthier lifestyle, we looked at their interaction with the application measured by days that the app was used.
Results
The participants improved their TIR significantly (p=0,032), from 70,8% to 75,4%, while using the PROTEIN-app versus without the PROTEIN-app. The participants interacted with the PROTEIN-app 64% of the total registered days. There was a significant (p=0,006) correlation between the percentage of days that the app was used and the change in TIR. This shows that higher engagement with the PROTEIN-app improves glucose management.
Conclusions
The framework created through intense interdisciplinary collaboration during the project contributed to increasing knowledge on nutrition and diabetes research field that urgently needs further improvements before providing a non-pharmacological treatment option. Future research should welcome Health 5.0 and take personalized lifestyle regimes to the next level.
Funding European Union's Horizon 2020 research and innovation program under grant agreement No 817732
Keywords: Lifestyle and personalized nutrition

SHORT ORAL ABSTRACT 5
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NEFA dynamics in adults with severe obesity and insulin resistance: no coupling to the rs9939609 FTO risk allele

Introduction: The FTO gene is highly expressed in adipose tissues, however whether non-esterified fatty acids (NEFA) dynamics is impacted by FTO has not been rigorously tested for in a study population uniformly obese and comprising both sexes.
Objectives: To test for associations of the rs9939609 FTO risk allele with NEFA suppression.
Methods: We investigated 97 subjects with severe obesity but without diabetes, having genotype TT (n=32), AT (n=31) or AA (n=34) in a cross-sectional observation study. NEFA suppression was assessed from a low-dose hyperinsulinemic euglycemic clamp with glucose-tracer as well as from the response to a standardized meal. Insulin sensitivity was assessed by hepatic and total insulin sensitivity measurements in the clamp and by the Matsuda index during the meal. Variabels of possible importance for NEFA dynamics were primarly assessed by linear regression.
Results: No genotype associations with fasting or suppressed NEFA were found whether in the clamp or meal situation. ($p > 0.7$ for all comparisons). Independent of genotype, higher fasting concentrations of NEFA and larger NEFA suppression were found in females compared with males. Fasting NEFA or degree of suppression were not associated with total fat mass or BMI. The respiratory quotient (RQ) was negatively associated with NEFA suppression.
Conclusion: In a gender-mixed adult population of obese individuals an FTO obesity risk allele did not affect fasting NEFA nor suppression thereof. These negative results on NEFA dynamics appear strengthened by the documentation of gender influence and associations with parameters reflective of insulin resistance.
Keywords: NEFA suppression, FTO rs9939609, insulin sensitivity, RQ, euglycemic clamp, meal test.
Funding: Two committees supported the study financially: 1) The Liaison Committee between the Central Norway Regional Health Authority (RHA) and the Norwegian University of Science and Technology (NTNU) and 2) The Joint Research Committee of St. Olavs Hospital and the Faculty of Medicine and Health Sciences at NTNU, Trondheim, Norway. The supporting sources had no involvement or restrictions regarding publication.

SHORT ORAL ABSTRACT 6
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The effect of alginate encapsulated supplements on substrate utilization, performance and health

Background: Carbohydrate (CHO) ingestion during exercise has been demonstrated to improve exercise performance. During ultra-endurance exercise (>2.5-3 hrs) an intake of CHO of up to 90 g/hr is recommended. Although these high rates benefit performance, they may also potentiate gastrointestinal (GI) distress. Thus, alginate hydrogels present a new nutritional solution, which may improve the substrate utilization by prolonging the release rate of nutrients. A nutritional solution, which may have beneficial effects in Diabetics. Purpose: to investigate the effect of an alginate encapsulation technology, where we encapsulate CHOs. Our primary end-point is cycling performance. Secondary end-points include substrate utilization and dental health. Method: In a randomized, cross-over, clinical trial 10 healthy men, 18-50 years and accustomed to cycling (e.g. cyclists, triathletes), completed a preliminary test and 3 experimental days separated by min. 6 days. An experimental day consisted of a preload followed by a Time-To-Exhaustion (TTE) performance test and a subsequent 2-hour recovery. Subjects ingested either: A) encapsulated CHO and amino acids, B) encapsulated CHO-only or C) CHO-only (not encapsulated) during the preload. During each experimental trial blood-, urine- and saliva samples were collected. Results: During recovery there was a significant difference in plasma glucose and insulin responses between products ($p=0.0006$ and $p=0.0018$, respectively). Higher plasma glucose was evident with product C vs. A and B ($P < 0.001$ and $P < 0.01$, respectively). In addition, higher plasma insulin response was found after intake of product C compared to A and B ($P < 0.01$ and $P < 0.01$, respectively). No differences in plasma glucose and insulin were found during the preload. No differences were found in TTE between treatments ($p= 0.4145$) nor in the pH of saliva ($p= 0.3648$). Perspectives: Understanding how prolonging the release rates of carbohydrates affects the substrate utilization may result in new nutritional solution for endurance athletes and potentially for Diabetics. These are preliminary data.
Keywords: Macronutrients and Lifestyle
Funding: Innovation Fund Denmark

SHORT ORAL ABSTRACT 7
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Undesired side effects of formula diets on erythropoietic parameters – data from three randomized controlled trials

Introduction: For prevention and therapy of type 2 diabetes (T2DM), formula diets are considered to be effective due to rapid, strong weight loss, even supporting diabetes remission. However, the spectrum of undesired side effects is insufficiently described and recent publications indicate potential harm to erythropoiesis.
Objective: We assess effects of formula diets on erythropoiesis in three RCTs with prediabetes (DiNA-P: n=267) and T2DM patients (DiNA-D: n=177; FAIR: n=55).
Methods: DiNA-P and DiNA-D started with a 3-week randomised hypocaloric diet phase (1200-1500 kcal/d) following low-carb (< 40 g/d) or low-fat design (< 30 kcal%). Prediabetes patients used conventional food products for both diets, while the low-fat approach for T2DM patients was a formula diet (MODIFAST/Vitalkost Nr. 1). In the FAIR study, T2DM patients underwent a 3-months formula diet (Hepafast vs. OptiFast) of 600-800 kcal/day. In all three trials, metabolic assessment was accomodated by the analysis of erythrocyte parameters as safety outcomes.
Results: In DiNA-P, both diet groups showed significant, but clinically minor reductions of hemoglobin, hematocrit, MCV and iron after 3 weeks, with stronger effects on iron in the low-carb diet. MCH and ferritin decreased under low-fat regime, only. Red blood cell counts (RBCC) remained unchanged. No patient fulfilled criteria of anemia.
In DiNA-D, both diets led to the reduction of RBCC, hematocrit, iron and transferrin saturation. Additionally, low-fat formula diet markedly reduced hemoglobin and erythrocyte variability (RDW-CV), while only the low-carb diet decreased ferritin.
The low-fat formula diet had a significantly stronger impact on RBCC, hematocrit, hemoglobin and RDW-CV.
In the FAIR study, only the OptiFast group developed a significant decrease in RBCC, hemoglobin and hematocrit as well as changes in erythrocyte morphology, starting after 1 week and maintained after 3 months.
Discussion: We demonstrate a consistent, qualitative alteration of erythropoiesis as specific side effect of formula diets with low-to-moderate protein content. Prolonged regimes in trials and clinical practice may lead to anemia. Additional aspects are rheologically desired hemodilution and a potential impact on the validity of HbA1c measurements in these patients. Further studies are warranted.
Fundings: DZD, DDG, CWC, EFSD
Keywords: Formula diet, side effects, erythropoiesis, protein intake, diabetes remission

SHORT ORAL ABSTRACT 8

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The Portfolio Dietary Pattern and Risk of Cardiovascular Disease: Findings from Three Prospective Cohort Studies

Introduction: The plant-based portfolio dietary pattern includes recognized cholesterol-lowering foods shown to improve several cardiovascular disease (CVD) risk factors in randomized controlled trials, however, there is limited evidence on the role of long-term adherence to the diet and CVD risk.
Objective: To examine the relationship between the portfolio dietary pattern and the risk of total CVD, coronary heart disease (CHD, including myocardial infarction and fatal CHD), and stroke.
Methods: We prospectively followed 73,924 women in the Nurses' Health Study (NHS) (1984-2016), 92,346 women in the NHSII (1991-2017), and 43,970 men from the Health Professionals Follow-up Study (HPFS) (1986-2016) without CVD and cancer at baseline. Diet was assessed using validated food frequency questionnaires at baseline and every four years using a portfolio diet score (PDS) which positively ranks plant protein (legumes), nuts and seeds, viscous fiber sources, phytosterols (mg/day), and plant monounsaturated fat sources, and negatively ranks foods high in saturated fat and cholesterol.
Results: Over 30 years of follow-up, 16,917 incident CVD cases, including 10,666 CHD cases and 6,473 strokes, were documented. After multivariable adjustment for lifestyle factors and a Modified Alternate Healthy Eating Index (excluding overlapping components), comparing the highest to the lowest quintile, participants with a higher PDS had a lower risk of total CVD (pooled HR: 0.86; 95% CI: 0.81-0.92, P trend<0.001), CHD (pooled HR: 0.86; 95% CI: 0.80-0.93, P trend=0.0001) and stroke (pooled HR: 0.86; 95% CI: 0.78-0.95, P trend=0.0003). In addition, a 25-percentile higher PDS was associated with a lower risk of total CVD (pooled HR: 0.92; 95% CI: 0.89-0.95), CHD (pooled HR: 0.92; 95% CI: 0.88-0.95) and stroke (pooled HR: 0.92; 95% CI: 0.87-0.96). Results remained consistent across sensitivity and most subgroup analyses, and there was no evidence of departure from linearity for CVD, CHD, or stroke.
Conclusions: Greater adherence to the portfolio dietary pattern was associated with a lower risk of CVD, including CHD and stroke, in three large prospective cohorts.
Funding: Canadian Institutes of Health Research, Diabetes Canada End Diabetes 100 Award, and the National Institutes of Health.
Keywords: Food, dietary patterns

SHORT ORAL ABSTRACT 9
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Feasibility of a Web-Based Health Application (PortfolioDiet.app) to Translate Nutrition Therapy for Cardiovascular Disease Risk Reduction in High-Risk Adults: A Pilot Study

Introduction: The Portfolio Diet is a plant-based dietary pattern that combines recognized cholesterol-lowering foods to manage dyslipidemia for the prevention of cardiovascular disease (CVD). To enhance the implementation of the Portfolio Diet in primary care settings, we developed the PortfolioDiet.app as a patient-facing engagement and educational tool. Our objective was to evaluate the effect of the PortfolfioDiet.app on dietary adherence over 3-months in the app's intended population of adults at high CVD risk.
Methods: A total of 41 potential participants in an ongoing study (ClinicalTrials.gov Identifier: NCT02481466) were invited by email to participate in a sub-study and be randomized (1:1) to 12-weeks of using the PortfolioDiet.app or a waitlist control. Adherence to the Portfolio Diet was assessed using 7-day weighed diet records at baseline and 12-weeks using the clinical-Portfolio Diet Score (c-PDS). Additionally, we evaluated app usage through the app's online repository and app usability with the System Usability Scale, with a score higher than 70 being considered acceptable, at 12-weeks.
Results: Between July 2021 and February 2022, a total of 15 participants were telephone screened and 14 were randomized (intervention: n=8; control: n=6) and completed the study. Participants were primarily female (64%), white (57%), 65±8 (mean±SD) years of age, 71% were on lipid-lowering medication, 29% had type 2 diabetes. Baseline adherence to the Portfolio Diet was high in both groups with a c-PDS of 13.2/25.0 (53%) points in the app group and 13.7/25.0 (55%) points in the control. Adherence increased by 1.25±2.8 (5.0%) points in the app and 0.19±4.4 (0.8%) points in the control group, yet neither increase was statistically significant and there was no difference between groups ($P>0.05$). Participants logged into the app 18±14 days per month over the 3-month follow-up period and the average System Usability Scale score was 80.9±17.3, indicating a high level of usability.
Conclusions: No difference was found for dietary adherence between the two groups; however, this pilot study suggests the PortfolioDiet.app is considered usable by adults at high risk of CVD. A randomized controlled trial investigating health-related outcomes, such as lipid targets, using the PortfolioDiet.app is warranted.
Funding: The Canadian Institutes of Health Research
Key words: Food, Dietary Patterns

SHORT ORAL ABSTRACT 10
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THE POSSIBLE ROLE OF BREAKFAST AND SLEEP QUALITY IN THE GLYCEMIC CONTROL OF PATIENTS IN TYPE 2 DIABETES

INTRODUCTION
International guidelines recommend various eating patterns for people with type 2 diabetes. Eating and sleep habits such as breakfast consumption and sleep quality seem to play a role in diabetes management.
OBJECTIVES
The present study examines the possible role of breakfast, and sleep quality in the glycemic control of patients with type 2 diabetes mellitus (T2DM).
METHODS
The study sample consisted of adults with type 2 diabetes in the outpatient diabetes clinics and the diabetic foot clinic of the General Hospital of Athens “Laiko”. Patients answered a questionnaire with the help of a dietitian-nutritionist. The validated visual-analog scale SQS (Sleep Quality Scale) helped to assess sleep quality. We used the IBM SPSS STATISTICS 28.0 program for the analysis.
RESULTS
The study included 205 people with T2DM. Fifty-two patients (25.4%) did not eat breakfast. Breakfast skippers, in comparison with breakfast eaters, were younger (63 ± 9.9and 66.9 ± 10.4 years, respectively, p=0.011); had a shorter duration of diabetes(12.4 ± 9.8 and 15.5 ± 10.1 years respectively, p=0.028); and the mean BMI values tended to be higher (33.0 ± 7.3 and 31.1 ± 7.9 kg/m2, respectively, p= 0.058). Breakfast skippers reported eating dinner as the largest meal of the day (p<0.001). In particular, 30.8% of breakfast skippers and 7.8% of breakfast eaters have a large dinner. We found no significant correlation between breakfast consumption and HbA1c. There was a significant difference between the SQS grade and people having a large dinner (p=0.011). It appeared that there is a negative linear relationship between the SQS and HbA1c values (pho:-0.212, p=0.003), between SQS and BMI (pho:-0.154, p=0.028), and between the age of patients and BMI (pho: -0.245, p< 0,001). There was a positive linear relationship, between the age of patients and meals per day (pho:0.175, p=0.012), between the age of patients and diabetes duration (pho:0.417, p<0,001)and, finally, between diabetes duration and meals per day (pho:0.237, p<0.001).
CONCLUSIONS
Breakfast skippers tend to eat a large dinner. Sleep quality appears to be associated with better glycemic control. The relationship between breakfast, sleep quality, and the regulation of T2DM needs further investigation.
KEYWORDS
diabetes, breakfast, sleep, lifestyle, personalized nutrition

SHORT ORAL ABSTRACT 11
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Adherence to healthy lifestyle behaviors, and cardiometabolic risk factors in the CORALS children cohort.

Introduction: Inverse associations between combined adherence to healthy lifestyle behaviors and certain cardiometabolic risk factors have been reported in observational studies. However, none of these studies have assessed breastfeeding, eating speed or adherence to Mediterranean diet as lifestyle behaviors.
Objective: To assess concomitant and individual associations between adherence to 6-healthy lifestyle behaviors and cardiometabolic risk factors in Spanish preschool children.
Methods: Baseline cross-sectional analyses were conducted in the CORALS study cohort (n=1,371), in children aged 3-6 years. Six recognized healthy lifestyle behaviors (breastfeeding, sleep duration, physical activity, sedentary behaviors, adherence to Mediterranean diet and eating speed) were assessed and included in a composite score. Unadjusted and adjusted multiple linear and logistic regression models were fitted to assess the associations with certain cardiometabolic risk factors (weight status, waist circumference, fat mass index, blood pressure, fasting plasma glucose and lipid profile).
Results: In full-adjusted models, compared with the reference category of adherence to the composite score comprised of 6-healthy lifestyle behaviors, participants in the category of highest adherence showed a lower prevalence risk of overweight or obesity (OR, 0.4; 95% CI, 0.2, 0.6; P< 0.01), waist circumference [β, -1.4 cm; 95% CI, -2.5, -0.4 cm; P< 0.01), fat mass index [β, -0.3 kg/m2; 95% CI, -0.5, -0.1 kg/m2; P< 0.05), systolic blood pressure [β, -3.0 mmHg; 95% CI; -5.2, -0.9 mmHg; P< 0.01) and fasting plasma glucose concentration [β, -1.9 mg/dL; 95% CI, -3.5, -0.4 mg/dL; P< 0.05). Slow eating was one of the major contributors in individual associations between each of the 6-healthy lifestyle behaviors and cardiometabolic risk factors and was the only lifestyle behavior inversely associated with fasting plasma glucose concentration.
Conclusions: Higher adherence to the composite score comprised of 6-healthy lifestyle behaviors was associated with lower adiposity, systolic blood pressure and fasting plasma glucose concentration in preschool children. Further prospective long-term and intervention studies are required to confirm these associations.

SHORT ORAL ABSTRACT 12
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Validation of a web-based program used for diet registration in adults with type 1 diabetes

Introduction: Nutrition Data (ND) is a web-based program for nutrition analysis, and diet and exercise registration. It may have the potential to be used in people with type 1 diabetes (T1D) to facilitate both diet registration and carbohydrate counting, and help track blood sugar levels and insulin doses.
Objectives: To evaluate user acceptability and relative validity of a web-based program used to measure energy, carbohydrate and other macronutrient intake in adults with T1D.
Methods: Forty-two adults with T1D (45% women, median age 48 years, median BMI 25.7) registered their daily intake in ND as part of the randomized controlled trial DANCE. Intakes from ND were compared against the intakes acquired by two unannounced 24-hour-recalls on overlapping days. Primary outcome was % of total energy intake (TEI) from carbohydrates, while secondary include energy intake (kcal/day), carbohydrate intake (gram/day), fat intake (% TEI and gram/day) and protein intake (% TEI and gram/day). Usability and user acceptability were assessed with a questionnaire.
Results: The Spearman's correlation coefficient for the different macronutrient intakes ranged from r=0.79 to r=0.90 and for energy intake was r=0.77. The Bland-Altman plots showed a varying bias for the macronutrients but with good relative agreement. The mean energy intake measured by the ND was 29 kcal/day less compared to the 24-hour-recall but the 95% limits of agreement were wide (- 595, 538 kcal/day). The majority of the participants (68%) found ND easy to use and helpful for carbohydrate counting (87%). Median time of registration was 20 min/day (12.5, 30).
Conclusions: The web-based program Nutrition Data can be a useful method for diet registration and carbohydrate counting in people with T1D.
Fundings: This validation study is part of the DANCE-study, which is funded by Skandia Research Foundation, Kostfonden, Swedish Diabetes Association, Swedish governmental funding of clinical research and Nutricia Research Foundation
Keywords: macronutrients, personalized nutrition

SHORT ORAL ABSTRACT 13
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Relation of Food Sources of Fructose Containing Sugars with Adiposity Outcomes: A Systematic Review and Meta-Analysis of Prospective Cohort Studies

Objective: Sugars have been implicated in the epidemic of obesity. It is unclear whether food sources of fructose-containing sugars other than sugar-sweetened beverages (SSBs) are associated with increased risk of obesity. To assess the evidence of the relation of food sources of fructose-containing sugars with incident overweight or obesity, we undertook a systematic review and meta-analysis of prospective cohort studies.
Methods: We searched MEDLINE, EMBASE and Cochrane Library through April 2023. We included prospective cohort studies of ≥ 1 year. Two reviewers extracted data and assessed the risk of bias. The primary outcome was incident overweight/obesity (OW/OB). Data were pooled using generic-inverse variance method (random effects) and expressed as relative risks (RR) for incident outcomes and ß-coefficients for WC with 95% confidence intervals (CI). GRADE assessed the certainty of evidence
Results: We included 23 prospective cohorts involving 375,243 adults. Five food sources of fructose-containing sugars were identified: SSBs, 100% fruit juice, fruit, yogurt and sweets. SSBs were associated with increased incident OW/OB (RR, 1.22 [95% CI, 1.03 to 1.45]) and incident abdominal obesity (1.15 [1.05 to 1.25]) but were not significantly associated with change in WC (ß, 0.48 cm [-0.08 to 1.05]). There was no association between fruit juice and incident abdominal obesity or WC, and no data was available on incident OW/OB. Fruit was associated with decreased incident OW/OB (0.87 [0.80 to 0.95]), decreased incident abdominal obesity (0.68 [0.58 to 0.80]) and decreased WC (-0.23 cm [-0.33 to -0.13]). Yogurt was associated with decreased incident abdominal obesity (0.76 [0.61 to 0.95]), but there was no association with incident OW/OB and no data was available on WC. There was no association between sweets and incident OW/OB or change in WC, and no data was available on incident abdominal obesity. The certainty of the evidence was graded as “very low” to “moderate”.
Conclusions: Current evidence indicates that the relation between fructose-containing sugars and obesity outcomes differs by food sources. More research of more food sources of sugars is needed to improve our certainty in the evidence. (ClinicalTrials.gov, NCT02558920)
Funding Sources: American Society for Nutrition, Diabetes Canada, Banting and Best Diabetes Centre, Canadian Institutes of Health Research

SHORT ORAL ABSTRACT 14
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Association Between Dietary Phytosterols and Risk of Cardiovascular Disease Mortality in US Adults: Findings from the Third National Health and Nutrition Examination Survey (NHANES III), 1988–1994

Introduction
Phytosterols (plant sterols) are naturally occurring components of plant food sources, including vegetable oils, nuts, cereals and legumes. Their chemical structure impedes intestinal cholesterol absorption and regular consumption has been related to lower serum low-density cholesterol (LDL-C), a causal risk factor for cardiovascular disease (CVD). The association between dietary plant sterol intake and CVD has yet to be determined.
Objective
We aimed to examine the association of phytosterol consumption in the diet with CVD mortality in US adults the National Health & Nutrition Examination Survey III (NHANES III), 1988–1994.
Methods
We conducted a prospective analysis on NHANES III cohort linked with the National Death Index mortality data (2019). We included 13,005 adults aged 20 years who were non-pregnant, free of CVD at baseline and completed ≥1 24h dietary recall with plausible caloric intake data. We created a database quantifying the phytosterol content of foods in the 24h dietary recall data and estimated usual intake using the NCI method. We estimated hazard ratios (HRs) and 95% CIs of the association of phytosterols and CVD mortality using Cox proportional hazards, with adjustment for potential sociodemographic, clinical and behavioural confounders.
Results
Over a mean follow-up period of 23y, 1,703 CVD deaths occurred in a population with a mean dietary plant sterol usual intake of 245 mg/day. The top sources of dietary phytosterols were from potatoes (23%), wheat and other grains (21%) and beans, legumes and nuts (13%). Mean usual intake in the 10th (Q1) and 90th (Q5) percentiles was 152 and 407 mg/day, respectively Participants with the highest intake of plant sterols had a lower risk of CVD mortality (HR 0.65; 95% CI: 0.43 to 0.96).
Conclusions
Preliminary analyses suggest a CVD benefit in the highest versus lowest intakes of dietary plant sterols in the US population. We will explore an expanded multivariable model including the Healthy Eating Index (diet quality) and stratification by healthful and unhealthful sources of phytosterols to determine the robustness of the association.
Funding
CIHR, BBDC, Toronto 3D Knowledge Synthesis and Clinical Trials foundation, Amgen Scholars Program
Key words: plant sterols, cardiovascular disease

SHORT ORAL ABSTRACT 15
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Short-chain fatty acids in plasma after the intake of fermentable cereal fibres-An extended postprandial study (FiFerM)

Introduction: The beneficial effects of dietary fibre are partly mediated by short-chain fatty acids (SCFA) produced through intestinal bacterial fermentation. However, not all fibres are equally able to stimulate SCFA production and probably each fibre could induce a specific fermentation pattern.
Objective: To depict differences in plasma SCFA profiles after the ingestion of two different fibre sources vs an inert fibre control in individuals at high cardiometabolic risk.
Methods: According to a randomized-controlled cross-over study design, twenty overweight/obese individuals, aged 30-75 years, consumed, at one-week interval, three test products (bread with arabinoxylans (AX), wheat bran puff, and cellulose puff as control) within breakfast meals, providing 11 g of fibre, similar for energy and macronutrient composition. Plasma samples were collected for SCFA analysis at fasting, for 8-hour after the test breakfast, with the same lunch without fermentable fibres consumed at the sixth hour.
Results: Acetate response to test fibres was much greater (about twenty times) than that of propionate and butyrate. Acetate began to increase 4-hours after all three test breakfasts and returned to baseline after 8-hours, with no differences between the test fibres. Propionate and butyrate profiles after the three breakfasts showed a biphasic pattern; they began to increase already after 1-hour and returned to baseline after 6-hours; then a more marked increase was observed lasting until the following morning. The average daily plasma levels of propionate were about 25% higher after AX than after wheat bran puffs; the difference became significant during the 8-hours after breakfast to the next morning ($p<0.05$). Conversely, the average daily levels of butyrate were similar after AX and bran. A significant correlation was observed between butyrate produced after AX and bran ($r=0.627$, $p<0.01$); conversely, there was no correlation between the two test fibres for acetate and propionate.
Conclusions: Arabinoxylan consumption induces a different plasma SCFA pattern than wheat bran, with propionate increase more pronounced after AX, whereas butyrate and acetate have similar daily plasma profiles after the two test fibers.
Funding. This research was supported by Italian Ministry of University and Research, within the DiGuMet Project, JPI-HDHL
Keywords: dietary fibre, SCFA, arabinoxylans, wheat bran

SHORT ORAL ABSTRACT 16
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Evaluation of the usability and adherence of the PROTEIN App

Introduction: A health behavior change is essential for the successful management of Type 2 diabetes. Due to the development of new technologies, there is a rise in the availability of and access to digital health and mobile wellness solutions. However, the biggest challenge remains maintaining user engagement with these mobile applications for longer periods of time.
Objective: To evaluate the usability and adherence of a mHealth application in participants with Type 2 Diabetes or Prediabetes.
Methods: The usability of the PROTEIN app was evaluated using the mHealth App Usability Questionnaire (MAUQ), a validated questionnaire consisting of 21 questions, answered using the Likert scale. As for adherence, we analyzed the engagement of the participant.
Results: Out of 27 individuals, 59% dropped out of the study. Those who dropped out used the app for an average of 19 (±17.62 SD) days, compared to the compliant participants (41%) who used it for an average of 59 (±23.49 SD) days out of 84 days planned. There were no significant differences at baseline between the two groups.
The MUAQ questionnaire results are divided in three sections: (1) easiness of use and satisfaction (alpha = 0,988): where the majority agreed that although the app was not easy to use and the interface was challenging, they found it easy to learn how to use it; (2) interface satisfaction (alpha = 0,946) where participants felt uncomfortable using the app in social settings and did not consider it useful for health and well-being. Still, they expressed overall satisfaction with the app; and (3) usefulness (alpha = 0.944), where the app did not have the expected functions and did not help manage health.
Conclusion: The results of the MUAQ highlight limitations and potential areas for improvement regarding mHealth apps for individuals with Type 2 Diabetes or Prediabetes. There were no baseline parameters that could help us predict if a participant would drop out of the study. This high quote may be explained by the questionnaire responses, such as being hard to use or lack of perceived usefulness. Further investigation is needed to provide better solutions to support sustained lifestyle changes.
Founding: European Union's Horizon 2020 research and innovation programme under grant agreement No 817732
Keywords: Personalized nutrition, Lifestyle

SHORT ORAL ABSTRACT 17
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Effect of Soy Protein on Blood Pressure: A systematic review and meta-analysis of randomized controlled feeding trials

Objective: Soy protein's approved health claim for coronary heart disease risk reduction is based on its ability to lower cholesterol. The evidence for its ability to lower blood pressure, a leading modifiable risk factor for coronary heart disease, remains unclear. To clarify the effects of soy protein on blood pressure, we conducted a systematic review and meta-analysis of randomized controlled trials.
Methods: MEDLINE, Embase, and The Cochrane Central Register of Controlled Trials were searched through January 19, 2023. We included randomized controlled feeding trials of >3 weeks. Two independent reviewers extracted data and assessed risk of bias. Outcomes included systolic and diastolic blood pressure. Data were pooled using the inverse variance method and expressed as a mean difference (MD) with 95% confidence intervals (95% CI). GRADE assessed certainty of evidence.
Results: We included 45 randomized controlled trials in 3,348 participants with and without hypertension. Sources of soy protein included whole soy protein and isolated soy protein with a median dose of 25 g soy protein. Comparators included whole food animal proteins, whey, casein, milk protein, cow's milk, carbohydrate, usual diet or placebo. Soy protein reduced systolic blood pressure (MD, -1.32 mmHg [95% CI, -2.18 to -0.47 mmHg] and diastolic blood pressure (MD, -1.00 mmHg [95% CI, -1.90 to -0.10 mmHg]. The certainty of evidence was low for both SBP and DBP, owing to downgrades for inconsistency and imprecision.
Conclusion: Current evidence suggests that soy protein may have a small advantage for blood pressure in participants with and without hypertension. ClinicalTrials.gov identifier, NCT05638061.
Funding: Canadian Institutes of Health Research

SHORT ORAL ABSTRACT 18
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Impact of polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) on human semen quality.

Introduction: The foods we eat and how we produce them could be a determinant of population health and the development of different chronic diseases such as obesity, diabetes and infertility. In particular, the incidence of infertility has increased considerably in the last decade. It currently affects about 15% of the world's population and male factors are responsible for 40-50% of cases. Several modifiable factors have been linked to impaired sperm quality, including diet type and dietary exposure to potential endocrine disruptors. It has been hypothesized that dietary exposure to polychlorinated dibenzo-p-dioxins (PCDDs) and to polychlorinated dibenzofurans (PCDFs), recognized as endocrine disruptors (EDs), could play an important role in occurrence of infertility and other chronic diseases. It is known that more than 90% of total PCDD/Fs exposure come from dietary sources. However, studies assessing the relationship between the dietary exposure to PCDD/Fs and human sperm quality are limited. Objective: To cross-sectionally assess the associations between dietary intake of PCDD/Fs and sperm quality parameters including: pH and semen volume, total sperm count, sperm concentration, vitality, progressive, non-progressive and total motility, immotility, and morphology in an adult male population. Methods: The dietary exposure to PCDD/Fs was estimated in 191 participants aged 18-40 years from the LED-FERTYL study, using the most updated levels in food (expressed as toxic equivalents-TEQ) and a 143-item validated food-frequency questionnaire. Associations between tertiles of PCDD/Fs dietary intake (in pgTEQ/week) and sperm quality parameters were assessed using lineal and logistic regression models adjusted by confounders. Results: Our results reveled that the highest tertile of PCDD/Fs dietary intake (T3) was related with higher levels of body mass index (BMI) (p=0.041) and higher consumption of fish (p=<0.001), red meat and derivates (p=<0.001). In addition, Participants in T3 showed an increase (β-coefficient [confidence interval]) in the percentage of abnormalities of the sperm head (6.02 % [1.24;10.78]; P-trend= 0.031). No other significant association was found in T3 but the tendency was in the expected direction for other morphological parameters and for semen volume, sperm concentration, and total sperm count. Conclusion: Higher dietary intake of PCDD/Fs was associated with sperm head abnormalities and higher levels in BMI. These preliminary analyses already point out major findings that should be studied further.

SESSION 10: SHORT ORAL ABSTRACTS
SHORT ORAL ABSTRACT 19
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The role of sex in the modulation of the daily plasma glucose and insulin profiles during a low or a high glycemic index diet: the MEDGI-Carb trial

Introduction: Recent evidence suggests that the ability to regulate glucose and insulin homeostasis is different in men and women. Against this background, it has been hypothesized that the impact on daily plasma glucose and insulin profiles of the glycemic index (GI) of the habitual diet may differ according to sex.
Objectives: To evaluate whether daily plasma glucose and insulin profiles during a low- or a high-GI diet in individuals at high risk of developing type 2 diabetes are influenced by sex.
Methods: We conducted a randomized, controlled, parallel group dietary intervention, comparing high- versus low-GI diets in a multi-national (Italy, Sweden, and the United States) sample of adults at risk for type 2 diabetes. For 12 weeks, participants consumed either a low-GI or high-GI Mediterranean diet. We assessed daily plasma glucose and insulin profiles in the two intervention groups separately for males and females.
Results: One hundred fifty-six adults (82 females,74 males) with at least two traits of the metabolic syndrome completed the intervention. In females, the high-GI induced significantly higher (23%) average daily plasma glucose concentrations in comparison to the low-GI diet already on the first day of the intervention; the difference increased up to 37 % after 12 weeks of diet. Conversely, there were no significant differences between the two diets in males. These results were confirmed by the two-way analysis of variance showing a statistically significant interaction between the effects of sex and diet on the daily plasma glucose profile ($F=7.887$, $p=0.006$).
Conclusions: The results of our intervention show that women, compared to men, are more sensitive to the metabolic effects of the dietary GI. This has a strong clinical and scientific relevance and might have important implications for dietary strategies for diabetes and cardiovascular disease prevention in the context of personalized nutrition.
Fundings: This research was supported by Barilla International and Barilla USA.
Keywords: Glycemic index; Glucose response; Insulin response; Type 2 diabetes prevention

SHORT ORAL ABSTRACT 20
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Dairy consumption and incident prediabetes: prospective associations and network models in the large population-based Lifelines study

Background: Evidence on associations between dairy consumption and incident prediabetes is inconsistent. One potential explanation for heterogeneity is that health behavior and food intake co-vary with the consumption of various high-fat and low-fat dairy types.
Objective: To investigate the associations of total dairy and dairy types with incident prediabetes, and to assess how dairy intake is linked with metabolic risk factors, lifestyle behaviors and foods, as potential explanations for these associations.
Methods: 74,132 participants from the prospective population-based Lifelines study were included (mean age 45.5±12.3 years, 59.7% female). Dairy intake was measured at baseline using a validated food frequency questionnaire. Prediabetes at follow-up was defined based on the WHO/IEC criteria as fasting plasma glucose of 110-125 mg/dl or A1C levels of 6.0-6.5%. Associations were analyzed using Poisson regression models adjusted for social demographics, lifestyle behaviors, family history of diabetes and food group intake. Interconnections were assessed with mixed graphical model (MGM) networks.
Results: At a mean follow-up of 4.1±1.1 years, 2,746 participants developed prediabetes (3.7%). In regression analyses, neutral associations were found for most dairy types. Intake of plain milk and low-fat (skimmed and semi-skimmed) milk were associated with a higher risk of prediabetes in the top vs. bottom quartiles (RR 1.17, 95%CI 1.05-1.30, ptrend=0.04 and 1.18, 95%CI 1.06-1.31, ptrend=0.01). Strong but non-significant effect estimates for high-fat yogurt in relation to prediabetes were found (RRservings/day 0.80, 95%CI 0.64-1.01). The network analysis showed that low-fat milk clustered with energy-dense foods including bread, meat, and high-fat cheese, and low-fat yogurt with healthy food groups and physical activity, while high-fat yogurt had no clear link with lifestyle risk factors and food intake. A lower intake of high-fat dairy types, and a higher intake of low-fat dairy types was associated with higher baseline diabetes risk.
Conclusions: In this large cohort of Dutch adults, low-fat milk intake was associated with higher prediabetes risk. Network analysis showed clustering of risk factors and behaviors in relation to prediabetes. Heterogeneous associations by dairy type and fat content might partly be attributed to reverse causation and confounding caused by behaviors and food intake related to dairy intake.

SHORT ORAL ABSTRACT 21

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Interplay of olive oil, gut microbiota, and cognitive performance in older adults with overweight/obesity and metabolic syndrome and at high cardiovascular disease risk

Introduction: Mediterranean diet (MedDiet) has been linked with improved cardiometabolic and cognitive health, with a promising mediating role of the gut microbiota. Olive oil, a characteristic component of the MedDiet, is rich in favourable fatty acids and biologically active compounds with potential neuroprotective effects.
Objectives: To assess the associations between olive oil consumption and cognitive function and cognitive decline, and the role of gut microbiota in mediating these associations, in older adults at high cardiovascular disease risk.
Methods: Eligible participants were adults aged 55-75 years with overweight/obesity (BMI: 27-40 kg/m2) and metabolic syndrome. Olive oil consumption was assessed at baseline with a validated 143-items food frequency questionnaire. Cognitive function was examined at baseline and after 2-years of follow-up using a comprehensive battery of neuropsychological tests. Gut microbiota was profiled by 16S rRNA amplicon sequencing from available stool samples at baseline and 1-year follow-up in a sub-cohort of 646 participants. Statistical analyses were performed in STATA and R using multivariable-adjusted linear regression models, permutational multivariate analysis of variance (PERMANOVA), the R package “MaAsLin2” and “mediation” as appropriate.
Results and conclusion: In multivariable-adjusted linear regression analyses, habitual olive oil consumption was studied in association with baseline and changes in cognitive function in 6,647 older adults (48% women, mean age 65±5 years). Higher olive oil consumption was associated with better cognitive status for all cognitive domains at baseline (i.e., attention: 0.28 [0.12,0.44] (β*100 z-score [95% CI*100]), p<0.001; executive function: 0.27 [0.11,0.42], p=0.001; general cognitive function: 0.23 [0.07,0.40], p=0.006; and the global composite score combining all tests: 0.26 [0.11,0.42], p=0.001). A positive association between higher olive oil consumption and a more favourable change in cognitive function was also observed. The mediation analysis assessing the mediatory effect of the gut microbiota on the association observed above is in process, and promising results are expected by May 2023, in time for the DNSG Symposium 2023.
Keywords: olive oil, gut microbiota, cognition, food, macronutrients.
Fundings: This study was supported by the CIBEROBN and ISCIII (Spain) through the Fondo de Investigación para la Salud and FEDER funds and was partially funded by EU-H2020 Grants (Eat2beNICE/H2020-SFS-2016-2).

SHORT ORAL ABSTRACT 22

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Plasma metabolite signature associated with a healthy lifestyle score and risk of type 2 diabetes and cardiovascular disease

Introduction
A healthy lifestyle (HL) has been inversely associated with type 2 diabetes (T2D) and cardiovascular disease (CVD), but few studies have identified its metabolite signature.
Objectives
The aim of the present study was to identify the metabolite signature of a HL score and assess the relationship between the HL and T2D and CVD in individuals at high cardiovascular risk.
Methods
From a set of 385 identified metabolites, we selected those metabolites that were associated with HL (based on the 2018 Word Cancer Research Fund/American Institute for Cancer Research recommendations) using elastic net regressions. We used 1833 PREDIMED study participants free of cardiovascular disease (CVD) but with several cardiovascular risk factors at baseline, and 1522 of these participants whose metabolomic data were available after 1 year of follow-up, as the self-validation sample. A 10 cross-validation procedure was used and the correlation coefficients or AUCs between the identified metabolite profiles and the HL score were evaluated in each pair of training validation data sets within the discovery sample. Finally, we analyzed the prospective associations between the identified metabolomic footprint and the incidence of T2D and CVD using Cox regression models.
Results
The metabolite signatures included 24 metabolites for the dichotomous model (AUC: 0.73, 95% CI: 0.70-0.75) and 58 metabolites for the continuous model (r 0.50, 95% CI: 0.47-0.54), including amino acids, several lipid species, energy intermediates, and xenobiotic compounds. After adjustment for potential confounding factors, low HL was associated with a lower risk of T2D (HR: 0.54, 95% CI: 0.38-0.77) and CVD (HR: 0.59, 95% CI: 0.42-0.83).
Conclusions
A HL was related to a signature of plasmatic metabolites which was associated with an increased risk of incidents of T2D and CVD in a Mediterranean population with high cardiovascular risk.

Funding's
This trial was funded by NIH grants (R01HL118264,R01DK102896) and ISCIII, through the Fondo de Investigación para la Salud (FIS) (PI13/004362,PI16/00501,PI19/00576) and FEDER funds (CB06/03). Consortium CIBER, M.P., CIBEROBN is an initiative of ISCIII, Spain (RD06/0045,RTIC-G03/140).

Decreased serum level of vitamin D imply increased cardiovascular risk in diabetes

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Background: Vitamin D deficiency is common in obese individuals, and that lower circulating concentrations may contribute to increase in metabolic risk. Absorption of vitamin B12, involved in the regulation of homocysteine (HCY) level, decreases with vitamin D deficiency. Increase in HCY level may increase cardiovascular risk (CVR), partly because of an impact on apolipoproteins and inflammatory markers. A possible association of vitamin D with visceral obesity and HCY was studied.
Method: HCY, 25-hydroxyvitamin D, vitamin B12, lipids, and other diabetes-related markers, including lipid accumulation product (LAP), were tested in 613 type 2 diabetic patients divided into four groups (1st group: LAP ≤ Q1; 2nd group: Q1 < LAP ≤ Med; 3rd group: Med < LAP ≤ Q3, 4th group: LAP ≥ Q3) according to LAP quartiles (Q1 = 28.5; Med = 50.59; Q3 = 80.64). LAP as an index, combining waist circumference and triglyceride, is related to risk of metabolic syndrome, diabetes and CVR. In all statistical tests: ANOVA, Tukey post hoc test, and stepwise multivariate linear regression, α=0.05 was considered as statistically significant.
Results: Significant difference in vitamin D and B12, and high-density lipoprotein (HDL) according to LAP groups was determined. HDL differed significantly between the 1st (1.56±0.27) and the 3rd (1.24±0.17), and between the 1st and the 4th (1.19±0.25) group, vitamin D between the 1st (67.21±11.87) and the 3rd (60.34±10.78), and between the 1st and the 4th (51.29±13.41) group, and vitamin B12 differed significantly between the 1st (319.33±158.71) and the 2nd (212.14±71.92) group. After stepwise regression two best predictive variables for vitamin D were glomerular filtration rate (GFR) (parR2=0.12) and LAP (parR2=0.07), for vitamin B12 HCY (parR2=0.07) and age (parR2=0.07), and for HCY GFR (parR2=0.23) and vitamin B12 (parR2=0.09).
Discussion: Vitamins D and B12 differed according to quartiles of LAP, implying an influence of central obesity on their levels. LAP was one of the main predictors of vitamin D, and vitamin B12 was among best predictive variables for HCY. The relationship between vitamin D, vitamin B12 and HCY imply decreased vitamins D to be involved in increase in CVR.

SHORT ORAL ABSTRACT 24
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Beneficial effects of freeze-dried kale bar on type 2 diabetes patients: A randomized, double-blinded, placebo controlled clinical trial

Beneficial effects of freeze-dried kale bar on type 2 diabetes patients: A randomized, double-blinded, placebo controlled clinical trial
Introduction: Type 2 diabetes mellitus is globally considered as one of the most common diseases and the need for more practical solutions in prevention and treatment of diabetes is constantly increasing. Kale (Brassica oleracea L. var. acephala) represents a good source of fiber and minerals like potassium and highly bioavailable calcium, also contains unsaturated fatty acids, prebiotic carbohydrates, various vitamins, health promoting secondary plant metabolites as well as high amounts of proteins (especially essential amino acids as Isoleucine, Leucine and Valine), compared to other Brassica vegetables. Objectives: The previously conducted MAXVEG project [1] on type 2 diabetes patients clearly showed that cabbage and vegetables have a unique beneficial effect on type 2 diabetes. Since it is often time-consuming to cook vegetables in large quantities due to their limited shelf life, the present study used freeze dried kale powder incorporated into a convenient snack bar to investigate the potential health benefits for T2D subjects in a randomized controlled human trial over a 12-week intervention period. Methods: 30 T2D patients were randomly allocated into one of two groups and provided with a either a Placebo snack bar (Control group) or Kale snack bar (Intervention group). They were instructed to consume 3 bars/day along with breakfast, lunch and dinner. The daily intervention contained 35 g of freeze-dried kale powder in total, corresponding to the intake of ca. 430 g fresh kale /day for the intervention group. Blood samples and oral glucose tolerance test (OGTT) were taken prior to and after the intervention, as well as 24-hour blood pressure measurements and DEXA scans. Results: There was a significant improvement in the insulin sensitivity (HOMA) for the Kale group compared to the placebo ($p<0.03$) and a reduction in body weight ($p<0.03$) and Caloric intake ($p<0.05$). There was a clear trend to a decrease in fasted blood glucose and HbA1c compared to placebo, as well as an increase in lipids for the placebo group compared to the intervention group, which was stable. Conclusions: The freeze-dried kale intervention showed significant positive effects on weight and caloric intake within the intervention group. Some positive trends are observed in BMI, blood pressure, cholesterol levels, HbA1c levels and fasten glucose levels. Due to the COVID-19 pandemic it was not possible to collect more data, this would have certainly strengthened the study.
Keywords: Type-2 diabetes; freeze dried kale powder, essential amino acids; Insulin Sensitivity, Calorie intake.
Reference:
1)Thorup A C; Lambert MNT; Jeppesen P B. Strong and Bitter Vegetables from Traditional Cultivars and Cropping Methods Improve the Health Status of Type 2 Diabetics: A Randomized Control Trial. Nutrients. 2021 May 26;13(6):1813. doi: 10.3390/nu13061813.

SHORT ORAL ABSTRACT 25
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Effect of liquid meal replacements on cardiometabolic risk in pre-diabetes and features of metabolic syndrome: a systematic review and meta-analysis of randomized controlled trials

Objective: To synthesize the evidence of the effect of liquid meal replacements on cardiometabolic risk in individuals with pre-diabetes and features of metabolic syndrome.
Methods: MEDLINE, EMBASE and Cochrane Library were searched through September 24, 2022. We included trials of ≥2-weeks comparing the effects of liquid meal replacements as part of a weight loss diet with traditional low-calorie weight loss diets on markers of adiposity (body weight, BMI, body fat and waist circumference), glycemic control (HbA1c, fasting glucose and fasting insulin), blood lipids (LDL-c, HDL-c, non-HDL-c, apo-B and triglycerides) and blood pressure (systolic and diastolic blood pressure) in individuals with pre-diabetes and features of metabolic syndrome. Data were pooled using the generic inverse variance method and expressed as mean difference [95% confidence intervals].
Results: Ten trials (n=1254) met the eligibility criteria. No trials were identified examining apo-B. Compared with traditional low-calorie weight loss diets, use of liquid meal replacements led to greater reductions in body weight (-1.38 kg [-1.81, -0.95]), BMI (-0.56 kg/m2 [-0.78, -0.34]), waist circumference (-1.17 cm [-1.93, -0.41]), HbA1c (-0.11% [-0.22, 0.00]), LDL-c (-0.18 mmol/l [-0.28, -0.08]), non-HDL-c (-0.17 mmol/l [-0.33, -0.01]), and systolic blood pressure (-2.22 mmHg [-4.20, -0.23]). No significant differences were observed for body fat, fasting glucose, fasting insulin, HDL-c, triglycerides, and diastolic blood pressure (p>0.05).
Conclusions: The available evidence suggests that weight loss diets incorporating liquid meal replacements lead to improvements in measures of adiposity, blood lipids, and blood pressure, with a tendency for an improvement in glycemic control beyond traditional low-calorie weight loss diets.
Funding: N/A
Keywords: dietary patterns, food
nu13061813.

SHORT ORAL ABSTRACT 26
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Beneficial glycaemic effects of high-amylose barley bread compared to wheat bread in type 2 diabetes

Background:
Cereals foods with a high content of dietary fibres or amylose have potential to lower postprandial glucose levels. Optimisation of cereal foods may delay development of or improve management of type 2 diabetes (T2D).
Methods:
We investigated the impact on postprandial glucose metabolism of bread made of hulless barley flour (50% or 75%) and wheat flour (50% or 25%) or an RNAi-based amylose-only barley flour (AmOn) (50%) and wheat flour (50%) in subjects with T2D.
Design:
Twenty adults with T2D were randomly allocated to one of four bread each corresponding to 50 g carbohydrate at four separate visits. We measured fasting and 4h postprandial responses of glucose, insulin, glucagon, triacylglycerol, free fatty acids, glucagon-like peptide-1 and gastric inhibitory polypeptide. Mixed model ANOVA was used to examine the differences.
Results:
Bread made from 50% AmOn lowered the postprandial glucose by 34%, 27%, 23% ($P < 0.05$) compared with 100% wheat, 50% or 75% hulless barley, respectively. Bread made from 75% hulless barley reduced the postprandial glucose by 11% ($P < 0.05$) compared to 100% wheat bread.
Postprandial insulin responses were reduced for 50% AmOn by 24% and 35% ($P < 0.05$) compared with 100% wheat and 50% hulless barley, respectively. Postprandial insulin was reduced by 22% ($P < 0.05$) for 75% compared to 50% hulless barley bread.
Conclusions:
Bread made by replacing wheat flour with either 75% hulless barley or 50% AmOn flour lowered postprandial glucose responses compared to 100% wheat bread indicating a beneficial impact in management of T2D.

SHORT ORAL ABSTRACT 27
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The Association of GI, Fiber and Whole Grains with Type 2 Diabetes in Mega Cohorts of over 100,000 participants: A Systematic Review and Meta-analysis

Introduction: The use of Glycemic index (GI) and load (GL) as carbohydrate quality markers for chronic diseases has been debated and considered ineffective when compared with fiber and whole grain intakes.
Objectives: To compare the association of GI, whole grain and fiber with type 2 diabetes (T2D) using the same prospective mega cohorts.
Methods: MEDLINE, EMBASE, Cochrane Library, and PubMed databases were searched up to November 25, 2022, for mega cohorts (≥100,000 participants) assessing the association of GI, whole grain and fiber with incident T2D for at least 1 year. Two independent reviewers extracted the data and assesed risk of bias. Data comparing extreme quantiles were analysed using the generic inverse variance method with DerSimonian and Laird random effects models and expressed as relative risks (RR) with 95% confidence intervals (CI). A fixed effect model was used when <5 observations were available.
Results: Four mega cohort studies were found to provide data on both GI and whole grains. Both low GI and high whole grain were significantly associated with risk of T2D (RR = 0.78; 95%CI: 0.74-0.82, p<0.00001 and RR=0.74; 95%CI: 0.071-0.78, p<0.00001, respectively) using data from the same cohorts. Two mega cohorts provided data on effects of GI and fiber. Both low GI and high fiber were significantly associated with T2D (RR=0.75; 95%CI: 0.70-0.81, p<0.00001 and RR=0.94; 95%CI: 0.89-0.99, p=0.01, respectively) when the same cohorts were used for both exposures.
Conclusions: Despite the limited number of very large cohorts, low GI, and high whole grain and fiber showed significant inverse associations with T2D. These data suggest that GI in addition to whole grain and fiber should be included in dietary guidelines for the prevention of T2D.
Funding: Banting and Best Distinguished Scholar Award
Keywords: Glycemic index, glycemic load, fiber, whole grain, cardiovascular disease, diabetes.

SHORT ORAL ABSTRACT 28
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100% fruit juice consumption and body weight in children and adults: a systematic review and meta-analysis of prospective cohort studies and randomized controlled trials

Background: 100% fruit juice has raised concerns as a potential contributor to weight gain due to its high amounts of free sugars. Current evidence on fruit juice and weight gain has yielded mixed findings from both epidemiological and clinical studies.
Objective: To synthesize the available evidence on 100% fruit juice consumption on body weight in children and adults.
Methods: MEDLINE, EMBASE, and Cochrane databases were searched through September 8th, 2022, for prospective cohort studies (≥ 6 months) and randomized controlled trials (RCTs) (≥ 2 weeks) assessing the effect of 100% fruit juice on body weight in children and adults. In trials, fruit juices were compared to non-caloric controls. Data were pooled using random effects models and presented as coefficients with 95% CIs for cohort studies and mean differences (MD)s with 95% CIs for RCTs.
Results: Thirty-nine articles were included in the analysis including 17 articles in children (17 cohorts; 0 RCTs) and 22 articles in adults (6 cohorts; 16 RCTs). Among cohort studies in children, each serving/day increase of 100% fruit juice was associated with a 0.03 kg/m2 (95% CI: 0.02, 0.05) unit increase in BMI. No trials in children were identified. Among cohort studies in adults the association was mediated by adjustment for energy intake. Studies that did not adjust for energy showed a higher body weight gain (0.21 kg; 95% CI: 0.15, 0.27) than studies that did adjust for energy intake (-0.08 kg; 95% CI: -0.11, -0.05). RCTs in adults found no effect on body weight (MD = -0.28 kg; 95% CI: -0.89, 0.32), and results are consistent in individuals with and without diabetes.
Conclusion: Based on the available evidence from prospective cohort studies, consumption of 100% fruit juice was associated with weight gain among children. Findings in adults found a significant association among studies unadjusted for total energy, suggesting mediation by calories. Trials in adults found no effect of 100% fruit juice on body weight in people with and without diabetes. As overweight and obesity are major risk factors for type 2 diabetes, our findings support public health guidance to consume moderate levels of fruit juice to prevent weight gain and related sequalae.

SHORT ORAL ABSTRACT 29
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Specific impact of different macronutrient components and weight loss on improvement of liver fat within the 12 month-randomized controlled NutriAct trial

Introduction: Recently, a beneficial effect of a dietary intervention focusing on high intake of unsaturated fatty acids (UFA) and protein on intrahepatic lipids (IHL) was demonstrated in the randomized controlled NutriAct trial over 12 months.
Objective: We now aimed to disentangle the impact of slight weight loss and the specific macronutrient components driving this IHL improvement within this trial in middle-aged and elderly subjects (50-80 y) at risk for age-related diseases.
Methods: The NutriAct trial (n=502) analyzed the effect of a high-protein and high-UFA diet vs. dietary recommendations of the German Nutrition Society (DGE) on age related diseases including fatty liver disease. Individuals who completed 3-day food records with available IHL data both at baseline and at month 12 were included in this analysis. The impact of each macronutrient (E%) on IHL (measured by magnetic resonance spectroscopy) was analyzed by linear regression analyses and mediation analysis.
Results: 248 participants were included in the analyses (34% male, median age 66y). Although BMI slightly declined during the intervention period, these changes were similarly in both groups within 12 months (p within groups <0.001, p between groups=0.09), IHL improved more strongly in the intervention group than in controls ($p<0.05$). Participants with stronger increase in protein and PUFA intake and a greater decrease in carbohydrate intake showed a stronger improvement in IHL ($p<0.05$). These associations were partially mediated by weight changes. However, increase in PUFA intake was also directly associated with IHL improvement independent of BMI changes ($p=0.01$).
Conclusions: Beneficial effects of increased protein and decreased carbohydrate intake on IHL are mediated by weight loss in middle-aged and elderly subjects. The effect of high PUFA intake on IHL improvement was partly independent of weight loss. These results give insight into the understanding of a macronutrient specific effect on IHL changes in a long-term dietary intervention.

SHORT ORAL ABSTRACT 30
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The association between inadequate protein intake and presence of sarcopenic obesity in diabetic patients

INTRODUCTION
Sarcopenic obesity and diabetes are two increasing health problems with strong negative clinical impacts which may lead to disabilities and complications, negatively affecting health and survival. Adequate protein and energy intake can help limit and treat age-related declines in muscle mass, strength, and functional abilities. Few studies have investigated the association between inadequate protein intake and presence of sarcopenic obesity in diabetic patients.
OBJECTIVES
The aim of the current pilot study was to obtain preliminary data on the association between protein intake and presence of sarcopenic obesity in community dwelling older diabetic patients.
METHODS
Twenty five community dwelling diabetic older adults (>65years old, 8/25 women) fulfilled an ad hoc questionnaire on diabetes (age of onset, type, insulin/medication use, Hba1c, macro and microvascular complications), performed a bioelectrical impedance analysis (BIA) and the chair stand test. Moreover, the screening tool SARC-F for sarcopenia was performed and the short food questionnaire, Protein Screener 55+ or Pro55+ were used for assessment of the probability for low protein intake.
RESULTS
The study's patients were aged 71.24±4.6 years, the BMI was 28.73±4.98, the mean weight was 81.65 ±15.85 kg and mean HbA1c was 6.87±1.07. The 12% of the patients had a score above average on the 30-sec chair stand questionnaire. Only 8% had a score higher than four on the Sarc-F questionnaire, 48% had a score equal to zero, 28% had 1, 4.0% had 2 and 12.0% had score 3. According to the Protein Screener questionnaire, the majority of the study's patients (52%) had enough protein intake and 48% did not enough. There was not a significant correlation between protein intake and sarcopenia ($p=0.532$). Higher education has a protective role against sarcopenia ($\beta=-0.932$, $p=0.049$), and people who are working and are not pensioners have a significantly lower risk to develop sarcopenia ($\beta=-0.890$, $p=0.048$).
CONCLUSIONS
According to our preliminary results there was not a significant correlation between protein intake and sarcopenia in diabetic patients. Further investigation, with a larger sample is needed.
FUNDINGS There was no funding
KEYWORDS diabetes, sarcopenic obesity, protein intake, aging

SHORT ORAL ABSTRACT 31
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The effect of rare sugars in honey on postprandial blood glucose response: as systematic review and meta-analysis

Introduction
Eighty percent of honey is composed of sugars including glucose, fructose and around thirty rare sugars, some of which have demonstrated effects on glucose response. Our aim was to determine the effect of floral source on acute glucose response and identify the sugars associated with this response.
Methods
We searched Medline, Cochrane and Google Scholar databases till April 2023, for acute, cross-over controlled feeding trials investigating the effect of floral honeys compared to a control matched for available carbohydrates in humans of all health backgrounds. The primary outcome was post-prandial glucose incremental area under the curve (iAUC). Two reviewers extracted the data and assessed the risk of bias and certainty of evidence (GRADE). Data was pooled using generic inverse-variance with random-effects model and expressed as ratio-of-means (RoM) with 95% confidence intervals (CIs). Meta-regression was used to estimate the association of rare sugar amount with acute glucose response.
Results
We included 85 trial comparisons [N=1030] all of which reported honey GI. Honey reduced glucose iAUC by 38% (0.62 [0.58, 0.65]) compared to equivalent glucose with evidence of interaction by floral source ($p<0.001$). The lowest glucose iAUC was estimated for Australian Eucalyptus honeys and Citrus honey. Of the 24 sugars reported, eight were associated with reduction (fructose, 1-kestose, kojibiose, maltulose, palatinose, laminaribiose, raffinose, theanderose), six with increase (maltose, nigerose, gentiobiose, melezitose, panose, maltotriose) and ten with no change in glucose iAUC. The certainty of evidence ranged from very-low to low for the impact of rare sugars on glucose iAUC.
Conclusion
Honey showed reduced glycemic response compared to equivalent glucose and the amount differed by the floral source of honey. There was an indication that the reduction in the honey glycemic response was associated with several rare sugars in addition to fructose. High-quality controlled trials focusing on floral honeys and their rare sugars content are needed to improve the precision of our estimates and address the generalizability of our conclusions.
Keywords
honey, ratio of means, glycemic index, meta-analysis,

SHORT ORAL ABSTRACT 32
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Impulsivity is associated with higher risk to develop type 2 diabetes and cardiovascular disease over 8 years of follow-up in the NutriNet-Santé cohort.

Type 2 diabetes (T2D) and cardiovascular diseases (CVD) are recognized major public health problems. Impulsivity is a psychological trait characterized by making quick decisions without forethought, and has been suggested as a key feature for health-related issues. However, to our knowledge, there is thus far no study has shown prospective associations between trait impulsivity and T2D or CVD.
The aims were to assess prospectively the association between trait impulsivity and the risk of developing T2D and CVDs over 8 years of follow-up.
A prospective study was conducted within the NutriNet-Santé population-based cohort (2014-2023). Trait impulsivity was assessed at baseline with the Barratt Impulsiveness Scale 11. Incident cases of T2D and CVD were collected. Cox regression models, using hazard ratios (HR) per 1SD of impulsivity, were fitted to evaluate the linear association between impulsivity level and T2D and CVD risk. Potential confounders (sociodemographics, lifestyle, and health characteristics) and moderators (age, sex, type 2 diabetes, overweight and diet quality) were considered.
A total of 50,884 individuals were included in the study (women 78.1%; age at baseline=50.5y ±14.5y; T2D cases=556; CVD cases=1,184; median follow-up 7.8y). A linear positive association was found between impulsivity and the risk to develop T2D [HR=1.10 (95%CI: 1.01, 1.20); p=0.026]. A significant interaction between impulsivity and T2D prevalence (yes/no) was found for CVD incidence ($p<0.05$). In individuals with T2D, a positive linear association between impulsivity and CVD was observed [HR=1.28 (1.05, 1.57); p=0.016], while no association was observed in individuals without prevalent T2D [HR=1.00 (0.94, 1.07); p=0.90].
Trait impulsivity is positively associated with T2D incidence. An association between impulsivity and CVD incidence was also observed in individuals with prevalent T2D at baseline. If these results are confirmed in other populations and settings, trait impulsivity could be a promising modifiable risk factor to consider for the prevention of T2D and CVD.
Funding
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Keywords: lifestyle, impulsivity, type 2 diabetes, cardiovascular diseases, cohort.

SHORT ORAL ABSTRACT 33
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Adherence to the Portfolio Diet is associated with improvements in LDL-C and other established cardiovascular risk factors in a younger multiethnic low-risk population

Background: The Portfolio Diet, a plant-based dietary pattern of cholesterol-lowering foods, has demonstrated clinically meaningful reductions in LDL-C and other cardiovascular risk factors. However, the Portfolio Diet has not been assessed in an ethnoculturally diverse population of university students.
Objective: We examined the association with the Portfolio Diet Score and the primary outcome of the established blood lipids (LDL-C, non-HDL-C) as well as other cardiovascular risk factors in the Toronto Nutrigenomics and Health (TNH) Study.
Methods: This cross-sectional analysis included 1,509 men and women (mean age 22.7±2.5 years) of diverse ethnocultural backgrounds in the TNH Study. Adherence to the Portfolio Diet was assessed using the Portfolio Diet Score based on six components (sources of nuts, plant protein coming from soy or pulses, viscous fibre, plant sterols, monounsaturated fat and saturated fat/cholesterol) derived from a validated Toronto-modified Harvard 196-item food frequency questionnaire. Data was analyzed using multiple linear regressions to examine the association with the Portfolio Diet Score and LDL-C, non-HDL-C as well as other cardiovascular risk factors (HDL-C, triglycerides, HbA1c, fasting glucose, systolic blood pressure (SBP), diastolic blood pressure (DBP), BMI, waist circumference and c-reactive protein). Adjustments were made for potential confounders, including sex, age, diabetes status, family history of CVD, family history of diabetes, hypertension status, hypercholesterolemia status, energy intake, smoking, physical activity, alcohol intake, BMI and ethnicity.
Results: Participants were predominantly Caucasian (49%), East Asian (34%) and South Asian (11%) with a mean LDL-C of 2.3±0.6 mmol/L, SBP/DBP of 114.1±11.7/69.4±8.1 mmHg and BMI of 22.9±3.6 kg/m2. A 1-point increase in the Portfolio Diet Score was significantly associated with lower LDL-C (ß [95% CI]: -0.008 mmol/L [-0.015, -0.001], P=0.03), non-HDL-C (-0.009 mmol/L [-0.017, -0.001], P=0.02), SBP (-0.147 mmHg [-0.247, -0.047], P<0.01), DBP (-0.133 mmHg [-0.219, -0.046], P<0.01) and BMI (-0.002 kg/m2 [-0.003, -0.000], P=0.01).
Conclusions: Among university students, greater adherence to the Portfolio Diet showed significant favourable associations with LDL-C, non-HDL-C and several other established cardiovascular risk factors. Future work will examine the genetic modification of these associations in the TNH Study to allow for personalization of dietary advice in primary care.
Funding: CIHR

SHORT ORAL ABSTRACT 34
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Substitution of sweetened soymilk for unsweetened cow's milk and cardiometabolic health: A systematic review and meta-analysis of randomized controlled feeding trials

Objective: Although fortified soymilk is recognized by the Dietary Guidelines for Americans and Health Canada as a non-dairy equivalent to cow's milk, it is at odds with dietary recommendations to reduce ultra-processed foods and added sugars (as soymilk is often made to be a similar sweetness containing 5-7g added sucrose [10-15% daily value] versus 12g lactose in cow's milk per 250 mL serving). To assess whether sweetened soymilk in substitution for unsweetened cow's milk impairs intermediate cardiometabolic outcomes, we conducted a systematic review and meta-analysis of randomized controlled feeding trials.
Methods: MEDLINE, Embase, and The Cochrane Central Register of Controlled Trials were searched. We included randomized controlled feeding trials of >3 weeks. Two independent reviewers extracted data and assessed risk of bias. Outcomes included established markers of blood lipids, glycemic control, blood pressure, inflammation, adiposity, and liver damage. Data were pooled and expressed as a mean difference (MD) with 95% confidence intervals (95% CI). GRADE assessed certainty of evidence.
Results: Eligibility criteria were met by 10 trials in 277 adults with a range of health statuses. The median dose of soymilk was 602 mL/day (24.5 g protein; 19 g/day or 7 g/250 mL added sugars) and cow's milk was 538 mL/day (24.5 g protein; 26 g/day or 12 g/250 mL lactose). The substitution of sweetened soymilk for unsweetened cow's milk reduced LDL-C (MD, -0.22 mmol/L [95% CI, -0.34 to -0.09 mmol/L]) and systolic (-7.51 mmHg [-10.26 to -4.76 mmHg]) and diastolic (-4.08 mmHg [-6.59 to -1.58 mmHg]) blood pressure. There was no effect on HDL-C, non-HDL-C, TG, HbA1c, FPG, 2hPG, fasting insulin, body weight, BMI, body fat %, waist circumference, AST, ALT, or CRP. The certainty of evidence was generally moderate across outcomes.
Conclusion: Sweetened soymilk in substitution for unsweetened cow's milk does not have an adverse effect on a broad range of intermediate cardiometabolic outcomes. The available evidence provides a good indication that sweetened soymilk providing up to 7 g/250 mL added sugars (15% DV) may even have advantages for LDL-C and blood pressure reduction. ClinicalTrials.gov identifier, NCT05637866.
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SHORT ORAL ABSTRACT 35
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Estimated dietary intake of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzo-p-furans, adiposity and obesity status in an elderly population

Introduction: The principal source of exposure to Polychlorinated dibenzo-p-dioxins and polychlorinated dibenzo-p-furans (PCDD/Fs) in humans comes from food intake. PCDD/Fs are a family of potential endocrine disruptors and have been associated with different chronic diseases such as diabetes and hypertension. However, studies assessing the relationship between the dietary exposure to PCDD/Fs and adiposity or obesity status in a senior population is limited.
Objective: To cross-sectionally and longitudinally assess the associations between estimated dietary intake (DI) of PCDD/Fs and body mass index (BMI), waist circumference (WC), and the prevalence/incidence of obesity and abdominal obesity in an elderly population.
Methods: In 5,899 participants aged 55-75 years (48% women) from the PREDIMED-plus cohort, PCDD/Fs DI was estimated using a 143-item validated food-frequency questionnaire and the levels of food PCDD/F expressed as Toxic Equivalents (TEQ). Consequently, cross-sectional and prospective associations between baseline PCDD/Fs DI (in pgTEQ/week) and adiposity or obesity status were assessed at baseline and after 1-year follow-up using multivariable cox, logistic or linear regression models.
Results: Compared to participants in the first PCDD/F DI tertile, those in the highest tertile showed an increase (β-coefficient [confidence interval]) in BMI (0.43kg/m2 [0.22;0.64]; P-trend <0.001), and WC (1.11cm [0.55;1.66]; P-trend <0.001), and a higher prevalence risk of obesity and abdominal obesity (1.05 [1.01;1.09] and 1.02 [1.00;1.03]; P-trend= 0.09 and 0.027, respectively). In the prospective analysis, participants in the top PCDD/F DI baseline tertile showed a higher increase in WC compared with those in the first tertile after 1-year of follow-up (β-coefficient 0.37 cm [0.06;0.70]; P-trend= 0.015).
Conclusion: Higher DI of PCDD/Fs was associated with adiposity parameters and obesity status at baseline and with WC after one-year of follow-up. Therefore, it is important to continue to establish prophylactic measures to reduce such exposure levels. Further prospective studies are warranted to strengthen our results.

SHORT ORAL ABSTRACT 36
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Cafestol and Kahweol Acutely Improve Glucose Metabolism in Humans with Impaired Glucose Tolerance and Type 2 Diabetes: A Randomized Crossover Trial

Objectives: Coffee consumption has been associated with a reduced risk of type-2 diabetes (T2D). However, the mechanisms behind this association are not well understood. The bioactive compounds cafestol and kahweol found in coffee have shown potential preventive effects against T2D in cell and animal studies.
Objectives: This study aimed to investigate the effects of cafestol and kahweol on glucose metabolism in healthy subjects with increased waist circumference and subjects with T2D.
Methods: We conducted a randomized, double-blinded crossover intervention study with 15 healthy participants with increased waist circumference and 16 subjects with T2D. Participants ingested a mixture of cafestol and kahweol or a placebo capsule along with a 75 g glucose load in oral glucose tolerance tests.
Results: In healthy participants, we observed no significant differences in area under the curve (AUC) for glucose, insulin, glucagon-like peptide 1 (GLP-1), or gastric inhibitory peptide (GIP) on placebo or cafestol intervention days. However, among healthy participants with impaired glucose tolerance and/or elevated fasting glucose (n=8, 53%), ingestion of 12 mg of cafestol and 2 mg kahweol resulted in an 11% larger GIP 1.5-hour area under the curve (AUC) (p=0.046) and a 5% smaller glucose 1.5-hour AUC (p=0.14) compared to placebo. In subjects with T2D, 14 mg cafestol and 14 mg kahweol combined reduced 60-minute blood glucose by 1.5 mmol/l (p<0.01) and lowered glucose 1.5-hour AUC by 4.2% (p=0.066) compared to placebo.
Conclusions: Our findings suggest that cafestol and kahweol may contribute to the inverse association between coffee consumption and the risk of T2D, particularly in subjects with T2D or impaired glucose tolerance, possibly through increased GIP secretion. Additional studies are needed to confirm these novel results in participants with impaired glucose metabolism and T2D.
Fundings:
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Keywords:
Phytochemicals, Food

SESSION 11: SCIENTIFIC RIGOR IN NUTRITION RESEARCH AND EVIDENCE ASSESSMENT: ARE THERE LESSONS FOR FUTURE NUTRITION GUIDELINES DEVELOPMENT?
ORAL ABSTRACT 8
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Rationale and Design of a Pragmatic Randomized Controlled Trial: Coronary Heart Effectiveness Assessment of the Portfolio diet in primary care (CHEAP) trial

Background/Objectives: The Portfolio Diet, a cholesterol-lowering, plant-based dietary pattern, has demonstrated clinically meaningful reductions in LDL-C and other cardiovascular risk factors and is recognized in clinical practice guidelines for nutrition therapy internationally. We developed a Portfolio Diet Program, using our novel PortfolioDiet.app with online behavioural support curriculum, to help patients meet Canadian Cardiovascular Society (CCS) clinical practice guideline targets for lipids and cardiovascular risk. Our objective is to present the rationale and design of our pragmatic trial to assess the clinical impact of the Portfolio Diet Program delivered through primary care in those with and without diabetes.

Methods: We will conduct a pragmatic, 2-arm, open-label, randomized controlled trial. Physicians will be recruited through primary care practice-based research networks to identify 1000 secondary [70%] and high-risk primary [30%] prevention participants on background statin therapy to randomize to either the Portfolio Diet Program as add-on therapy to standard of care or standard of care alone. The Portfolio Diet Program will deliver the intervention through the PortfolioDiet.app via interactive features (dashboard, goal setting, gamification, nudges, etc.) and a 16-session online behaviour change curriculum. A stepwise gatekeeping procedure will be used to assess two primary outcomes: proportion achieving a ≥8% reduction in LDL-C or non-HDL-C at 1-year, and major cardiovascular events at 7-years. If superiority of the intervention is shown by the first primary outcome at 1-year, the trial will continue to assess the second primary outcome at 7-years. Secondary outcomes will be diet adherence, proportion achieving CCS therapeutic targets, medication changes, patient and provider experience, and cost-effectiveness. Primary outcomes will be obtained from local laboratories and linkage to population-based administrative data, with secondary outcomes from online questionnaires and electronic medical records. The Applied Health Research Centre will manage data.

Significance: The Portfolio Diet Program is a promising intervention that may help patients achieve clinical practice guideline-based lipid targets for cardiovascular prevention while improving the patient and provider experience and reducing health care costs. If successful, this program will have major influence on implementation of clinical practice guidelines with a ready-to-use clinical tool for patients and providers readily available through the CCS.

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ORAL ABSTRACT 9
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Effect of a 3-year lifestyle intervention on telomere length in an older Mediterranean population at cardiovascular risk

INTRODUCTION
Mediterranean diet (MedDiet) adherence, physical activity (PA), and weight-loss have been individually associated with improvements in telomere homeostasis. However, evidence of the effect of an intensive lifestyle intervention on telomere length (TL), a marker of ageing, is limited.
OBJECTIVE
To determine whether weight-loss induced by a 3-year intensive lifestyle intervention (IG) with an energy-reduced Mediterranean diet (erMedDiet) and PA promotion could modify TL compared to an unrestricted MedDiet without PA promotion (CG).
METHODS
In 317 randomized non-smoker participants (mean age, 65.8±4.98 years; mean BMI, 32.1±2.6 kg/m2) with metabolic syndrome from two Prevención con Dieta Mediterránea-Plus (PREDIMED-Plus) trial centres (Reus and Navarra), we evaluated MedDiet adherence, PA, anthropometric variables and TL measured by quantitative-PCR method at baseline and after a 3-year intervention. The likelihood ratio test was used to examine interactions between intervention group and sex for TL changes after the intervention. ANCOVA models were run to test the effect of the intervention groups on TL changes in women and men, separately. To estimate the risk for accelerated telomere shortening (ΔTL≤ percentile 20) during 3-year follow-up, multivariable-adjusted logistic regression models were performed stratified by sex.
RESULTS
Participants in the IG displayed greater 3-year weight reductions (-3.7±4 kg, P<0.001) compared to those in the CG. No differences in TL changes between groups were shown in the whole cohort (n=317). However, an interaction was observed between intervention group and sex for TL changes (p-interaction=0.039). Women in the IG showed an increase in TL after 3 years (+0.25±0.9, relative units) compared to those in the CG (-0.07±1.0) (p-ANCOVA=0.036), whereas no differences between groups were observed in men. Women in the IG had lower risk of telomere shortening after 3-year intervention (OR= 0.17, 95%CI: 0.05 to 0.64, p=0.008) compared to women in the CG.

CONCLUSION
A 3-year lifestyle intervention based on an erMedDiet and PA slowed down telomere shortening in women but not in men with metabolic syndrome.
KEYWORDS
Mediterranean diet; calorie restriction; telomere length; physical activity; randomized controlled trial.
Fundings
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C.V-H.: 2022 FI_B100108.

SESSION 12: THE INTERPLAY BETWEEN TECHNOLOGY AND NUTRITION IN DIABETES MANAGEMENT: WHAT ARE THE OPPORTUNITIES?
ORAL ABSTRACT 10
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Lifestyle intervention in the T2D-GENE trial

Type 2 diabetes (T2D) can be prevented or postponed by lifestyle modifications. In the 3-year T2D-GENE trial the effect of lifestyle intervention on the prevention of type 2 diabetes was studied in male participants with high or low genetic risk for type 2 diabetes. We also investigated whether a less resource-demanding form of group and internet-based counseling is feasible and effective in preventing T2D in people with an increased risk for T2D. Altogether, 628 middle-aged to elderly men either with a high (n = 313) or low (n = 315) number of T2D risk alleles were recruited in the intervention group. Inclusion criteria were fasting plasma glucose 5.6-6.9 mmol/l and HbA1c < 48 mmol/mol (< 6.5 %), age 50-75 years, male, and body mass index ≥ 25 kg/m2. The primary outcome was incident type 2 diabetes. The results regarding T2D incidence will be reported later. Five to seven group sessions on health promoting diet and physical activity were organized during the intervention. The participants monitored body weight and physical activity weekly via the web portal. Information on diet and physical activity were delivered monthly via the web portal. Furthermore, during the second and the third year of the intervention the participants were given self-feedback tasks via the web portal on optimal food choices. Four-day food records were collected five times during the study. The participants were given personal feedback on dietary intake and food choices based on the food records. Of the 549 participants completing the intervention, over 90 % participated in the group sessions and kept the food records. The four self-feedback tasks delivered during the second and the third year of the study were completed by 80–89 % of the participants. During the 3-year intervention dietary intakes of fiber, unsaturated fat, folate, and vitamins C, D and E increased and dietary intakes of saturated fat, sucrose and cholesterol decreased ($p < 0.05$ for all). In conclusion, a group and web portal-based lifestyle intervention is applicable for middle-aged to elderly men as a lifestyle modification aiming to prevent T2D.
Funding: Academy of Finland, Sigrid Juselius Foundation, Diabetes Research Foundation, Finnish Cultural Foundation, Finnish Cultural Foundation (North Savo Regional Fund), Ella and Georg Ehrnrooth Foundation, State Research funding, Yrjö Jahnsson Foundation, Juho Vainio Foundation.
Key words: diabetes; diet; genetics; human; intervention; lifestyle; physical exercise

POSTERS

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Effects of two isocaloric healthy diets on postprandial lipid response in type 2 diabetes patients

Introduction: Postprandial lipid concentrations are an independent risk factor for atherosclerosis and may better predict cardiovascular disease risk (CVD) than fasting measurements in individuals with Type 2 Diabetes (T2D). Quantitative and qualitative dietary changes are known to be the main modulators of postprandial lipid response.
Objective: To investigate the effects of an isocaloric Multifactorial diet on postprandial lipid response in individuals with type 2 diabetes (T2D). quantity and quality diet
Methods: According to a randomized controlled parallel group design, 43(25M/18F) T2D patients, 35–75 years old, were assigned to an 8-week isocaloric intervention with a Multifactorial diet rich in MUFA, PUFA, fibre, polyphenols, and vitamins (n=21) or a MUFA rich diet (n=22). Before/after the intervention plasma triglycerides, total and HDL-cholesterol concentrations were measured at fasting and over a 4h test-meal with a similar composition as the assigned diet.
Results: Fasting plasma triglycerides and total cholesterol did not change after both diets; HDL-cholesterol significantly decreased after Multifactorial (42±10 vs 39±8 mg/dL, p=0.010), but not after MUFA diet (39±9 vs. 39±10 mg/dL, p=0.324), with no significant difference between groups (p=0.090). Postprandial triglycerides (iAUC) did not change significantly after Multifactorial (5790±5008 vs. 5661±6057, mg/dL*240 min, baseline vs. 8-week, p=0.370) and MUFA diet (7579±4424 vs. 8503±4382 mg/dL*240 min, p=0.194); with a significant difference between groups (p=0.018). Total cholesterol (iAUC) did not change after Multifactorial diet (-1866±1466 vs -1957±1218 mg/dL*240 min, p=0.725); while it tended to decrease less after MUFA diet (-1511±1324 vs -953±1109 mg/dL*240 min, p=0.077), with a significant difference between groups (p=0.013). Postprandial HDL-cholesterol did not change after Multifactorial diet (-708±399 vs -642±402 mg/dL*240 min, p=0.725); it decreased less after MUFA diet (-723±466 vs -431±440 mg/dL*240 min, p=0.014), with no difference between groups (p=0.066).
Conclusion: In T2D patients, a Multifactorial diet improved postprandial lipid profile especially in terms of triglycerides response.
Funding. This research was supported by the Department of Clinical Medicine and Surgery, Federico II University, Naples
Keywords: plasma triglycerides, cholesterol, type 2 diabetes, dietary fiber, polyphenols, MUFA

The role of nutrition intervention in changing dietary and lifestyle habits in obese children

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Introduction
The rise of obesity in children nowadays is one of the major public health problems and most often it is a result of improper dietary habits and insufficient physical activity. Changing lifestyle is considered to be one of the key components in reducing the risk of developing chronic non-communicable diseases associated with obesity later in life.
Objectives
The aim was to determine the effect of nutritional intervention on dietary and lifestyle habits and consequential improvements of specific metabolic indicators of obesity.
Methods
The study included 100 obese subjects (F=50), mean age (12.61±1.90 years), body weight (84.30±17.74 kg), body mass index (31.18±4.17 kg/m2). They were divided into groups based on age, as a part of a 5-day structured multidisciplinary program in daily hospital. Intervention consisted of children`s dietary education during 5 days from 60 to 120 minutes and parents'/guardians education during 3 days from 60 to 120 minutes. Dietetic methods used in addition to education were meals which were served during their stay, educational material and sample menus of 2-week meal plans based on the principles of Mediterranean-reduction diet. Risk factors related to dietary habits and physical activity were assessed using the questionnaire at the beginning, after 12 months and at the end of the study. Controls checks, were performed in the first 6 months once a month, and then every 2 months until the end of the study (24 months of follow-up).
Results
Sixty-two subjects completed the study. Nutrition intervention had a significant impact on reducing body weight after 6 and 12 months. 30.64% of respondents reduced their body mass index after 24 months (P<0,001). The number of weekly meals consumed at home increased (P=0,001), weekly intake of fruits and vegetables for dinner increased significantly (P<0,001) along with daily intake of milk and dairy products (P=0,002). The intake of high energy and low nutritional density food has been significantly reduced. A significant increase in physical activity and improvements in WHtR and WHR were recorded.
Conclusions
Nutritional intervention that involves education of children and their parents/guardians has a significant effect on changing dietary and lifestyle habits.
Keywords
Lifestyle, Dietary patterns

Adherence in dietary and lifestyle changes – is motivation key to success?

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Introduction
Type 2 diabetes today is considered to be one of the major health challenge all over the world. When it comes to treatment in general one of the problems which health professional deals with is the adherence of patients in terms of taking prescribed therapy, following a healthy? diet and executing lifestyle changes. The question that remains open is how to maintain the achieved changes in type 2 diabetes patients after the specific goals are achieved.
Objectives
The aim was to present the influence of attendance number and motivation on the medical nutrition therapy adherence, through two case reports, in the sense of body weight changes (targeted reduction is 5-10% in accordance with the guidelines), cardiometabolic risk indicators, glycemia and liver enzymes.
Methods
Patients were educated on implementation and conduction of appropriate dietotherapy (diabetic-reduction diet) in accordance to established diagnosis, guidelines and Croatian standard of nutrition for patients in hospitals. They were provided educational materials and the example of a 7-day menu. Additionally, regular follow-up was arranged.
Results
Both patients, in addition to physician recommendation, also had a strong personal motivation to change their habits and improve their health. The female subject wanted to get pregnant, and the male subject wanted to change his eating and lifestyle habits due to the imminent arrival of the child. Until the moment they achieved their goals, when motivation decreased and attendance number reduced, they achieved recommended reduction in body weight (female subject 10.8% and male subject 22.4% from the initial body mass) that lead to improvement of cardiometabolic risk indicators (BMI, WHtR) and biochemical parameters (glycemia and liver enzymes).
Conclusions
Clearly, it is difficult to sustain the long-term dietary and lifestyle changes, especially when specific goals are achieved. We can conclude that there is a significant need to implement behavioral approaches and adjustments as a part of a holistic multidisciplinary approach in treatment of type 2 diabetes patients, in order to maintain the achieved lifestyle habits in the long term .
Keywords
Lifestyle, Dietary patterns

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Association between Nutritional Habits, Personal Traits and Glycaemic Regulation: A Prospective isCGM Study

Objective: This study aimed to examine the impact of diet, nutritional status, general characteristics, personality traits, and physical activity on glycemic regulation in adult patients with Type 1 diabetes mellitus (T1DM).

Methods: The study utilized a prospective design involving seven data collection cycles with 151 participants aged 18-60, both genders, with a medical confirmation of type 1 diabetes mellitus. All participants used the FreeStyle Libre Flash Glucose Monitoring System. Each participant completed the Croatian version of the International Personality Item Pool scale (IPIP50s), a questionnaire designed to gather socioeconomic data, duration of diabetes, presence of chronic complications, cardiovascular risk factors, frequency, and type of pre-existing hypoglycemic episodes per week and Diet Diary questionnaire for each day of the week including the time of consumption, types and amount of food and drink consumed. Blood and urine samples were collected and body mass index (BMI) was calculated at each visit.

Results: A correlation between participants' dietary habits and glycaemic regulation was demonstrated. Participants with a higher intake of protein-rich foods more frequently achieved target HbA1c values. Those consuming more fat and protein-rich foods showed a higher occurrence of hyperglycemia. No significant correlation was found between dietary variables and the occurrence of hypoglycemia. More frequent daily glucose monitoring was found in participants who consumed more protein and less simple carbohydrates. Physically active participants spent more time in normoglycemia. Participants in marital partnerships recorded less hyperglycemia and hypoglycemia, spending most of the time in normoglycemia. A higher education level was associated with better glycaemic values. No significant difference was found between personality types.

Conclusions: The results of this study confirmed the possible association between isCGM and attaining healthier dietary habits thus influencing DMT1 management, along with socioeconomic status and physical activity. However, no significant link was found between personality traits and glycaemic regulation in isCGM users.

Fundings: The research was financed by the Department of Endocrinology of Clinical Hospital Centre Osijek.

Keywords: Type 1 diabetes, glycemic regulation, lifestyle, dietary patterns, personality traits

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Retrospective Analysis of the Effectiveness and Safety of Oral Semaglutide in Type 2 Diabetes Mellitus

Introduction
Oral semaglutide is the only orally available GLP-1 receptor agonist. This innovative medicine formulation is a substitute for the injectable semaglutide form since the compliance with usage of the injectable form is often compromised.
Materials and methods:
This retrospective study enrolled 35 patients with type 2 diabetes mellitus (T2DM) (12 female, 23 male) who were 63 ± 10 years old, had a BMI of 32,71 ± 3,44 kg/m2 with an average diabetes duration of 14 ± 10 years, and had HbA1c 8,1 ± 1,2%. Patients had multiple comorbidities (dyslipidemia, arterial hypertension, coronary artery disease, chronic kidney disease, cerebrovascular disease). Oral semaglutide was prescribed alongside other antidiabetic medicines (insulin, metformin, sulfonylurea, pioglitazone, SGLT-2 inhibitors) because of uncontrolled diabetes. Oral semaglutide was dose-adjusted (3,7, or 14mg) every 4 weeks. At baseline, LDL cholesterol level was on average 2,2 ± 0,7 mmol/L.
Results
At 7,0 ± 2,6 months follow-up, 28 patients (80%) adhered to the prescribed oral semaglutide (all patients on 14mg). 7 patients (20%) discontinued the oral semaglutide because of adverse gastrointestinal symptoms (nausea, vomiting, diarrhea). 22 patients (79%) lost weight and on average they lost 6 ± 3kg. A clinically significant weight loss of 5% was achieved by 14 patients (50%). 22 patients (79%) had a reduction in HbA1c and on average it was reduced by 1,6 ± 1,2 % (8,1% vs. 6,5%). 17 patients (65%) met HbA1c targets of less than <7%. 35% of the patients had a reduction in LDL cholesterol level which was on average 1,6 ± 0.5 mmol/L. No clinically significant or severe hypoglycemia was reported with oral semaglutide.
Conclusions
Oral semaglutide may be an effective option for the intensification of therapy in patients with T2DM, since more than half of the patients had significant weight loss and achieved a significant reduction of the HbA1c, demonstrating the value of oral semaglutide for overweight patients with relatively long-standing type 2 diabetes. 1/5 of the patients were unable to utilize semaglutide in its oral formulation at all, therefore gastrointestinal adverse effects should be taken into account. The oral semaglutide's impact on LDL cholesterol levels should be further investigated.

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Impact of nutritional intervention on changes in dietary habits and regulation of glycaemia and lipid profile in patients with type 2 diabetes

Introduction
Nutritional intervention, including lifestyle changes are considered to be the most important factor in the treatment of diabetes.
The objectives of study was to: determine the impact of nutritional intervention in persons with type 2 diabetes on the regulation of glycaemia, lipid profile and body mass index (BMI), determine the relationship between dietary habits and their influence on the regulation of glycemia and lipid profile during the twelve months follow-up.
Methods
The study included 160 patients with non-regulated type 2 diabetes (HbA1c > 7.5 %), median age 61.8 ± 8.5 years, BMI 32.57 ± 6.48 kg/m2 and disease duration 10.9 ± 7.6 years. All subjects have participated in an intensive 5 day program in daily hospital, involving education and nutritional intervention, followed by three follow-up visits after 3, 6, and 12 months. Dietary habits were monitored through patient's selection of menus from Diabetic, Mediterranean or Higher-carbohydrate diets.
Results
The study showed that nutritional intervention had a statistically significant effect on lowering concentrations of HbA1c ($p < 0.001$); plasma glucose ($p = 0.003$); LDL cholesterol ($p = 0.022$); triglycerides ($p = 0.019$) and total cholesterol ($p = 0.021$) during the observed period. At the end of the study, there was a statistically significant increase the number of patients (10.3 vs. 23.1 %; $p < 0.05$) with normal weight (BMI < 25 kg/m2). It was found that dietary habits correlate with the biochemical parameters of the patients at the beginning, during the follow-up period and at the end of the study. In patients who chose menus of the Mediterranean diet the most during the five-day education, after three, six and twelve months they had the lowest values of all biochemical parameters compared to other patients ($p < 0.05$). There was a statistically significant ($p < 0.05$) influence of nutritional intervention on changing dietary habits and decreasing levels of HbA1c and lipid profile.
Conclusions
The study found that nutritional intervention, which includes education, testing of eating habits, results better regulation of diabetes, established reduction of HbA1c and has a beneficial effect on weight loss and lipid profile in patients with diabetes type 2.
Keywords: lifestyle, food

Ultra-Processed Food Consumption and its Association with Body Composition, Metabolic, and Inflammatory Status in Young Adults with Obesity

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Introduction
High consumption of energy-dense ultra-processed foods (UPF) is associated with risk of obesity, weight gain, greater accumulation of total and visceral fat mass, and obesity-related metabolic complications such as nonalcoholic fatty liver disease, insulin resistance and type 2 diabetes.
Objectives
The research aimed to assess UPF consumption and its association with body composition, metabolic and inflammatory status in young adults with obesity.
Methods
The anthropometric parameters and body composition of 84 participants with a BMI > of 30 kg/m2 (mean age 43 years, 71 women) were assessed. Serum levels of fasting plasma glucose, HbA1c, total cholesterol, low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), triglycerides, and high-sensitivity C-reactive protein (hsCRP) were determined. A total of 123 FFQ foods were categorized according to degree of processing using the NOVA classification. The inflammatory potential of the diet was assessed using the Dietary Inflammatory Index (DII®).
Results
Mean UPF intake ranged from 10.1% of total daily energy intake among participants in the lowest tertile of UPF consumption (T1) to 30.2% among those in the highest tertile (T3). Individuals reporting the highest (T3) intake of UPF, in contrast to the lowest (T1), had higher energy intake (p=0.002), a diet with more pro-inflammatory potential, more total and visceral fat (p=0.001), and less favorable glycemic, lipid, and inflammatory status.
Conclusions
Public health education strategies to prevent obesity in young adults should aim to replace ultra processed foods with minimally processed and unprocessed foods.
Keywords: ultra-processed foods, inflammation, NOVA classification, obesity
Funding: This research was supported by the University of Rijeka, Croatia (grant numbers: Uniri-biomed-18-269/1441 and Uniri-biomed-18-220).

Increased inflammatory and procoagulant state are responsible for vascular complications in diabetic patients with fatty liver

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Aims: Vascular complications are characterised by inflammation and procoagulant state related to hyperglycaemia. The aim of this study was to compare the behaviour of inflammatory and other markers responsible for endothelial dysfunction (ED) and atherosclerosis related to nephropathy and liver steatosis in type 2 diabetic patients.
Methods: Markers of inflammation and coagulation, as well as other markers relevant for diabetes and metabolic syndrome, were tested according to the presence of non-alcoholic fatty liver disease (NAFLD) and the albumin excretion rate (AER) (normoalbuminuria<30 mg/24h; albuminuria: 30-300 mg/24h). NAFLD was diagnosed by ultrasonography. Fatty liver index (FLI) (≤60; >60) was used as a predictor of liver steatosis. To compare the tested markers, patients were divided into quartiles according to FLI and AER [1st: FLI≤60 and AER<30), 2nd: FLI>60 and AER<30), 3rd: FLI≤60 and AER:30-300) and 4th: FLI>60 and AER:30-300).
Results: Significant differences ($p<0.05$) were determined using analysis of variance in waste circumference (WC), postprandial blood glucose (BGPP), glycated haemoglobin (HbA1c), adiponectin (ApN), fibrinogen (FIB), white blood cell (WBC) count, AER, high density lipoprotein (HDL), triglycerides (Tg), alanine transaminase (ALT), fasting C-peptide (FC) and eGDR among the groups according to the presence of NAFLD and albuminuria. FLI groups that differed were determined using Tukey post hoc test. Patients in the 4th quartile (FLI>60 and MA) had significantly higher FIB, WBC, WC, BGPP, HbA1c, Tg, ALT, and fC-peptide, and lower ApN, HDL and eGDR values compared with 1th quartiles (FLI≤ and MA). Patients in the 2nd quartile had higher WC and lower eGDR compared with the1st quartile.
Conclusions: Increased FIB, WBC, Tg, ALT, BGPP and HbA1c, and decreased ApN, HDL and eGDR pointed to increased inflammatory and procoagulant state in the presence of albuminuria and NAFLD. Decreased eGDR reflected increased insulin resistance even in normoalbuminuric patients with NAFLD. Reported correlations among the tested variables unravelled the association between inflammatory state, coagulation and glycaemia as a culprit of vascular complications in the investigated patients.

Low dose radon effect on ghrelin and glucose levels in streptozotoccin-induced type 2 diabetes mellitus rats

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Ivane Beritashvili experimental biomedicine center, Tbilisi, Georgia

Purpose: The aim of our research was to identify the ghrelin concentration in experimental animals with type 2 diabetes mellitus (T2DM) and also to study the low dose radiation effect of radon on ghrelin and glucose metabolism.
Materials and methods: To study the effect of radon, group of experimental animals (multiple low doses streptozotocin induced T2DM Wistar rats were used) went through the procedure of inhalation of radon by the Tskaltubo mineral water pool, once daily, during 10 days. In animals of the control groups, inhalation with radon was not used. After radon inhalation therapy the blood of the rats from experimental and control group was analysed.
Results: After radon inhalation therapy, a normalization of the ghrelin levels was observed in experimental group and despite the different body weight, the levels were approximately the same and close to those of the control group. In the experimental group, ghrelin level normalization was accompanied by glycemia normalization.
Conclusion: This research showed that low dose radon inhalation decreased ghrelin levels in rodents with T2DM and obesity and the result was stable during 3 month. Ghrelin level stabilization positively influenced on glucose levels. The result of the experiment gives us a stimulus to continue future research to find more specific neurochemical mechanisms positively influencing on glucose levels and T2DM outcome.
Keywords: T2DM; Ghrelin; Glucose levels; Radon;

Ghrelin level changes in humans with Type 2 Diabetes Mellitus and Obesity

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Purpose : The aim of the research was to identify the plasma ghrelin concentration in humans with Type 2 Diabetes mellitus and obesity and to investigate a statistically significant relation between plasma ghrelin levels and other important metabolic factors in Type 2 Diabetes mellitus and obesity pathogenesis.
Materials and methods : In this study, to investigate the possible involvement of ghrelin in the regulation of metabolic balance, plasma ghrelin concentrations were measured in patients with type 2 diabetes mellitus(T2DM) and obesity. Subjects were divided into two groups; control and experimental group. In the control group, subjects had normal weight without T2DM. Subjects from the experimental group were divided into three subgroups, based on their weight: Group I- normal weight or overweight patients with T2DM; Group II – obesity I degree patients with T2DM, and Group III- obesity II degree patients with T2DM. Plasma Ghrelin concentration, lipid panel, HbA1c level were measured at the same time.
Results : A statistically significant correlation was found between ghrelin levels and BMI, HBAlc, HDL and Total Cholesterol levels.
Conclusion: The present study demonstrates plasma ghrelin changes in humans with Type 2 Diabetes Mellitus (T2DM) and different classes of obesity. As plasma ghrelin levels are lower in individuals with T2DM and obesity, ghrelin appears to have diabetogenic actions. Research on experimental models showed an improvement of glucose after ghrelin levels normalisation. These findings shed new light upon the involvement of the novel gastrointestinal peptide, ghrelin, in the regulation of energy homeostasis.
Taken together, these results indicate that there may be a system in ghrelin-producing cells that responds to metabolic changes during T2DM and obesity. Molecular signals that regulate ghrelin secretion are not well known. Further investigation is needed to define the receptors, transporters, and/or channels expressed in ghrelin-producing cells.
Keywords: T2DM; Obesity; Ghrelin; Tota Cholesterol; HDL; BMI;

FIRST CROATIAN MEDICAL NUTRITION THERAPY GUIDELINES FOR DIABETES IN ADULTS

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Introduction
Adequate nutrition is extremely important in diabetes prevention and regulation of glycemia. Diabetes counts into the category of diseases that can be successfully prevented and treated with possible delay of chronic complications development. Change in lifestyle habits, which includes proper diet, regular physical activity and weight management, can greatly contribute to regulation of glycemia and in in some cases of type 2 diabetes can lead to its remission.
Objectives
Considering the significant increase in the number of people with diabetes in Croatia there was a need to develop first professional guidelines on medical nutrition therapy.
Methods and Results
The guidelines were made as a result of collaboration of health professionals who participate in the treatment and education of individuals with diabetes. They are evidence-based, according to the GRADE methodology (Grading of Recommendations, Assessment, Development and Evaluation), which describes the level of recommendation in addition to the strength of the evidence. The fundamental conclusions refer to the assessment of nutritional needs and the implementation of medical nutrition therapy, individually adapted to individuals with diabetes and those with related comorbidities.
Conclusions
High-quality diabetes care should include medical nutrition therapy that includes individual approach, regular and adapted physical activity, adjusted intake of carbohydrates and other macronutrients to help patients in introducing and sustaining diet and lifestyle changes that are important part of diabetes treatment, preventing and managing comorbid conmplications related to diabetes.
Keywords
Lifestyle, Dietary patterns

NOTES

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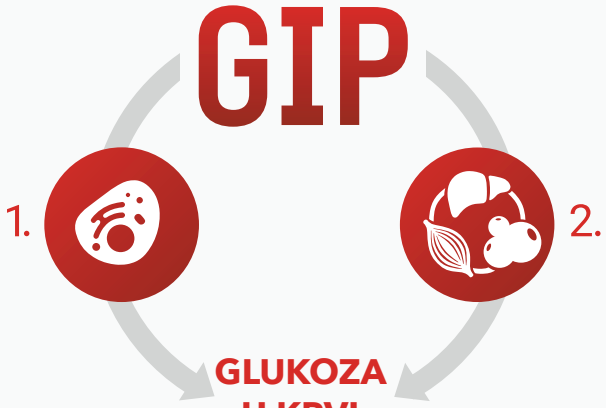
U šećernoj bolesti tip 2 **inzulinska rezistencija, poremećaj otpuštanja inzulina i oslabljeni inkretinski učinak** su 3 patofiziološka oštećenja odgovorna za progresiju bolesti[2]



GIP pomaže u održavanju razine glukoze u krvi na dva važna načina

Pretkliničke studije su pokazale da GIP doprinosi regulaciji glukoze u krvi svojim učincima na osjetljivost na inzulin.[1,3]

1. Iz beta stanica **pojačava otpuštanje inzulina ovisno o glukozi**[1]
2. Temeljeno na pretkliničkim podacima **poboljšava osljetljivost na inzulin**[4-6]

Dok je uloga GIP-a u učinku inkretina dobro dokumentirana,[1] istražuju se dodatna potencijalna djelovanja GIP-a, a većina podataka u ovom trenutku dolazi iz pretkliničkih studija.[4] **Najnovija istraživanja pokazala su da GIP može utjecati na mehanizme povezane s tjelesnom masom, kao što je unos hrana i apetit**.[3,5-11] Osim toga, nekoliko studija genetske povezanosti povezuju GIP s regulacijom inzulina, glukoze, lipida i tjelesne mase.[12-14]

GIP (engl.glucose-dependent insulinotropic polypeptide) = inzulinotropni polipeptid ovisan o glukozi; **GLP-1**, (engl. glucagon-like peptide-1.) = glukagonu sličan peptid-1

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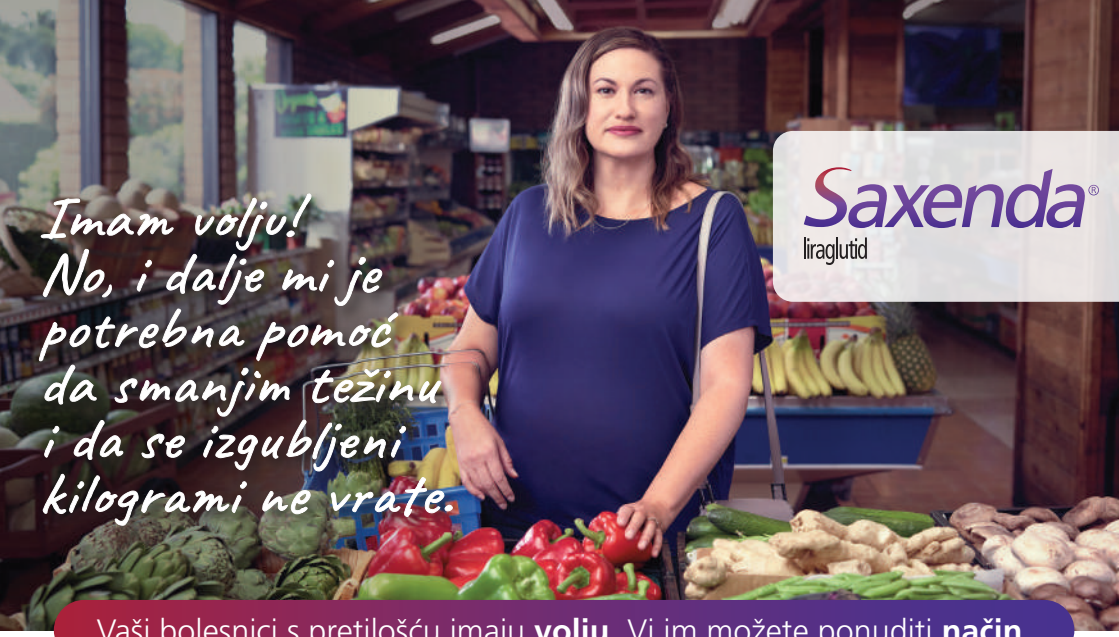

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Skraćeni sažetak opisa svojstava lijeka

Naziv lijeka: Saxenda® 6 mg/ml otopina za injekciju u napunjenoj brizgalici. **Međunarodni naziv djelatne tvari:** liraglutid. **Odobrene indikacije:** Saxenda® je indicirana kao dodatak dijeti sa smanjenim unosom kalorija i povećanoj fizičkoj aktivnosti za kontrolu tjelesne težine u odraslih bolesnika s početnim indeksom tjelesne mase od: ≥30 kg/m² (pretilost) ili ≥27 kg/m² do <30 kg/m² (prekomjerna tjelesna težina) uz prisutnost najmanje jednog komorbiditeta povezanog s tjelesnom težinom kao što je disglikemija (predijabetes ili šećerna bolest tipa 2), hipertenzija, dislipidemija ili opstruktivna apneja u snu. Liječenje lijekom Saxenda® potrebno je prekinuti nakon 12 tjedana na dozi od 3,0 mg/dan ako bolesnici ne izgube barem 5% svoje početne tjelesne težine. Saxenda® se može primjenjivati kao dodatak

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Ne preporučuje se primjena u bolesnika: u dobi od 75 ili više godina, liječenih drugim lijekovima za kontrolu tjelesne težine, s pretilošću koja je sekundarna endokrinološkim poremećajima ili poremećajima prehrane ili liječenju lijekovima koji mogu uzrokovati porast tjelesne težine, s teškim oštećenjem bubrega ili jetre. Liraglutid je potrebno primjenjivati s oprezom u bolesnika s blagim ili umjerenim oštećenjem jetre. Primjena liraglutida ne preporučuje se u bolesnika s upalnom bolešću crijeva i dijabetičkom gastroparezom. Ako se sumnja na pankreatitis, potrebno je prekinuti primjenu liraglutida; ako se potvrdi akutni pankreatitis, liječenje liraglutidom ne smije se ponovno započeti. U kliničkim ispitivanjima za kontrolu tjelesne težine zabilježena je viša stopa kolelitijaze i kolecistitisa kod bolesnika liječenih liraglutidom nego u bolesnika koji su dobivali placebo. Bolesnike je potrebno obavijestiti o karakterističnim simptomima kolelitijaze i kolecistitisa. Potreban je oprez kod primjene liraglutida u bolesnika s bolešću štitnjače. U kliničkim ispitivanjima zabilježen je porast srčane frekvencije prilikom primjene liraglutida. Srčanu frekvenciju potrebno je pratiti u redovitim razmacima u skladu s uobičajenom kliničkom praksom. Bolesnike je potrebno informirati o simptomima povećane srčane frekvencije (palpitacije ili osjećaj ubrzanih otkucaja srca tijekom mirovanja). Liječenje liraglutidom potrebno je prekinuti u bolesnika kod kojih je prisutan klinički značajan trajan porast srčane frekvencije tijekom mirovanja. Bolesnike liječene liraglutidom potrebno je upozoriti na mogući rizik od dehidracije zbog gastrointestinalnih nuspojava i na to da poduzmu mjere opreza kako bi izbjegli gubitak tekućine. U bolesnika sa šećernom bolešću tipa 2 koji primaju liraglutid u kombinaciji s inzulinom i/ilisulfonilurejom moguć je povećani rizik od hipoglikemije, koji se može smanjiti snižavanjem doze inzulina i/ili sulfonilureje. Saxenda® se ne smije primjenjivati u bolesnika sa šećernom bolešću kao zamjena za inzulin. Dijabetička ketoacidoza prijavljena je u bolesnika ovisnih o inzulinu nakon brzog prekida ili smanjenja doze inzulina. Saxenda® sadrži manje od 1 mmol (23 mg) natrija po dozi, tj. zanemarive količine natrija. **Trudnoća i dojenje:** Liraglutid se ne smije primjenjivati tijekom trudnoće. Ako bolesnica želi zatrudnjeti ili se trudnoća dogodi, liječenje liraglutidom potrebno je prekinuti. Saxenda® se ne smije primjenjivati tijekom dojenja. **Nuspojave u odraslih:** *Vrlo često:* mučnina, povraćanje, proljev, konstipacija, glavobolja; *često:* hipoglikemija; nesanica; omaglica, disgeuzija; suha usta, dispepsija, gastritis, gastroezofagealna refluksna bolest, bolovi u gornjem dijelu abdomena, flatulencija, podrigivanje, distenzija abdomena; kolelitijaza; reakcije na mjestu injiciranja, astenija, umor; povišena lipaza, povišena amilaza; *manje često*: dehidracija, tahikardija; pankreatitis, odgođeno pražnjenje želuca; kolecistitis; urtikarija; opće loše stanje; *rijetko:* anafilaktička reakcija; akutno zatajenje bubrega, oštećenje bubrega. Učestalost, tip i težina nuspojava u pretilih adolescenata usporedivi su s onima uočenim u odrasloj populaciji. Povraćanje se pojavilo s dvostruko višom učestalošću u adolescenata u usporedbi s odraslima. **Doziranje:** Početna doza je 0,6 mg jednom dnevno. Dozu je potrebno povećati do 3,0 mg jednom dnevno s povećanjima od 0,6 mg u najmanje jednotjednim intervalima kako bi se poboljšala gastrointestinalna podnošljivost lijeka. Ako bolesnik ne podnosi povećanje na sljedeću dozu tijekom dva uzastopna tjedna, potrebno je razmotriti prekid liječenja. Ne preporučuju se dnevne doze veće od 3,0 mg. U adolescenata u dobi od 12 do manje od 18 godina potrebno je primijeniti sličan raspored postupnog povećavanja doze kao i u odraslih. Dozu je potrebno povećati do 3,0 mg (doza održavanja) ili dok se ne dosegne maksimalna podnošljiva doza. Ne preporučuju se dnevne doze veće od 3,0 mg. Ako se doza propusti unutar 12 sati od kada se obično primjenjuje, bolesnik treba uzeti dozu što je prije moguće. Ako je do sljedeće doze ostalo manje od 12 sati, bolesnik ne smije uzeti propuštenu dozu i sa sljedećom planiranom dozom treba nastaviti uobičajeni režim primjene jedanput na dan. Ne smije se uzeti dodatna doza niti se doza smije povećati kako bi se nadoknadila propuštena doza.
Saxenda® se ne smije upotrebljavati zajedno s drugim agonistom receptora GLP-1. Pri započinjanju liječenja lijekom Saxenda® potrebno je razmotriti smanjivanje doze istodobno primijenjenog inzulina ili inzulinskih sekretagoga (kao što je sulfonilureja) kako bi se smanjio rizik od hipoglikemije. Nužna je samokontrola razine glukoze u krvi radi prilagođavanja doze inzulina ili inzulinskih sekretagoga. Nije potrebno prilagođavanje doze prema dobi. Terapijsko iskustvo u bolesnika u dobi ≥75 godina ograničeno je i ne preporučuje se primjena lijeka u tih bolesnika. Nije potrebno prilagođavanje doze u bolesnika s blagim ili umjerenim oštećenjem bubrega (klirens kreatinina ≥30 ml/min). Primjena lijeka Saxenda® ne preporučuje se u bolesnika s teškim oštećenjem bubrega (klirens kreatinina ≤30 ml/min), uključujući bolesnike sa završnim stadijem bubrežne bolesti. Ne preporučuje se prilagođavanje doze u bolesnika s blagim ili umjerenim oštećenjem jetre. Primjena lijeka Saxenda® ne preporučuje se u bolesnika s teškim oštećenjem jetre te se treba primjenjivati s oprezom u bolesnika s blagim ili umjerenim oštećenjem jetre. Nije potrebno prilagođavanje doze u adolescenata u dobi od 12 i više godina. Sigurnost i djelotvornost lijeka Saxenda® u djece mlađe od 12 godina nisu ustanovljene. **Način primjene:** Saxenda® je namijenjena samo za supkutanu primjenu. Ne smije se primjenjivati intravenski ili intramuskularno. Saxenda® se primjenjuje jedanput na dan u bilo koje doba dana, neovisno o obrocima. Injicira se u abdomen, bedro ili nadlakticu. Mjesto i vrijeme injiciranja mogu se mijenjati bez prilagođavanja doze. Međutim, preporučljivo je da se Saxenda® injicira otprilike u isto doba dana u odabrano najprikladnije doba dana. **Nositelj odobrenja**: Novo Nordisk A/S, Novo Allé, DK-2880 Bagsværd, Danska. **Broj odobrenja**: EU/1/15/992/002. **Način izdavanja**: na recept. **Datum revizije sažetka**: 11/2021.

Prije propisivanja lijeka Saxenda® obvezno proučite posljednji odobreni sažetak opisa svojstava lijeka te posljednju odobrenu uputu o lijeku.

Saxenda® je zaštićeni žig u vlasništvu društva Novo Nordisk A/S, Danska.

SAMO ZA ZDRAVSTVENE RADNIKE
Novo Nordisk Hrvatska d.o.o.
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HR21SX00012
Datum sastavljanja: 12/2021.

novo nordisk®

Saxenda®
liraglutid

Abbott

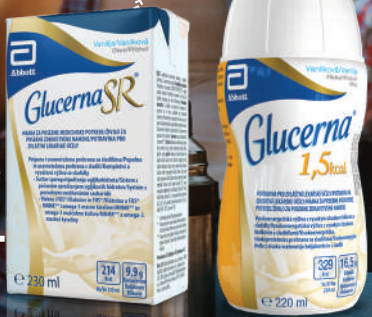
PRAVI PUT OPORAVKA

GLUCERNA® SR i GLUCERNA® 1,5 kcal

Pomažu u boljoj kontroli glikemije.[1-6]

Glucerna SR: za dijetalnu prehranu bolesnika s dijabetesom.

Glucerna 1,5 kcal: za dijetalnu prehranu bolesnika s dijabetesom ili abnormalnim metabolizmom glukoze, s malnutricijom ili rizikom njene pojave.



snaga za život

1. Sanz A, et al. Nutrients 2016; 8:153. 2. Alisl1 CJ, et al. Diabetes Tecl1nol Tl1er. 2010;12:419-425. 3. Yokoyama et al. The Journal of International Medical Research 2008; 36: 137-146. 4. Han YY, et al. Clin Nutr 2017;36:1567-1572. 5. Amy A. Devitt, et al. Advances in Bioscience a11d Biotechnology, 2013, 4, 1-10. 6. Matia, P et al. Accepted fl)r prese11tatio11 at CNW2017 at ASPEN Congress. Abstract ID number 2634801.

SAMO ZA ZDRAVSTVENE RADNIKE

HR-GLU1-5K-2300002, lipanj 2023

NUTRITION

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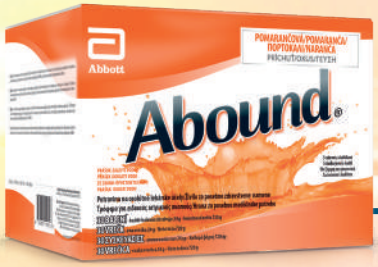
PRAVI PUT
OPORAVKA

ABOUND®

Pomaže cijeljenje kroničnih rana jedinstvenom kombinacijom tri ključna sastojka: HMB*, glutamin i arginin[1]



*snaga za **život***

*ß-hidroksi-ß-metilbutirat

1. Williams JZ et al. Effect of a specialized amino acid mixture on human collagen deposition. Ann Surg 2002; 236:369-74.

SAMO ZA ZDRAVSTVENE RADNIKE

NUTRITION

HR-ABD-2300008,lipanj 2023

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isključiti. Dugoročna regulacija glikemije smanjuje rizik od dijabetičke retinopatije. Kako bi se postigao optimalan učinak semaglutida preporuča se pridržavanje režima doziranja. Ukoliko je odgovor na liječenje semaglutidom niži od očekivanog, liječnik koji provodi liječenje mora biti svjestan kako je apsorpcija semaglutida vrlo varijabilna i može biti minimalna (2-4% bolesnika neće imati nikakvu izloženost), te da je apsolutna bioraspoloživost semaglutida niska. Ovaj lijek sadrži manje od 1 mmol (23 mg) natrija po dozi, tj. zanemarive količine natrija. **Plodnost, trudnoća i dojenje:** Ženama reproduktivne dobi preporučuje se korištenje kontracepcije tijekom liječenja semaglutidom. Semaglutid se ne smije primjenjivati tijekom trudnoće niti dojenja. Učinak semaglutida na plodnost u ljudi nije poznat. **Nuspojave:** *Vrlo često*: hipoglikemija kod primjene s inzulinom ili sulfonilurejom; mučnina, proljev; *Često*: hipoglikemija kod primjene s drugim oralnim antidijabeticima, smanjen apetit; komplikacije dijabetičke retinopatije; povraćanje, bol u abdomenu, distenzija abdomena, konstipacija, dispepsija, gastritis, gastroezofagealna refluksna bolest, flatulencija; umor; povišena lipaza, povišena amilaza; *Manje često:* preosjetljivost; povećana srčana frekvencija; eruktacija, odgođeno pražnjenje želuca; kolelitijaza; smanjenje težine; disgeuzija; *Rijetko:* anafilaktička reakcija; akutni pankreatitis. **Doziranje:** Početna doza semaglutida je 3 mg jednom dnevno tijekom jednog mjeseca. Nakon jednog mjeseca dozu treba povećati na dozu održavanja od 7 mg jednom dnevno. Nakon najmanje jednog mjeseca uz dozu od 7 mg jednom dnevno, doza se može povećati na dozu održavanja od 14 mg jednom dnevno kako bi se dodatno poboljšala regulacija glikemije. Maksimalna preporučena jednokratna dnevna doza semaglutida je 14 mg. Uzimanje dvije tablete od 7 mg radi postizanja učinka doze od 14 mg nije ispitano te se stoga ne preporučuje. Za informacije o prelasku sa semaglutida koji se primjenjuje kroz usta na supkutani (s.c.), vidjeti dio 5.2. sažetka opisa svojstava lijeka. Kada se semaglutid uzima zajedno s metforminom i/ili inhibitorom suprijenosnika natrija i glukoze 2 ili tiazolidindionom, postojeća doza metformina i/ili inhibitora SGLT2 ili tiazolidindiona može se nastaviti primjenjivati. Kada se semaglutid uzima zajedno sa sulfonilurejom ili inzulinom, može se razmotriti smanjenje doze sulfonilureje ili inzulina kako bi se smanjio rizik od hipoglikemije. Nije potrebno samopraćenje glukoze u krvi radi prilagođavanja doze semaglutida. Samopraćenje razine glukoze u krvi nužno je radi prilagođavanja doze sulfonilureje i inzulina, posebice ako je započeta terapija semaglutidom, a inzulin je smanjen. Preporučuje se smanjenje doze inzulina korak po korak. Ako se doza propusti, propuštenu dozu treba preskočiti, a sljedeću dozu treba uzeti sljedeći dan. Nije potrebno prilagođavanje doze prema dobi. Nije potrebno prilagođavanje doze u bolesnika s blagim, umjerenim ili teškim oštećenjem funkcije bubrega. Semaglutid se ne preporučuje u bolesnika sa završnim stadijem bolesti bubrega. Nije potrebno prilagođavati dozu u bolesnika s oštećenjem funkcije jetre. Iskustvo s primjenom semaglutida u bolesnika s teškim oštećenjem funkcije jetre je ograničeno, stoga je potreban oprez kod liječenja tih bolesnika semaglutidom. Sigurnost i djelotvornost lijeka Rybelsus® u djece i adolescenata mlađih od 18 godina nisu ustanovljene. Nema dostupnih podataka. **Način primjene:** Rybelsus® je tableta koja se uzima jednom dnevno kroz usta, na prazan želudac u bilo koje doba dana. Tabletu treba progutati cijelu s gutljajem vode (najviše pola čaše vode što odgovara količini od 120 ml). Tablete se ne smiju lomiti, drobiti niti žvakati jer nije poznato utječe li to na apsorpciju semaglutida. Bolesnici moraju pričekati najmanje 30 minuta prije obroka ili napitka ili uzimanja drugih lijekova kroz usta. Ako ne pričekaju 30 minuta, smanjuje se apsorpcija semaglutida. **Broj odobrenja**: EU/1/20/1430/002, EU/1/20/1430/005, EU/1/20/1430/008. **Način izdavanja**: na recept. **Nositelj odobrenja**: Novo Nordisk A/S, Novo Allé, DK-2880 Bagsværd, Danska. **Datum revizije sažetka:** 04/2023.

Prije propisivanja lijeka Rybelsus® obvezno proučite posljednji odobreni sažetak opisa svojstava lijeka te posljednju odobrenu uputu o lijeku.

Rybelsus®, Victoza® i Apis bik su zaštićeni žigovi u vlasništvu društva Novo Nordisk A/S.

▼*Ovaj je lijek pod dodatnim praćenjem. Time se omogućuje brzo otkrivanje novih sigurnosnih informacija. Od zdravstvenih radnika se traži da prijave svaku sumnju na nuspojavu za ovaj lijek. Upute za prijavljivanje nuspojava dostupne su na www.halmed.hr.*

Reference: 1. Posljednji odobreni sažetak opisa svojstava lijeka Rybelsus®. **2.** Rosenstock J, Allison D, Birkenfeld AL, et al. Effect of additional oral semaglutide vs sitagliptin on glycated hemoglobin in adults with type 2 diabetes uncontrolled with metformin alone or with sulfonylurea: the PIONEER 3 randomized clinical trial. *JAMA.* 2019;321(15):1466-1480. **3.** Rodbard HW, Rosenstock J, Canani LH, et al. Oral semaglutide versus empagliflozin in patients with type 2 diabetes uncontrolled on metformin: the PIONEER 2 trial. *Diabetes Care.* 2019;42(12):2272-2281. **4.** Pratley R, Amod A, Hoff ST, et al. Oral semaglutide versus subcutaneous liraglutide and placebo in type 2 diabetes (PIONEER 4): a randomised, double-blind, phase 3a trial. *Lancet.* 2019;394(10192):39-50.

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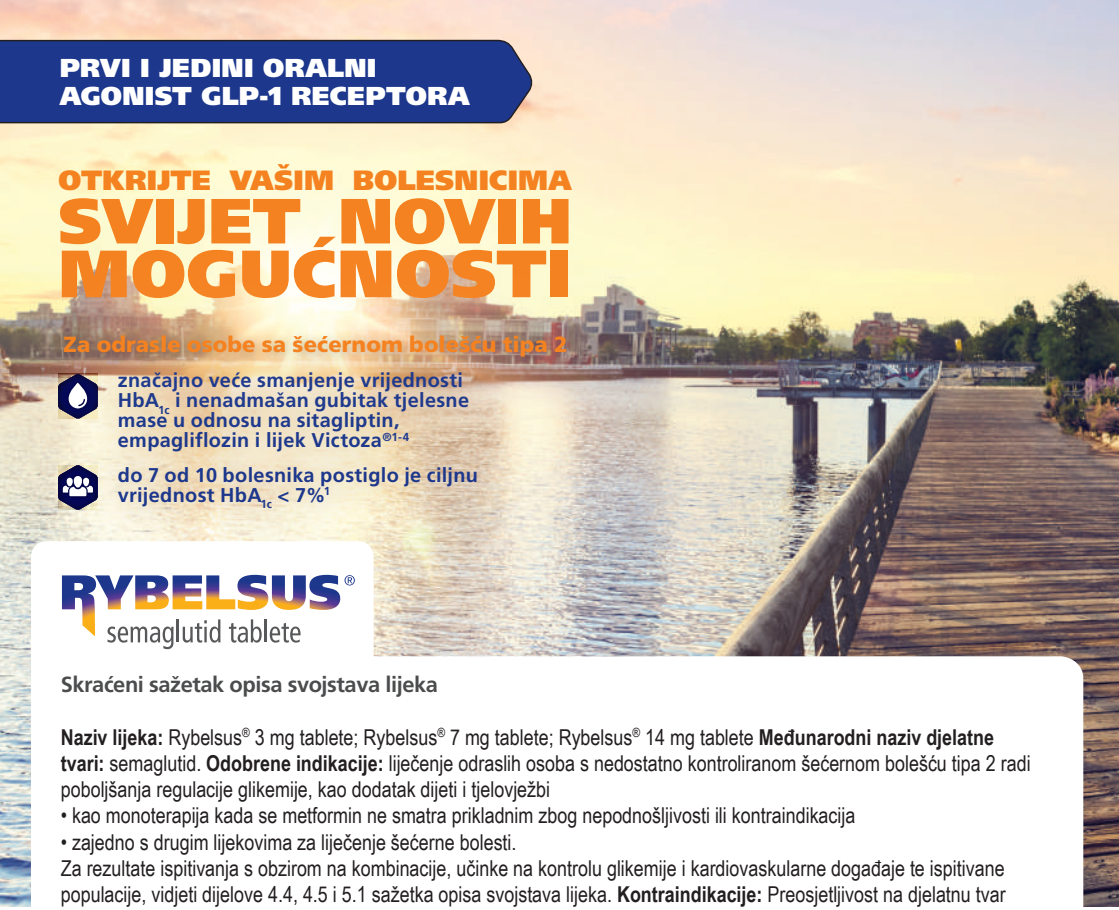
HR23RYB00012 Datum sastavljanja: 05/2023.

RYBELSUS®
semaglutid tablete



PRVI I JEDINI ORALNI AGONIST GLP-1 RECEPTORA

OTKRIJTE VAŠIM BOLESNICIMA SVIJET NOVIH MOGUĆNOSTI

Za odrasle osobe sa šećernom bolešću tipa 2

- **značajno veće smanjenje vrijednosti HbA_{1c} i nenadmašan gubitak tjelesne mase u odnosu na sitagliptin, empagliflozin i lijek Victoza®[1-4]**
- **do 7 od 10 bolesnika postiglo je ciljnu vrijednost HbA_{1c} < 7%[1]**

RYBELSUS®
semaglutid tablete

Skraćeni sažetak opisa svojstava lijeka

Naziv lijeka: Rybelsus® 3 mg tablete; Rybelsus® 7 mg tablete; Rybelsus® 14 mg tablete **Međunarodni naziv djelatne tvari:** semaglutid. **Odobrene indikacije:** liječenje odraslih osoba s nedostatno kontroliranom šećernom bolešću tipa 2 radi poboljšanja regulacije glikemije, kao dodatak dijeti i tjelovježbi
• kao monoterapija kada se metformin ne smatra prikladnim zbog nepodnošljivosti ili kontraindikacija
• zajedno s drugim lijekovima za liječenje šećerne bolesti.
Za rezultate ispitivanja s obzirom na kombinacije, učinke na kontrolu glikemije i kardiovaskularne događaje te ispitivane populacije, vidjeti dijelove 4.4, 4.5 i 5.1 sažetka opisa svojstava lijeka. **Kontraindikacije:** Preosjetljivost na djelatnu tvar ili neku od pomoćnih tvari. **Posebna upozorenja i mjere opreza pri uporabi:** Kako bi se poboljšala sljedivost bioloških lijekova, naziv i broj serije primijenjenog lijeka potrebno je jasno evidentirati. Semaglutid se ne smije primjenjivati u bolesnika sa šećernom bolešću tipa 1 niti za liječenje dijabetičke ketoacidoze. Prijavljena je dijabetička ketoacidoza u bolesnika ovisnih o inzulinu nakon brzog prekida ili smanjenja doze inzulina kada se započelo liječenje agonistom GLP-1 receptora. Nema terapijskog iskustva u bolesnika s kongestivnim srčanim zatajenjem stupnja IV prema NYHA klasifikaciji pa se stoga primjena semaglutida ne preporučuje u tih bolesnika. Nema terapijskog iskustva s primjenom semaglutida u bolesnika s barijatrijskim kirurškim zahvatima. Primjena agonista receptora GLP-1 može se povezati s gastrointestinalnim nuspojavama koje mogu prouzročiti dehidraciju, što u rijetkim slučajevima može dovesti do pogoršanja bubrežne funkcije. Bolesnike liječene semaglutidom treba obavijestiti o potencijalnom riziku od dehidracije zbog gastrointestinalnih nuspojava te da poduzmu odgovarajuće mjere opreza kako bi izbjegli gubitak tekućine. Kod primjene agonista GLP-1 receptora primijećen je akutni pankreatitis. Bolesnike treba obavijestiti o karakterističnim simptomima akutnog pankreatitisa. Ako se sumnja na pankreatitis, treba prekinuti primjenu semaglutida, a ako se pankreatitis potvrdi, liječenje semaglutidom ne smije se ponovno započeti. Oprez je nužan u bolesnika koji u anamnezi imaju pankreatitis. U bolesnika liječenih semaglutidom u kombinaciji sa sulfonilurejom ili inzulinom moguć je povećani rizik od hipoglikemije. Rizik od hipoglikemije može se smanjiti smanjenjem doze sulfonilureje ili inzulina na početku liječenja semaglutidom.U bolesnika s dijabetičkom retinopatijom liječenih inzulinom i s.c. semaglutidom zabilježen je povećani rizik od komplikacija dijabetičke retinopatije, rizik koji se ne može isključiti kod semaglutida primijenjenog kroz usta. Potreban je oprez pri primjeni semaglutida u bolesnika s dijabetičkom retinopatijom liječenih inzulinom. Te je bolesnike potrebno pažljivo nadzirati i liječiti u skladu s kliničkim smjernicama. Naglo poboljšanje regulacije glukoze povezano je s privremenim pogoršanjem dijabetičke retinopatije, ali drugi mehanizmi se ne mogu

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RYBELSUS®
semaglutid tablete