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# INTERNAL MEDICINE: CARDIOLOGY, ENDOCRINOLOGY: INTERNATIONAL SCIENTIFIC CONFERENCE ON MEDICINE AND HEALTH SCIENCES OF THE UNIVERSITY OF LATVIA, 2026

On 26 March 2026, the University of Latvia hosted the International Scientific Conference on Medicine and Health Sciences.

This section includes a broad collection of abstracts reflecting clinical and technological developments in the field of cardiovascular, metabolic and endocrine diseases.

Within the area of diabetes and metabolic disorders, orally presented studies provide insights on impact of breakfast habits on 24-hour glucose levels and glycaemic variability, as well as postprandial glucose fluctuations following eating events in overweight and obese individuals. Two reports on modulation of gut microbiome reveal rapid effects of polyherbal adjunct therapy and improved metformin tolerance in patients with type 2 diabetes. Education on gestational diabetes mellitus improves patient adherence to lifestyle changes resulting in reduced rates of foetal macrosomia. Short-term changes in desacyl ghrelin following bariatric surgery are inversely associated with preoperative weight and excess body weight. Poster presentations reported results of various epidemiologic studies on comorbidity of type 2 diabetes and arterial hypertension, prevalence of type 2 diabetes among patients with liver cirrhosis, sleep apnoea screening in patients with arterial hypertension and type 2 diabetes, glycaemic control and presence of diabetic complications in family doctor practice, lifestyle recommendations and association between lifestyle habits and glycemia in medical college students.

Orally presented studies in cardiovascular medicine highlight the critical role of medication adherence, providing insights into the real-world impact of direct oral anticoagulants in reducing initial stroke severity among atrial fibrillation patients presenting with cardioembolic stroke. Other scientific works presented in this session explore the association between familial hypercholesterolemia-related genetic variants, particularly in the LDLR gene, and the earlier development of coronary atherosclerosis, as well as the utility of novel biomarkers, such as oxidised low-density lipoprotein and vimentin, in assessing the severity of coronary artery disease. Furthermore, data from the first Latvian Takotsubo registry is presented regarding the recovery of left ventricular function following hospitalisation for transient left ventricular apical ballooning syndrome. Poster presentations reported results of investigations on the association of CT-derived thrombus density with laboratory biomarkers for early risk stratification in acute pulmonary embolism, the subjective effectiveness of antiarrhythmic drug therapy for symptom control in patients with premature ventricular contractions awaiting catheter ablation, and the assessment of exercise capacity — including lactate profiles, peak oxygen consumption, and cardiovascular responses — during maximal exercise testing in grassroots athletes.

*Sandra Jēgere,*
*Valdis Pīrāgs*

# PHARMACOLOGICAL MODULATION OF THE GUT MICROBIOME VIA A STANDARTISED POLYHERBAL FORMULATION TO ENHANCE METFORMIN TOLERANCEE

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**Background**. Gastrointestinal intolerance to metformin is a major clinical challenge in Type 2 Diabetes Mellitus (T2DM) management, often linked to gut dysbiosis and mucosal inflammation. Standardised polyherbal formulations (PHF) offer a multi-target approach to modulate the gut ecosystem, yet their rapid pharmacological impact on microbial metabolic pathways remains under-investigated.

**Aim**. To evaluate the short-term (7-day) pharmacological efficacy of a standardised PHF in modifying gut microbial community structure and attenuating pro-inflammatory metabolic pathways in metformin-intolerant T2DM patients receiving concurrent metformin therapy.

**Methods**. A randomised, double-blind, placebo-controlled crossover study (n = 27) was conducted using a PHF containing eleven standardised extracts of *Salacia reticulata, Trigonella foenum-graecum, Moringa oleifera, Phyllanthus emblica (Emblica officinalis), Hibiscus sabdariffa, Curcuma longa, Zingiber officinale, Cuminum cyminum, Piper nigrum, Mentha piperita,* and *Murraya koenigii.* Shotgun metagenomic sequencing (Illumina) was employed to assess taxonomic shifts and MetaCyc pathway abundances. Continuous glucose monitoring (CGM) ensured glycaemic safety. DNA analysis of the PHF was performed to differentiate between prebiotic and probiotic effects.

**Results**. Within 7 days, PHF administration significantly modified microbial beta-diversity ($p = 0.04$). The pharmacological synergy of the formulation's key phytoconstituents — tannins, gingerols, and curcuminoids — was associated with a multi-targeted metabolic response, characterised by the selective enrichment of six *Bifidobacterium* species, notably *B. adolescentis* and *B. ruminantium*. We observed a selective enrichment of the *Bifidobacterium* shunt pathway ($p = 0.04$), indicating a robust prebiotic effect and enhanced fermentation of polyphenols into short-chain fatty acids (SCFAs), such as acetate and lactate. Simultaneously, functional profiling revealed a significant reduction in the anhydromuropeptide recycling pathway, suggesting a potent anti-inflammatory modulation via the mitigation of NOD-receptor signaling. Furthermore, a decrease in the methylglyoxal degradation pathway was identified, highlighting the formulation's role in attenuating host carbonyl stress — a key driver of diabetic complications. CGM data confirmed that the PHF is glycaemically safe and well-tolerated.

**Conclusions**. The PHF acts as a rapid-response, microbiome-modulating adjuvant. By promoting beneficial metabolic pathways, such as the production of SCFAs, the formulation enhances intestinal barrier integrity through the reinforcement of epithelial tight junctions. By exerting targeted anti-inflammatory effects and potentially reducing endotoxin translocation, this composed formulation enhances intestinal resilience. These findings provide a strong pharmacological rationale for using standardised PHF to modulate the gut ecosystem, reduce luminal irritation, and improve metformin tolerance in T2DM patients.

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## SHORT-TERM CHANGES IN DES-ACYL GHRELIN FOLLOWING BARIATRIC SURGERY

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**Background**. Bariatric surgery induces profound metabolic changes, including alterations in des-acyl ghrelin (DAG) secretion. Existing evidence suggests an inverse association between DAG levels and adiposity, yet the dynamics of DAG in relation to early postoperative weight loss remain insufficiently understood.

**Aim**. To examine the associations between circulating DAG concentrations and early postoperative changes in body weight after bariatric surgery.

**Setting.** Prospective multicenter cohort study was conducted at three bariatric surgery centres in Latvia.

**Methods**. Fasting blood samples for DAG quantification were collected at three time points: one day preoperatively, two days postoperatively, and at the three-month postoperative follow-up. Concurrent with blood sampling, anthropometric measurements and other blood tests were conducted at the same time.

**Results**. Sixty-two patients were included (64.5% RYGB; 35.5% SG; 67.7% female). Median preoperative weight and BMI were 129 kg (IQR 106–150) and 45.1 kg/m², respectively. Median excess weight loss at three months was 40.2% (IQR 32.2–54.3). DAG levels showed moderate, statistically significant negative correlations with preoperative body weight ($r = –0.371$, $p$ 0.05), BMI ($r = –0.311$, $p < 0.05$), and excess weight ($r = –0.355$, $p < 0.05$). These associations persisted across all three time points in the RYGB group. In SG patients, significant correlations were primarily observed on postoperative day two (e.g., weight $r = –0.593$, $p < 0.05$). No significant associations were found between DAG levels and relative weight loss metrics (TWL%, %BMIL, EWL%). Sex differences in DAG levels were observed, with females showing higher baseline DAG levels, while age had no significant effect on DAG dynamics.

**Conclusion**. Circulating DAG levels are inversely associated with absolute measures of adiposity (weight, BMI, excess weight), rather than with relative weight loss, and this association is particularly pronounced in RYGB patients. These findings support DAG's potential as a biomarker of total body fat burden, with postoperative dynamics influenced by surgical type and sex. Further studies are needed to clarify its metabolic role and clinical utility.

## EFFECTIVENESS OF ANTIARRHYTHMIC DRUG THERAPY IN PATIENTS WITH PREMATURE VENTRICULAR CONTRACTIONS AWAITING CATHETER ABLATION

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**Background.** Premature ventricular contractions is a common arrhythmia that may cause significant symptoms and impairment of quality of life. Catheter ablation is an effective treatment option for symptomatic patients; however, in Latvia its availability is limited by long waiting times. During this period, patients are usually managed with antiarrhythmic drug therapy. Data on the real-world effectiveness of such therapy and its relationship with waiting time for ablation are limited.

**Aim.** The ai mis to evaluate the use and subjective effectiveness of antiarrhythmic drug therapy in patients waiting for catheter ablation and to analyse its association with waiting time.

**Methods**. A structured online survey was conducted among 126 patients with premature beats who were on the waiting list for catheter ablation. The questionnaire included questions on antiarrhythmic medication use, symptom control, and subjective treatment effectiveness. Medication use was analysed as a binary variable (use vs. no use) and by drug class. Patients were grouped according to the duration of waiting time for catheter ablation. Descriptive statistics and group comparisons were applied.

**Results.** Overall, 69.8% of patients reported using at least one antiarrhythmic medication while waiting for catheter ablation, whereas 28.6% did not use drug therapy. Among patients receiving medication, 89.8% rated symptom control as very or partially effective, and only 10.2% reported no effect. In contrast, among patients not using medication, ineffective symptom control predominated (86.1%). Across all waiting-time groups, most patients continued to use antiarrhythmic drugs, and no marked decline in medication use was observed with longer waiting times. With increasing waiting duration, a higher proportion of patients reported very or partially effective symptom control; however, a consistent subgroup of patients reported persistent symptoms despite medical therapy.

**Conclusions.** Most patients waiting for catheter ablation receive antiarrhythmic drug therapy, which subjectively provides at least partial symptom relief in the majority. Nevertheless, a substantial proportion of patients experience insufficient symptom control despite prolonged medical treatment, highlighting the importance of timely access to catheter ablation for symptomatic premature beats.

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## CHARACTERISTICS OF TYPE 2 DIABETES IN ADULTS AGED 30 AND OVER: ANALYSIS OF COMPENSATION AND COMPLICATIONS IN TWO FAMILY DOCTOR PRACTICES

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**Background**. Type 2 diabetes mellitus is a chronic condition associated with significant risk of microvascular and macrovascular complications. Primary care plays an important role in routine diabetes management, while specialist care is involved in more complex cases. However, data on long term metabolic compensation and complication burden in family medicine populations remain limited, and patient adherence represents an important aspect of diabetes care in routine practice.

**Aim.** To characterise adults aged 30 and over, with type 2 diabetes in two general practices, focusing on glycaemic control and diabetes-related complications, and, to evaluate the role of treatment adherence and lifestyle related factors as secondary contributors.

**Methods**. A retrospective cross-sectional study was conducted using medical records from two general practices. Demographic data, anthropometric measurements, diabetes duration, laboratory parameters, glycaemic control (mean HbA1c), treatment adherence, lifestyle-related factors (dietary adherence and/or increased physical activity), and diabetes-related complications were analysed. Statistical analysis included chi-square tests, Fisher's exact test, Spearman correlation, and multivariable linear regression.

**Results**. Seventy patients were included. Glycaemic control was not independently associated with the number of diabetes-related complications. Diabetes duration showed a moderate positive correlation with complication burden (Spearman's $\rho = 0.547$, $p < 0.001$) and remained a significant predictor in multivariable regression analysis ($\beta = 0.531$, $p < 0.001$), whereas glycaemic control did not. Good treatment adherence was significantly associated with a lower prevalence of complications ($\chi^2(1) = 10.431$; $p = 0.001$; Fisher's exact test $p < 0.001$). Lifestyle modification was not significantly associated with the presence of complications ($\chi^2(1) = 0.098$; $p = 0.754$).

**Conclusions**. In this primary care population, diabetes duration rather than current glycaemic control was the main determinant of complication burden. Treatment adherence was associated with lower prevalence of diabetes-related complications, while lifestyle-related factors did not show an independent association. The findings highlight the importance of strengthening patient adherence in general practice to reduce the risk of diabetes-related complications.

**Acknowledgements**. The authors declare no conflicts of interest. No external funding was received.

## LACTATE PROFILE, $VO_2$PEAK, AND BLOOD PRESSURE RESPONSES IN MAXIMAL EXERCISE TESTING IN GRASSROOTS ATHLETES

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**Background.** Most individuals participating in sports are grassroots athletes, with the aim of improving and maintaining health. Unlike professional athletes, grassroots athletes are often less informed about their health. For this reason, cardiopulmonary exercise tests were conducted to evaluate grassroot athletes.

**Aim.** The aim of this study was to assess the exercise capacity of grassroots athletes during a maximal incremental exercise testing by analysing blood lactate profile, $VO_2$peak, and cardiovascular system responses.

**Methods.** The study included 86 participants (41 women, 36.6 ± 8.3 years old (SD), 45 men, 37.4 ± 11.1 years old

(SD)). Study took place at the Laboratory of Sports Physiology, University of Latvia. The test was carried out on a veloergometer (Ergoline, ergoselect 100/200 GmbH, Bitz, Germany). After one resting minute participants performed an incremental maximal exercise test with a load of 0.7 W/kg for 5 min and a subsequent load increase of 0.1 W/kg/min. The test was continued until the exhaustion following by five minutes of active recovery. During the test, capillary blood samples were collected to determine blood lactate concentration. Also, heart rate, 12-lead electrocardiogram, arterial blood pressure, $O_2$ consumption, $CO_2$ production, pulmonary ventilation was measured.

**Results.** Blood lactate concentration (mmol/l) for females was 1.58 ± 0.51 at rest, 1.63 ± 0.44 at the aerobic threshold, 3.71 ± 0.67 at the anaerobic threshold and 8.19 ± 1.93 at maximal load, for males it was 1.73 ± 0.80, 1.84 ± 0.49, 3.85 ± 1.07 and 9.44 ± 2.11, respectively, systolic blood pressure (mmHg) for females was 119 ± 14 at rest, 138 ± 15 at the beginning of the testing and 189 ± 23 at maximal load, for males it was 132 ± 14, 156 ± 19 and 216 ± 18, respectively, females reached a $VO_2$peak of 33.7 ± 4.7 ml/min/kg, however, male athletes achieved a $VO_2$peak of 36.9 ± 6.5 ml/min/kg.

**Conclusions.** Grassroots athlete trends indicate that most would benefit from improving aerobic endurance, and a substantial proportion of athletes exhibited hypertensive response to exercise. Some participants may have achieved better results if tested in a more familiar activity, such as running.

**Acknowledgements.** This research was carried out within the National Research Programme "Sports", Project/Agreement No. VPP-IZM-Sports-2023/1-0001.

## POSTPRANDIAL BLOOD GLUCOSE CHANGES FOLLOWING FIXED-TIME EATING EVENTS IN ADULTS WITH OVERWEIGHT OR GRADE 1 OBESITY IN REAL-LIFE DATA

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**Background.** Postprandial glucose excursions are important markers of metabolic health and may be associated with future cardiometabolic risk. Nutrient composition and meal timing are known to influence postprandial glycaemic responses, but their effects in individuals with overweight or grade 1 obesity under real-world conditions remain underexplored.

**Aim.** This study aimed to assess how nutrient composition influences postprandial glucose excursions using continuous glucose monitor (CGM) data.

**Methods**. Seventy participants were included in the study. The inclusion criteria were adults with normal glucose metabolism (fasting glucose < 5.6 mmol/l and HbA1c < 5.7%), and body mass index 25-34.9 kg/m$^2$. Each participant wore a blinded CGM sensor (Libre ProIQ, Abbott) for 14 days and completed a 3-day food diary.

CGM data were grouped into five fixed-time events (00:00–05:30; 05:31–10:30; 10:31–15:30; 15:31–20:30; 20:31–23:59), within which all consumed foods and beverages were combined. A total of 814 fixed-time events aligned with CGM readings were used. Energy, macronutrient, and selected micronutrient contents were calculated for each event and classified into high or low groups based on the median.

To analyse CGM data different metrics were used: baseline glucose, peak glucose, time to peak (T.T.Peak) and time to baseline (T.T.Baseline); incremental area under the curve (iAUC), calculated as glucose exposure above baseline during the postprandial period; proportion of time spent below, within, and above the tight glycaemic range (3.9-7.8 mmol/l) after meal onset is reported as TBR, TITR, TAR.

CGM metrics are calculated separately for events with high or low nutrient content. Differences between groups are assessed using Mann–Whitney U tests.

**Results.** Events with high calorie or nutrient content showed consistently higher postprandial glucose peaks than low-content events ($p < 0.05$).

High-nutrient meals also exhibited larger incremental iAUC and delayed T.T.Peak, indicating slower progression to maximum glucose levels and prolonged recovery, resulting in longer postprandial glucose elevation ($p < 0.05$).

Participants who consumed a higher amount of calories (96.81%, 96.58% low vs high group) and fibre (97.12%, 96.27% low vs high group) spent less time in a TITR ($p < 0.05$).

Events high in calories, carbohydrates, proteins, fibres, and sugar showed higher TAR, consistent with greater and longer-lasting glucose elevations (2.10%, 1.98%, 1.98%, 2.20%, 2.34%, respectively; $p < 0.05$).

**Conclusion**. Meal composition may influence postprandial glucose curves; however, the magnitude and clinical relevance of this effect require further investigation, taking into account intra- and inter- individual variability.

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## IMPACT OF EDUCATION ABOUT THE GESTATIONAL DIABETES MELLITUS ON NEONATAL BIRTH WEIGHT AND PATIENT ADHERENCE AT PAULS STRADIŅŠ CLINICAL UNIVERSITY HOSPITAL

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**Background.** Gestational diabetes mellitus (GDM) is a common pregnancy-related metabolic disorder associated with increased maternal and neonatal risk, including macrosomia and neonatal hypoglycaemia. Patient education on nutrition, glucose self-monitoring, and lifestyle modification is a key component of GDM management; however, adherence to recommendations varies.

**Aim.** To evaluate the impact of gestation diabetes education on neonatal birth weight and patient adherence among women with GDM.

**Methods.** This prospective study included 70 women diagnosed with GDM who delivered at the Department of Obstetrics of Pauls Stradiņš Clinical University Hospital between July and December 2025. Data were obtained from medical records and structured postpartum questionnaires addressing gestational diabetes education and adherence. Statistical analysis was performed using IBM SPSS Statistics and Microsoft Excel.

**Results.** The mean maternal age was 33.3 ± 4.35 years. Primiparous women accounted for 48.6% (n = 34) of participants, while 51.4% (n = 36) were multiparous; among multiparous women, 52.8% (n = 19) had a history of GDM or previous delivery of neonate weight ≥ 4000 g.

Participants were divided into two groups: women who received gestational diabetes education and demonstrated good adherence (57%, n = 40) and women who did not receive education or showed low adherence (43%, n = 30).

Daily glucose monitoring was reported by 97.5% (n = 39) of educated women, whereas only 70 % (n = 21) of women in the non-adherent group performed daily measurements. Among educated women, 50% (n = 20) monitored blood glucose 3-4 times per day, while only 2.5% (n = 1) measured glucose four times per week. In contrast, only 43% (n=14) of women in non-adherent group performed glucose monitoring 3–4 times daily; 7% (n = 2) monitored glucose 2-6 times per week, and 23% (n = 7) reported glucose measurements only once per week. Overall, educated women demonstrated significantly higher frequencies of blood glucose monitoring both per week and per day ($p = 0.001$ and $p = 0.002$, respectively). Additionally, gestational weight grain was significantly lower in the educated group compared with non-adherent group (+9.1 kg vs. +13.3 kg; $p = 0.004$). Mean neonatal birth weight was significantly lower among neonates born to mothers who received gestational diabetes education compared with those born to non-adherent mothers (3361.6 g vs. 3637.8 g; $p = 0.046$). The incidence of neonatal macrosomia was substantially higher in non-adherent group (40%, n = 12 vs. 15%, n = 6). A statistically significant association was observed between gestational diabetes education status and neonatal birth weight category ($\chi 2 = 5.61$, $p = 0.018$; Fisher's exact test $p = 0.027$), with a small-to-moderate effect size (Cramer's V = 0.28), indicating a clinically relevant relationship. Neonatal hypoglycaemia also occurred more frequently among neonates born to non-adherent mothers (30%, n = 9 vs. 20%, n = 8).

**Conclusion.** Education about gestational diabetes, regular follow-up and higher adherence to recommendations are associated with better glucose self-monitoring, lower gestation weight gain, and improved neonatal outcomes, including lower birth weight and reduced rates of macrosomia.

**Acknowledgements.** The authors declare no conflict of interest.

## ASSOCIATION OF FAMILIAL HYPERCHOLESTEROLEMIA-RELATED GENETIC VARIANTS WITH CORONARY ARTERY DISEASE IN THE LATVIAN FH REGISTRY

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**Background.** Familial hypercholesterolemia (FH) is a common inherited lipid disorder characterised by lifelong elevation of low-density lipoprotein cholesterol and a markedly increased risk of premature coronary artery disease. Pathogenic variants in genes such as LDLR, APOB, PCSK9, and LDLRAP1 are known to underlie FH, yet the relationship between specific genetic variants and the clinical manifestation of coronary disease remains incompletely characterised in many populations.

**Aim.** To evaluate the association between FH-related genetic variants and coronary artery disease in patients enrolled in the Latvian FH Registry.

**Methods.** Patients were selected from the Latvian FH Registry if genetic testing results were available from either whole-genome sequencing (WGS) or targeted gene panel sequencing using Oxford Nanopore Technologies (ONT). Genetic variants were analysed in four canonical FH-associated genes (LDLR, APOB, PCSK9, LDLRAP1) and six additional genes from broader dyslipidemia with WGS. Only three genes (LDLR, APOB, PCSK9) were analysed with ONT. Patient medical records were reviewed to determine the first occurrence of acute coronary syndrome, history of coronary revascularisation (percutaneous coronary intervention [PCI] or coronary artery bypass grafting [CABG]), and findings from invasive or computed tomography (CT) coronary angiography.

**Results.** In total, 406 patients (341 in the WGS group and 65 in the ONT group) were eligible for analysis, among whom 311 patients had undergone coronary angiography and were analysed for coronary findings. Patients with monogenic FH exhibited a significantly earlier onset of coronary atherosclerosis compared with patients without an identifiable monogenic variant (48.4 ± 11.9 vs. 53.1 ± 10.2 years; $p = 0.003$). Difference between the groups regarding the age at which at least one ≥ 50% coronary artery stenosis developed was nonsignificant (51.4 ± 11.5 vs. 55.2 ± 10.2 years; $p = 0.207$). In a subgroup analysis, patients carrying LDLR gene variants demonstrated an earlier development of atherosclerosis compared with patients with APOB variants (47.2 ± 12.4 vs. 53.2 ± 8.6 years; $p = 0.041$). The age at which the first revascularisation procedure was performed (50.8 ± 9.5 vs. 55.1 ± 11.3 years; $p = 0.091$) or the first acute coronary syndrome event occurred (50.5 ± 11.6 vs. 52.8 ± 9.4 years; $p = 0.554$) was nonsignificantly earlier in patients with monogenic variant.

**Conclusions.** Monogenic FH, particularly due to LDLR variants, is associated with earlier development of coronary atherosclerosis compared with patients without identified FH-related variants.

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## ASSOCIATION BETWEEN LIFESTYLE HABITS AND BLOOD GLUCOSE LEVELS IN MEDICAL COLLEGE STUDENTS

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**Background**. Glucose plays a central role in human energy metabolism and is strongly influenced by dietary patterns, physical activity, sleep, and stress. Medical college students frequently face irregular daily routines, which may negatively affect glucose regulation and increase the risk of metabolic disturbances.

**Aim**. To evaluate fasting blood glucose levels in medical college students in relation to lifestyle factors.

**Methods**. The study included 70 medical college students. Fasting capillary blood glucose was measured in May and October 2024. Participants completed a structured questionnaire addressing dietary habits, physical activity, and sleep patterns, and body mass index (BMI) was calculated. Data were analysed using comparative statis-tics and cross-tabulation to assess associations between lifestyle variables and glucose levels.

**Results**. Mean fasting glucose values were slightly lower in October than in May. During the first assessment, students who reported frequent sugar consumption demonstrated higher glucose levels (5.17 mmol/l) compared with those reporting rare sugar intake (4.92 mmol/l); this difference was less pronounced in October. Students following a more varied diet tended to show more stable glycaemic values. No meaningful association was identified between BMI and blood glucose.

Sleep duration showed seasonal variation in its relationship with glucose levels. In May, lower values were observed among students sleeping more than nine hours, whereas in October the lowest glucose levels occurred in the 7–8 hour sleep group. Moderate physical activity (3–4 hours per day) in October was associated with the lowest glucose concentrations, while very high activity levels were occasionally accompanied by transient glucose elevations in both measurement periods.

Statistical analysis revealed a weak and non-significant association between lifestyle factors and blood glucose levels (Cramer's V = 0.171; $p = 0.366$).

**Conclusions**. Among medical college students, blood glucose levels were more closely related to lifestyle habits and seasonal factors than to body mass. Balanced nutrition, sufficient sleep, and moderate physical activity were associated with more stable glycaemic values. Although statistically significant relationships were not demonstrated, the observed patterns support the importance of healthy lifestyle behaviours in reducing the risk of metabolic imbalance in this population.

**Acknowledgements**. The study was approved by the Ethics Committee of Pauls Stradiņš Medical College.

## CT THROMBUS DENSITY AND ITS ASSOCIATION WITH BIOMARKERS AND SEVERITY IN ACUTE PULMONARY EMBOLISM

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**Background.** Acute pulmonary embolism (PE) requires rapid and accurate risk stratification in the emergency department to guide management and improve outcomes. Current assessment relies on CT pulmonary angiography and biochemical markers such as D-dimer and cardiac troponin. While these tools are well established, the relationship between CT-derived thrombus characteristics — particularly thrombus attenuation — and laboratory biomarkers remains insufficiently explored. A better understanding of this relationship may enhance early risk assessment and support more precise clinical decision-making in patients with acute PE.

**Aim.** This study examines CT thrombus attenuation, D-dimer, and troponin in pulmonary embolism, assessing whether combining imaging and laboratory markers improves rapid risk stratification and diagnostic decisions in the emergency department.

**Methods.** This retrospective study included adult patients presenting to the emergency department with suspected pulmonary embolism who underwent CT pulmonary angiography. For confirmed cases, anonymised clinical records, laboratory data (D-dimer, cardiac troponin), and imaging studies were reviewed. Thrombus attenuation was measured in Hounsfield units on native CT images. Pulmonary embolism severity was classified as low-risk, submassive, or massive based on clinical and radiological criteria. Statistical analyses included descriptive statistics, correlations (Pearson or Spearman), Chi-square tests, sensitivity and specificity calculations, and logistic regression to identify predictors of severe pulmonary embolism ($p < 0.05$).

**Results.** In patients presenting to the emergency department with acute pulmonary embolism, thrombus attenuation on native CT differed across pulmonary embolism severity categories, with higher attenuation values observed in massive and submassive PE compared with low-risk PE. Thrombus attenuation demonstrated a moderate positive correlation with cardiac troponin levels (Spearman $\rho = 0.34$, $p < 0.001$), while its correlation with D-dimer was weak and not statistically significant (Pearson $r = 0.19$, $p = 0.054$). Elevated troponin levels were significantly associated with higher PE severity in the emergency setting ($\chi^2 = 8.12$, $p = 0.017$). Logistic regression identified troponin elevation as an independent predictor of severe PE (OR 3.2, 95% CI 1.4–7.5, $p = 0.006$), whereas D-dimer showed high sensitivity but low specificity for identifying severe pulmonary embolism.

**Conclusions.** CT-derived thrombus density shows significant associations with laboratory biomarkers and clinical severity in acute pulmonary embolism. Quantitative thrombus assessment may enhance the radiological contribution to early risk stratification and interdisciplinary decision-making in emergency PE management.

## LEFT VENTRICULAR EJECTION FRACTION RECOVERY AFTER TAKOTSUBO SYNDROME: FIRST DATA FROM A LATVIAN TTS REGISTRY WITH 3– 6-MONTH ECHOCARDIOGRAPHIC FOLLOW-UP

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**Background**. Takotsubo syndrome (TTS) is an acute heart failure syndrome with dynamic electrocardiographic changes and typically reversible left ventricular (LV) dysfunction. Echocardiography is essential to define wall-motion patterns, identify haemodynamically relevant complications, and document recovery.

**Aim.** To summarise admission ECG and echocardiographic findings in InterTAK-confirmed TTS hospitalisations and quantify LV ejection fraction (LVEF) recovery at 3–6 months.

**Methods**. We analysed 56 InterTAK-confirmed TTS hospitalisations from an investigator-initiated Latvian TTS registry (retrospective n = 33, prospective follow-up n = 23). The prospective subgroup underwent repeat transthoracic echocardiography at 3–6 months. Paired LVEF changes were assessed using a two-tailed paired sign test; associations were explored with Spearman's rank correlation.

**Results**. Mean age was 69.2 ± 11.7 years; 50/56 (89.3%) were female. Admission ECG most frequently showed T-wave inversion 24/56 (42.9%) and ST-segment elevation 23/56 (41.1%), followed by QT prolongation 16/56 (28.6%) and pathological Q waves 14/56 (25.0%). Baseline LVEF was 45.4 ± 9.7%. Echocardiography demonstrated LV apical akinesia in 18/56 (32%) and right ventricular involvement, recorded as RV apical akinesia, in 12/56 (21.4%), both ventricular involvement in 10/56 (18%). LV outflow tract obstruction occurred in 4/56 (7.1%), and apical aneurysm was recorded in 4/56 (7.1%). Baseline systolic impairment showed a moderate inverse association with age (Spearman's $\rho = -0.38$, $p = 0.006$) and a stronger inverse relationship with NT-proBNP concentrations ($\rho = -0.55$, $p < 0.001$). Among patients with paired baseline and 3–6-month echocardiograms (n = 23), LVEF increased consistently over time (paired sign test $p = 0.00012$); by follow-up, 21/23 (91.3%) had recovered to ≥ 50% while 2/23 (8.7%) remained mildly reduced.

**Conclusions**. These are the first combined results from an investigator-initiated Latvian TTS registry. The early data show typical acute left ventricular systolic dysfunction with characteristic ECG and echocardiographic findings, and recovery of LVEF in almost all patients at 3–6 months with follow-up imaging. Continued enrolment in the registry will allow a better understanding of echocardiographic patterns, recovery over time, and late complications.

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## ENDOTHELIAL DAMAGE MARKERS AND ATHEROGENIC LIPOPROTEINS ACROSS CORONARY ATHEROSCLEROSIS SEVERITY

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**Background.** Atherosclerotic cardiovascular disease remains the leading cause of mortality and morbidity worldwide, so it is necessary to improve risk stratification beyond traditional lipid measurements. Atherogenic lipoproteins and biomarkers of endothelial damage and extracellular matrix remodelling may reflect subclinical vascular damage and the severity of coronary artery disease (CAD).

**Aim.** This study investigated the interrelationships between atherogenic lipoproteins (lipoprotein(a) (Lp(a)), apolipoprotein B (ApoB), oxidised low-density lipoprotein (oxLDL), endothelial damage markers (endocan and vimentin), and extracellular matrix glycoproteins (thrombospondin-1, thrombospondin-2) across different severities of coronary atherosclerosis.

**Methods.** This cross-sectional pilot study included 93 patients with stable angina pectoris who underwent invasive coronary angiography, coronary computed tomography angiography, or both to assess CAD. Disease severity was evaluated using segment involvement score (SIS), segment stenosis score (SSS), and the Gensini and CAD-RADS classifications. Serum levels of oxLDL, thrombospondin-1, thrombospondin-2, vimentin, and endocan were determined

by ELISA using commercially available kits (EUROIMMUN Analyzer I, Germany). Standard biochemical analyses (ApoB and Lp(a)) were performed using the AU680 automated clinical chemistry analyser (Beckman Coulter, USA).

**Results.** CAD was diagnosed in 76.3% of patients (n = 71). OxLDL correlated with multiple indicators of coronary atherosclerosis severity, including the Gensini score (r = 0.455, $p = 0.006$), number of atherosclerotic segments (r = 0.469, $p = 0.005$) and affected arteries (r = 0.479, $p = 0.004$), indication for revascularisation (r = 0.318, $p = 0.003$), and significant circumflex artery stenosis (r = 0.323, $p = 0.005$). OxLDL was also significantly associated with the endothelial damage marker vimentin (r = 0.459, $p < 0.001$). Vimentin showed significant associations with multiple measures of CAD severity, including the Gensini score (r = 0.480, $p = 0.005$), SIS (r = 0.349, $p = 0.003$), SSS (r = 0.320, $p = 0.008$), CAD-RADS classification (r = 0.331, $p = 0.005$), number of atherosclerotic segments (r = 0.515, $p = 0.003$) and affected arteries (r = 0.384, $p = 0.030$), as well as indication for revascularisation (r = 0.324, $p = 0.003$). ApoB, Lp(a), endocan, thrombospondin-1, and thrombospondin-2 showed no significant associations with CAD presence or severity.

**Conclusions.** OxLDL and vimentin were significantly associated with CAD severity, suggesting their potential utility as biomarkers of disease progression. These exploratory findings warrant confirmation in larger, prospective studies.

**Acknowledgements.** The authors declare no conflict of interest. This research received no external funding.

## COMORBID COURSE OF TYPE 2 DIABETES MELLITUS AND ARTERIAL HYPERTENSION

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**Background**. Type 2 diabetes mellitus (T2DM) and arterial hypertension (AH) are among the most common chronic non-communicable diseases. Their coexistence significantly increases the risk of cardiovascular complications, progression of diabetic nephropathy, and damage to target organs. The comorbid course of T2DM and AH is associated with aggravated metabolic disturbances and accelerated vascular injury, resulting in an unfavourable prognosis.

**Aim**. The aim is to assess the clinical, metabolic, and renal characteristics of the comorbid course of type 2 diabetes mellitus and arterial hypertension.

**Methods**. A retrospective analysis of 200 patients with T2DM monitored was performed. Patients were divided into two groups: T2DM without AH (n = 100) and T2DM with concomitant AH (n = 100). Statistical analysis was conducted using SPSS software.

**Results**. Patients with combined T2DM and AH were older (predominantly 50–70 years) than patients with iso-lated T2DM (35–50 years) and had a longer duration of diabetes (median 13–14 years vs. 7–8 years). The T2DM + AH group demonstrated higher levels of HbA1c and fasting plasma glucose, indicating poorer glycaemic control. Total cholesterol levels were more frequently within the range of 6.0–7.5 mmol/l and higher in patients with T2DM and AH, whereas in isolated T2DM they ranged from 5.0–6.2 mmol/l. Median levels of low-density lipoproteins and triglycerides were higher, while high-density lipoprotein levels were lower (≈ 1.0–1.2 mmol/l) in the T2DM + AH group compared to the T2DM-only group. Renal function was more impaired in patients with T2DM and AH: eGFR was more often < 90 ml/min/1.73 m², median creatinine levels were higher, and microalbuminuria was more pronounced. Ketonuria was detected in 38.6% of patients with T2DM + AH com-pared to 21.6% in patients with T2DM.

**Conclusions**. The coexistence of type 2 diabetes mellitus and arterial hypertension is associated with longer dis-ease duration, poorer glycaemic control, more pronounced dyslipidemia, and progression of renal impairment. Arterial hypertension has a significant aggravating effect on the course of diabetes, enhancing metabolic dis-turbances and increasing the risk of cardiovascular complications.

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# TWO-MONTH RESPONDER OUTCOMES FOLLOWING LIFESTYLE RECOMMENDATIONS IN OUTPATIENT FOLLOW-UP

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**Background.** Lifestyle modification is recommended as first-line management for metabolic and cardiovascular risk factors. In routine outpatient care, short-term changes are often modest and heterogeneous, and mean group differences may underestimate meaningful improvement. Responder analysis using predefined thresholds may better capture early real-world outcomes.

**Aim.** This study assessed two-month changes in anthropometric, metabolic, lipid, and renal function parameters following lifestyle recommendations using a responder-based approach, without pharmacological treatment.

**Methods.** Observational longitudinal study of 77 adult outpatients with normal glucose metabolism (fasting plasma glucose < 5.6 mmoll; HbA1c < 5.7%) and BMI 25–34.9 kg/m², assessed over three visits (~2-month intervals). Lifestyle recommendations were delivered at visit 2; visit 3 outcomes were evaluated without pharmacological treatment. Outcomes included anthropometrics, fasting glucose, creatinine, and lipid profile. Responders (from visit 2 to 3) were defined by predefined thresholds (weight ≥0.5 kg; waist/hip ≥1 cm; total cholesterol/LDL ≥0.3 mmol/l; triglycerides ≥0.2 mmol/l; fasting glucose ≥0.3 mmol/l; creatinine ≥5 μmol/l). Paired changes were analysed using Wilcoxon signed-rank tests.

**Results.** The study included 77 participants, of whom 56 (72.7%) were women, with a mean baseline age of 36.9 ± 9.4 years. Analysis revealed clinically meaningful improvement in a substantial proportion of participants, predominantly in anthropometric measures. Weight reduction ≥0.5 kg was observed in 34 (44.2%), waist reduction ≥1 cm in 31 (40.3%), and hip reduction ≥1 cm in 25 (32.5%). Lipid improvements were observed in a smaller but consistent subset: total cholesterol reduction ≥0.3 mmol/l in 23 (30.3%), LDL-C reduction ≥0.3 mmol/l in 21 (27.6%), and triglyceride reduction ≥0.2 mmol/l in 19 (25.0%). Metabolic and renal responses were less frequent, with fasting glucose reduction ≥0.3 mmol/l in 14 (18.7%) and creatinine reduction ≥5 μmol/l in 15 (19.7%). Paired analyses demonstrated small median reductions in anthropometric parameters (weight –0.26 kg; waist –0.42 cm; hip –0.22 cm), while group level changes in glucose, lipids, and creatinine were minimal and not consistently significant.

**Conclusions.** In a two-month outpatient follow-up after lifestyle recommendations, responder analysis demonstrated clinically meaningful improvements in almost half of patients for weight and waist circumference, with lipid improvements observed in approximately one-third of patients. Mean group changes were modest and often not statistically significant, highlighting the heterogeneity of response over short follow-up. Responder-based reporting provides a clinically informative framework for evaluating early real-world outcomes of non-pharmacological interventions. Longer follow-up and larger cohorts are needed to confirm sustained effects and identify predictors of response.

**Acknowledgements.** Project "Physics informed machine learning-based prediction and reversion of impaired fasting glucose management (Praesiidium)", Nr. 101095672.

## SHIFTING THE GUT MICROBIOTA LANDSCAPE: IMPACT OF POLYHERBAL ADJUNCT THERAPY IN TYPE 2 DIABETES

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**Background**. Metformin-induced gastrointestinal side effects are a major barrier to treatment adherence in patients with type 2 diabetes (T2D). Emerging evidence indicates that these effects are mediated by the gut microbiome, which also plays a role in the drug's therapeutic efficacy. Polyherbal formulations (PHFs) may act as prebiotics to aid this microbial environment.

**Aim**. To evaluate the short-term impact of a PHF as an add-on to metformin on the gut microbiota composition and function in T2D patients with a history of metformin intolerance.

**Methods**. 27 adults with T2D were involved in a randomised, placebo-controlled crossover trial (NCT06846138). Participants received either a PHF (containing amla, turmeric, ginger and black pepper) or placebo for 7 days alongside their usual metformin dose. Shotgun metagenomic sequencing was performed on stool samples collected at baseline and on day 8. The data was analysed using Kraken2, Bracken, and HUMAnN3. Glycaemic metrics were assessed via continuous glucose monitoring (CGM).

**Results**. While alpha-diversity remained stable, the PHF intervention significantly altered beta-diversity (PERMANOVA $R^2 = 0.04$, $p = 0.04$). Differential abundance analysis revealed significant shifts in 17 species only within the PHF group. Most notably, there was a selective enrichment of six *Bifidobacterium* species, including *B. adolescentis* (coef. = 3.99, FDR < 0.25) and *B. ruminantium* (coef. = 3.54, FDR < 0.25). Conversely, potential butyrate-producers like *Roseburia intestinalis* significantly decreased (coef. = –2.42, FDR 0.25). Functional profiling identified the enrichment of the Bifidobacterium shunt (P124–PWY) and chorismate biosynthesis, alongside a reduction in methylglyoxal degradation and cell-wall recycling pathways. No such shifts were observed in the placebo group.

**Conclusions**. Short-term PHF administration acts as a potent prebiotic-like modulator, specifically driving the expansion of beneficial Bifidobacterium taxa and their metabolic pathways. These microbial adjustments provide a mechanistic basis for using PHF to improve metformin tolerance and support long-term metabolic health in patients with T2D.

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## REAL-WORLD USE AND IMPACT OF DIRECT ORAL ANTICOAGULANTS AMONG ATRIAL FIBRILLATION PATIENTS WITH CARDIOEMBOLIC STROKE

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**Background.** Atrial fibrillation (AF) is a primary cause of cardioembolic stroke (CES). AF-related mortality increased substantially in Eastern Europe in the last decade. Non-adherence to direct oral anticoagulants (DOACs) seems to be a major health policy issue.

**Aim.** This study aimed to investigate real-world DOAC usage among AF patients presenting with stroke and to evaluate the impact of prior DOAC therapy on stroke severity.

**Methods.** This retrospective study analysed data from CES patients with AF admitted to the two largest Latvian university hospitals from January 2022 to December 2024. Secondly, a propensity-matched analysis was performed on a single-centre cohort to compare outcomes between patients receiving DOAC therapy and those not receiving it.

**Results.** Of 2773 CES patients enrolled, the largest subgroup (45%) consisted of patients with known AF who were not on anticoagulation therapy before the stroke event. The propensity-matched analysis based on demographics, arrival time, AF type, and CHA2DS2-VA score (163 patients per group) revealed that patients taking DOACs presented with significantly milder strokes than non-users (mean admission NIHSS: 9.8 vs. 11.6, $p = 0.009$). Stroke patients on DOAC therapy had significantly larger left atrial volume indices (LAVI) than non-users (56.4 vs. 48.0, respectively; $p = 0.004$).

**Conclusion.** Non-adherence to DOACs represents a substantial contributor to the CES burden. Prior DOAC use is associated with significantly reduced initial stroke severity, highlighting the protective benefit of therapy even when it fails to prevent an event. Severely dilated left atria might present a risk factor for breakthrough strokes.

## IMPACT OF BREAKFAST HABITS ON 24-HOUR GLUCOSE LEVELS AND GLYCAEMIC VARIABILITY IN INDIVIDUALS WITH OVERWEIGHT AND CLASS I OBESITY

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**Background.** Breakfast habits may influence daily glucose regulation, particularly in individuals with excess body weight. Continuous glucose monitoring (CGM) enables detailed assessment of glycaemic variability and time spent within target glucose ranges beyond mean glucose levels.

**Aim.** To assess the relationship between breakfast habits and 24-hour glucose levels and glycaemic variability in individuals with overweight and class I obesity.

**Methods.** A quantitative cross-sectional secondary data analysis was conducted using data from the PRAESIIDIUM project. The inclusion criteria were adults with normal glucose metabolism (fasting glucose < 5.6 mmol/l and HbA1c < 5.7%) and body mass index 25–34.9 kg/m². The analysis included 71 adults with a mean age of 36.99 ± 8.31 years (range 21–55); 73.2% (n = 52) were women and 26.8% (n = 19) were men. Breakfast regularity and breakfast carbohydrate amount and quality were assessed using 3-day food diaries. Each participant wore a blinded CGM sensor (Libre Pro IQ, Abbott) for 14 days. CGM-derived parameters included mean glucose levels, glycaemic variability (%CV), time in tight target range (TITR; 3.5–7.8 mmol/l), time above range (TAR; > 7.8 mmol/l), and time below range (TBR; < 3.5 mmol/l). Group comparisons and correlations were evaluated using appropriate statistical tests, including Spearman rank correlation analysis.

**Results.** Mean 24-hour glucose levels did not differ significantly between low and high breakfast carbohydrate intake groups ($p = 0.11$). Participants in the high-carbohydrate breakfast group showed significantly higher glycaemic variability (%CV; $p = 0.049$), lower TITR ($p = 0.020$), and higher TAR ($p = 0.004$). No significant differences were observed in TBR ($p = 0.940$). Higher breakfast carbohydrate intake was correlated with lower TITR (r = –0.266; $p = 0.025$) and higher TAR (r = 0.314; $p = 0.008$). Higher breakfast fibre intake was correlated with higher TITR (r = 0.382; $p < 0.001$) and lower TAR (r = –0.374; p $p = 0.001$). Breakfast sugar intake and carbohydrate-to-fibre ratio were positively correlated with TAR ($p < 0.05$). No significant correlations were observed between breakfast characteristics and mean glucose levels or glycaemic variability.

**Conclusions.** In individuals with overweight and class I obesity, breakfast carbohydrate amount and quality were correlated with CGM-derived daily glycaemic distribution, while breakfast regularity was not directly related to CGM parameters.

**Acknowledgements:** The authors declare no conflicts of interest. This study was conducted within the project "Physics-Informed Machine Learning-Based Prediction and Reversion of Impaired Fasting Glucose Management (PRAESIIDIUM)", Grant Agreement No. 101095672.

# PREVALENCE OF TYPE 2 DIABETES MELLITUS AND ASSOCIATED FACTORS AMONG PATIENTS WITH LIVER CIRRHOSIS AT THE LATVIAN CENTRE OF INFECTIOUS DISEASES (2020–2024)

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**Background.** Type 2 diabetes mellitus (T2DM) and liver cirrhosis are frequent comorbid conditions associated with considerable morbidity and a substantial contribution to years of life lost. Evidence suggests that T2DM adversely affects outcomes in chronic liver disease. Therefore, timely recognition and management of metabolic comorbidities in cirrhosis is clinically important, and risk stratification by cirrhosis etiology may help to identify vulnerable patient subgroups.

**Aim.** To identify risk factors associated with T2DM among patients with liver cirrhosis.

Methods. This cross-sectional study was based on inpatient medical records from the Latvian Centre of Infectious Diseases. A total of 264 patients with liver cirrhosis hospitalised between 2020 and 2024 were included; 49 had concomitant T2DM. Demographic variables (age, sex) and cirrhosis etiology (HCV, HBV, MAFLD, PBC, alcohol-associated liver disease) were analysed. Associations with T2DM were evaluated using multivariable logistic regression.

**Results.** T2DM was present in 18.6% of patients (n = 49). Patients with T2DM were significantly older than those without diabetes (61.4 ± 10.9 vs 54.9 ± 11.3 years; $p$ = 0.001). Sex distribution did not differ between groups (women: 53.1% vs 56.7%; $p$ = 0.61). HCV infection (current or resolved) was more common among patients with T2DM than among non-diabetic patients (57.1% vs 40.9%; $p$ = 0.031). Alcohol-associated liver disease was more frequent in the non-diabetic group (61.9% vs 49.0%; $p$ = 0.095), showing a non-significant trend. Due to the small MAFLD subgroup (n = 9), no significant association with T2DM was detected ($p$ = 0.38). No significant associations were observed for PBC or HBV ($p > 0.05$).

**Conclusions.** Increasing age was independently associated with higher odds of T2DM in cirrhosis (OR 1.05 per year; 95% CI; $p < 0.001$). HCV infection (including resolved cases) was associated with an almost two-fold increase in the odds of T2DM (OR 1.95; 95% CI; $p$ = 0.038).

Older cirrhosis patients and those with current or resolved HCV represent a high-risk subgroup in whom proactive screening and early management of dysglycaemia should be prioritised.

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