

News and Views

Smartphone-linked Artificial Pancreases Developed by IISc to Monitor Blood Sugar Level

A research team from IISc, Bengaluru, in collaboration with doctors from MS Ramaiah Medical College, has developed an artificial pancreas system. This can monitor and control blood sugar levels in real-time to help people with type 1 diabetes who need to take insulin regularly to avoid low blood sugar (hypoglycemia) or high blood sugar (hyperglycemia).

The Artificial Pancreas (AP) setup developed by Dr Radha Kant Padhi, Professor in the Department of Aerospace Engineering and Robert Bosch Centre for Cyber-Physical Systems, mimics the body's closed loop system that regulates insulin production. The setup has three parts, namely a sensor, an insulin pump and an Android app.

The sensor is a small coin-like device with a tiny needle-like extension that is stuck to the skin like a patch or band-aid that will monitor the glucose concentration in the subcutaneous tissue continuously. The sensor is connected to an insulin pump that will infuse insulin under the skin. The pump is a small rectangular device that can be carried around in a pocket. Both the sensor and the pump are connected to the android app. The app analyses the data sent by the sensor and determines how much insulin should be pumped into the body through the insulin pump. The key component of the app is the Model Predictive Control (MPC). This predicts how much insulin is required based on the sensor's data and sends the signal to the insulin pump. This predictive nature makes MPC a good algorithm for the AP system since blood glucose levels of type 1 patients need to be continuously regulated.

(Source: <https://health.economictimes.indiatimes.com/news/medical-devices/bengaluru-iisc-develops-smartphone-linked-artificial-pancreas-to-monitor-blood-sugar-levels/94673859>)

Risk of Obesity in Kids is Increased by the Intake of Ultra-Processed Food by Mothers

A recent study published in the *BMJ* revealed that a mother's use of ultra-processed foods was connected to an elevated risk of being overweight or obese in her kids, regardless of other lifestyle risk factors. According to the World Health Organization (WHO), 39 million children were overweight or obese in 2020, leading to increased risks of heart disease, diabetes, cancer and early death.

The study suggested that mothers may benefit from limiting their intake of ultra-processed foods. The researchers also suggested that the dietary guidelines should be refined, including the removal of financial and social barriers to improve nutrition for women of childbearing age and to reduce childhood obesity. In the study, the researchers used data from the Nurses' Health Study II (NHS II) and the Growing Up Today Study (GUTS) I and II. The researchers also considered a range of other potentially influential factors, such as the mother's weight (body mass index [BMI]), physical activity, smoking, living status and partner's education, as well as children's ultra-processed food consumption, physical activity and sedentary time.

Based on the analysis, the study results showed that a mother's ultra-processed food consumption was associated with an increased risk of obesity or being overweight in her offspring. For example, a 26% higher risk was seen in the group with the highest maternal ultra-processed food consumption (12.1 servings/day) in comparison to the lowest consumption group (3.4 servings/day). It also found that prenatal ultra-processed food intake had no significant association with an increased risk of offspring being overweight or obese.

(Source: <https://theprint.in/features/study-mothers-intake-of-ultra-processed-food-associated-with-risk-of-obesity-in-kids/1156511/>)

New 3D Technique Developed to Treat Diabetic Foot Ulcers

Researchers at Queen's University Belfast have created a new cost-effective bandage therapy called a scaffold to treat diabetic foot ulcers, which provides better patient outcomes. The scaffolds, which are created by 3D bioprinting, gradually release antibiotics over a 4-week period to cure the wound. The study was published in *The Journal of Drug Delivery and Translational Research*.

The scaffold structure, according to experts, is a unique carrier for cell and medication transport that improves wound healing. By using these scaffolds, which function like windows, surgeons can continuously monitor the healing process without having to remove them, as frequent interference for changing the dressing increases the risk of infection and slows down the healing process. "The 'frame' contains an antibiotic that kills the bacterial infection, and the 'glass', is made

of collagen and sodium alginate, which might include a growth factor that promotes cell growth. The scaffold has two molecular levels, each of which is crucial to the healing of the wound." This new development has been shown to enhance the quality of life among patients and decrease the cost of treatment and also the clinical burden in diabetic foot ulcer treatment.

(Source: <https://m.dailyhunt.in/news/india/english/ani67917250816496966-epaper-anieng/new+3d+technique+developed+by+researchers+to+revolutionise+diabetes+treatment-newsid-n429702646?listname=topicsList&topic=health%20fitness&index=2&topicIndex=8&mode=pwa&action=click>)

Risk of Adverse Outcomes Increased by Long-term Antidepressant Use

Long-term antidepressant usage has been associated with an increased risk of adverse effects, including cardiovascular disease (CVD), cerebrovascular disease (CV), coronary heart disease (CHD) and all-cause mortality, according to a study published in the *British Journal of Psychiatry Open*.

The study involved 2,22,121 participants whose information was connected to primary care records in 2018. They found that 10-year antidepressant usage was linked to an almost twofold increased risk of CVD and CVD mortality, a nearly twofold high risk of CHD, a greater chance of CV and an almost twofold increased risk of all-cause mortality. At 5 years, selective serotonin reuptake inhibitors (SSRIs) were linked to a lower risk of developing diabetes. At 10 years, SSRIs were linked to a higher risk of CV, CVD and all-cause mortality, a lower risk of diabetes and hypertension, and a higher risk of CHD, CVD and all-cause mortality when compared to non-SSRIs. Mirtazapine, venlafaxine, duloxetine and trazodone caused more adverse effects; however, SSRIs were also associated with an elevated risk. The studies highlight the importance of proactive cardiovascular monitoring and prevention in patients with depression taking antidepressants, as both have been linked to greater risks.

(Source: https://www.medscape.com/viewarticle/981951#vp_3)

India Diabetes Study: High BMI Linked to Raised Risk of CVDs

India Diabetes Study (IDS) has reported that more than 55% of newly diagnosed type 2 diabetes mellitus (T2DM) patients in India have low high-density lipoprotein cholesterol (HDL-C) values, suggesting that they are at higher risk of developing some form of CVD in their lifetime. The study also said that 42% of all

T2DM patients are at a higher risk of hypertension. As per the Indian Consensus Group guidelines, the mean body mass index (BMI) of the patients was recorded to be 27.2. The study published in the *PLOS* journal was supported by Eris Lifesciences and co-authored by 16 doctors during the period 2020-2021. It was conducted with the involvement of more than 1,900 physicians and had a sample size of 5,080 patients with a mean age of 48 years, from 27 states across the country.

Dr AG Unnikrishnan said, "India Diabetes Study focused on highlighting the cardiovascular risk factors in newly diagnosed diabetes patients across India. While treatment should focus on dietary changes, physical activity and glucose control, additionally addressing cardiovascular risk by strategies like a blood pressure control and lipid management offer a more holistic way of management- as also suggested in the India Diabetes Study."

The study also reported that 92.5% and 83.5% of the total patients did not receive any cholesterol-lowering and antihypertension treatment. Low HDL-C was reported as the most frequent major risk while 82.5% of patients seemed to have at least one cholesterol-related abnormality.

(Source: *ET HealthWorld*, April 8, 2022)

Treatment of Mild Hypertension During Pregnancy is Safe and Effective

There were fewer adverse pregnancy outcomes when pregnant women with mild chronic hypertension were treated with an antihypertensive medication before or during the first 20 weeks of pregnancy in the Chronic Hypertension and Pregnancy (CHAP) trial published in the *New England Journal of Medicine*.¹

A total of 2,408 pregnant women with mild hypertension were enrolled in this multicenter trial, from 2015 to 2021. Of these, 1208 participants were assigned to treatment with antihypertensive medication to keep their blood pressure (BP) below 140/90 mmHg (intervention group); the remaining 1,200 received an antihypertensive only when the BP increased to 160/105 mmHg and higher (control group). They were followed through delivery and for 6 weeks after delivery.

Results showed that treatment of hypertension to keep the BP below 140/90 mmHg reduced the odds of preterm birth or other pregnancy-related complications. About 70% of women did not have any negative pregnancy outcomes, while 30% developed pre-eclampsia, placental abruption, preterm birth (<35 weeks) or intrauterine or neonatal death. About 37%

of the participants in the control group experienced a similar adverse event.

The antihypertensive treatment had no adverse impact on fetal growth as the birth weight of infants was comparable between the two groups. Most of them had normal birth weight; 11% of babies born to participants who received medication and 10% of babies born to those in the control group had impaired fetal growth.

This study from the National Institutes of Health (NIH) shows that hypertension in pregnancy can be safely and effectively treated. Giving antihypertensive therapy to keep BP below 140/90 mmHg in pregnant women with mild chronic hypertension is a feasible strategy rather than waiting to start treatment when hypertension increases to severe levels, according to the study.

Reference

1. Tita AT, et al; Chronic Hypertension and Pregnancy (CHAP) Trial Consortium. Treatment for mild chronic hypertension during pregnancy. *N Engl J Med.* 2022;386(19):1781-92.

A Low-salt Diet Improves the Quality of Life in Heart Failure Patients

A recent study published in *The Lancet* reported that while low-sodium diets help in improving the quality of life for people with heart failure, they did not reduce clinical events such as hospitalization or emergency room visits.

Researchers in the study reported that reducing sodium intake in the diet can benefit people with heart failure. However, adverse clinical outcomes such as hospitalization do not get affected by the reduction of sodium in diet. In the study, participants were randomly placed into two groups, the intervention group with a low-sodium diet (<1,500 mg of sodium daily) and the control group receiving the standard of care of the region they were located in.

The results showed that the hospitalizations, emergency room visits, and all causes of death were not reduced for participants in the low-sodium diet group compared to the control group. However, a moderate benefit on quality of life and in the New York Heart Association (NYHA) scale classification in the intervention group was seen.

The study results were summarized by Dr Paz as, "Following a low-salt diet did not reduce death or trips

to the hospital in people with congestive heart failure. Despite this fact, there still was a signal for benefit in some key endpoints favoring a low-salt diet, including functional assessments." (Do low salt diets improve outcomes in heart failure? [medicalnewstoday.com])

Healthy Plant-based Diet and the Risk of Type 2 Diabetes

Eating healthy plant-based foods reduces the risk of developing type 2 diabetes compared to those who consumed a diet rich in unhealthy plant-based foods. And, those who ate a healthy plant-based diet also had a different metabolic profile, suggests a recent study published in the journal *Diabetologia*.¹

Researchers from the US evaluated the dietary patterns of 8,827 participants from the Nurses' Health Study, Nurses' Health Study II and Health Professionals Follow-up Study using semi-quantitative food frequency questionnaires. Three plant-based diets were examined and based on the answers, three indices were developed namely overall Plant-based Diet Index (PDI), a Healthy Plant-based Diet Index (hPDI) and an Unhealthy Plant-based Diet Index (uPDI), which were used to evaluate their adherence to plant-based diet. The mean age of the study subjects was 54 years and the mean BMI was 25.6 kg/m².

The *healthy plant-based* diet included whole grains, fruits, vegetables, nuts, legumes, vegetable oil, tea and coffee. The *unhealthy plant-based* diet included refined grains, fruit juices, potatoes, sugar-sweetened beverages and sweets and desserts, while the *animal-based* diet included animal fats, dairy, eggs, fish, meat and other animal-based products.

The plant metabolites were measured to develop metabolite profile scores for the participants and their association with the risk of incident type 2 diabetes was examined. Fifty-five metabolites were found to correlate with an overall plant-based diet, 93 metabolites with a healthy plant-based diet and 75 metabolites with an unhealthy plant-based diet.

Analysis of different metabolites revealed a difference between the healthy and unhealthy plant-based diets and the risk of type 2 diabetes. Participants with high PDI and hPDI scores were at a lower risk of type 2 diabetes with an adjusted hazard ratio of 0.83 and 0.8, respectively.

Gamma-aminobutyric acid, C5-carnitine and three triacylglycerol metabolites were associated with lower PDI score and consequently a higher risk for type 2 diabetes. On the other hand, an inverse association

was noted between isoleucine, C22:0 ceramide and six triacylglycerol metabolites and a hPDI and therefore an increased risk of type 2 diabetes.

Metabolites such as trigonelline, betaine and glycine showed an association with higher PDI score and lower risk for type 2 diabetes. Likewise, trigonelline, hippurate and C22:6 ceramide were associated with a higher hPDI score and a lower risk for type 2 diabetes.

This study recapitulates the beneficial role of plant-based diets, especially a healthy plant-based diet on the risk of type 2 diabetes as well as in the management of type 2 diabetes in achieving glycemic control. A healthy plant-based diet is also heart-friendly. This study has also shown a correlation between the plant metabolites and risk of type 2 diabetes, which warrants further investigation to validate their role in the risk of developing type 2 diabetes. "The metabolite profiles we identified could be used to assess the adherence and metabolic response to plant-based diets during dietary interventions", suggest the authors.²

References

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CRP: A Potential Biomarker to Predict Risk of Delirium in Stroke Patients

Acute stroke patients with high C-reactive protein (CRP) levels >7.09 mg/L are at greater risk for developing delirium, suggests a study from Poland published in the journal *Acta Psychiatrica Scandinavica*.¹

For this study, researchers retrospectively analyzed data from 459 patients who had been hospitalized for acute stroke or transient ischemic attack (TIA) within 24 hours with the aim to find out if including CRP with other clinical factors (Models A and B) could enhance prediction of delirium in these patients.

The factors in Model A were age and stroke severity, while in Model B, severity of stroke, diabetes, atrial fibrillation, pre-stroke dependency and hemorrhagic stroke were the factors included. They were a part of the PRospective Observational POLish Study on delirium (PROPOLIS), which was an observational, prospective single-center study and had recruited patients with ischemic stroke, TIA or intracerebral

hemorrhage from May 2014 to March 2016, within 48 hours of symptoms. Patients who had CRP measured at baseline were enrolled for this study. Their median age was 73 years and more than half (52.7%) the study population was comprised of women. Patients were evaluated for neurological deficits (National Institutes of Health Stroke Scale [NIHSS]), cognitive decline, pre-stroke dependency (modified Rankin Scale) and delirium (Brief Confusion Assessment Method for verbal patients and the Confusion Assessment Method for the Intensive Care Unit for nonverbal patients).

Nearly one-third (29.2%) of patients developed delirium with 46.2% experiencing mixed delirium, 39.2% hypoactive delirium and 14.2% hyperactive delirium. The delirious patients also had higher levels (median) of CRP than those who did not have delirium; 13.2 mg/L vs. 4.4 mg/L, respectively.

A cut-off level of 7.09 mg/L was identified as marking the distinction between the two groups. On univariate analysis, CRP and other clinical factors such as age, diabetes, atrial fibrillation, pre-stroke dependency, pre-stroke cognitive decline, NIHSS score on admission. Hemorrhagic stroke were associated with increased risk for delirium. But on multivariate analysis, this association remained significant only for CRP. The risk was threefolds higher in patients with CRP levels >7.09 mg/L with an adjusted odds ratio (aOR) of 2.98. The researchers also noted that addition of CRP to the two clinical models examined, the "area under receiver operator curve increased from 0.77 to 0.80 for Model A and from 0.81 to 0.84 for Model B."

Delirium in stroke patients is indicative of a poor clinical outcome. Identification of a factor that could predict development of delirium enables monitoring of at-risk patients and timely implementation of appropriate management strategies. CRP, a marker of systemic inflammation, is a commonly performed test in clinical practice. Based on their findings, the authors suggest CRP as a potential marker for risk of delirium in post-stroke patients. Acute stroke patients with high CRP levels, above the cut-off level defined in this study, should be closely monitored for delirium.

Reference

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