Could a 'DNA diet' help to reduce health risks linked to high blood sugar?

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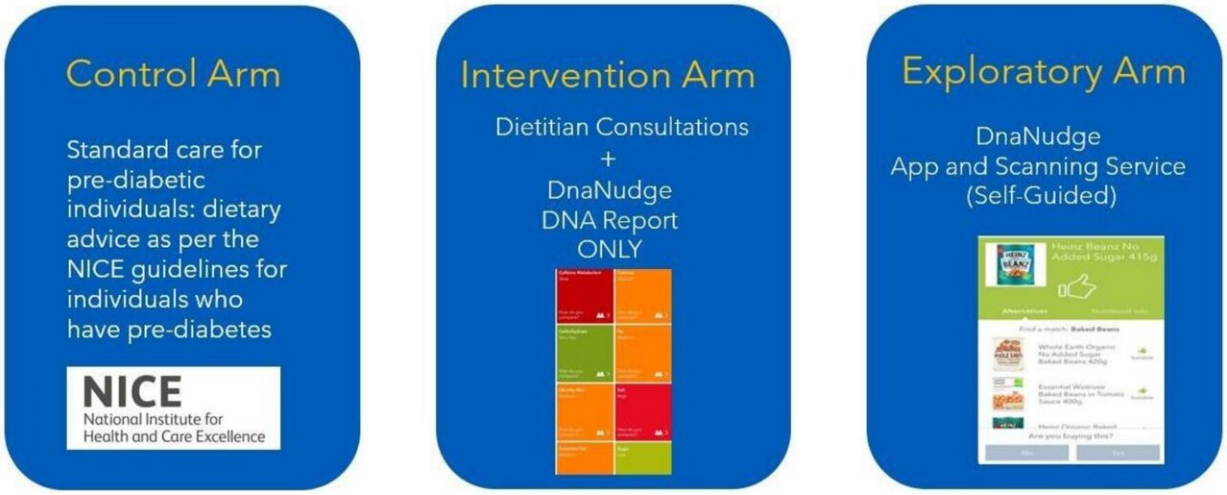

Breakdown of each study arm. Credit: *Scientific Reports* (2024). DOI: 10.1038/s41598-024-55105-6

A U.K. trial has found a DNA-tailored diet could help manage blood glucose and reduce risk of progressing to type 2 diabetes in high-risk individuals.

The findings come from a small Imperial College London and DnaNudge pilot study involving 148 people with high blood sugar levels who were at risk of going on to develop type 2 diabetes (T2D).

It found that following personalized dietary advice informed by genetic information, in combination with face-to-face dietary coaching from a health care professional, was more effective at reducing blood glucose levels than standard dietary coaching based on the National Institute for Health and Care Excellence (NICE) guidelines, which are the current standard of care in the U.K.

While the work is at an early stage, the researchers say it is a promising example of how genetic data might help to prevent long-term conditions and improve health.

They note that larger trials are needed to verify their findings and ensure the approach is suitable for use in clinical practice and for a range of people and conditions.

Joint senior author Regius Professor Chris Toumazou, from Imperial College London's Department of Electrical and Electronic Engineering and DnaNudge, said, "Genetic profiles of chronic conditions, such as type 2 diabetes, obesity, hypertension, and blood cholesterol can tell us which foods individuals might be better or worse at reducing the risk of these conditions, allowing us to specifically tailor advice around their dietary intake of fats, carbohydrates, and other macronutrients.

"Our pilot study, where we apply this to pre-diabetes, shows promising results, suggesting that genetically-informed diets could be an effective intervention compared to, or combined with, standard NICE-guided advice."

The results of the pilot study are published in *Scientific Reports*.

Lifestyle changes

Pre-diabetes is a term used to classify when a person's blood glucose is

consistently higher than usual, but not yet high enough to be classed as T2D. Unlike diabetes, "pre-diabetes" is reversible, but if left unaddressed, up to 10% of people with pre-diabetes progress to T2D each year.

Diabetes is a major cause of sight loss, kidney failure, heart attacks, stroke and lower limb amputation. There are currently 4.9 million people living with diabetes in the U.K., 90% of whom have T2D.

Lifestyle changes can halve the likelihood of pre-diabetes developing into T2D. In the U.K., GPs, nurses, and other health care professionals use interventions from NICE to help improve people's diets and increase their physical activity. However, such interventions can be expensive and labor intensive, requiring multiple appointments.

Certain genetic traits can predict a person's risk of developing diet-related chronic conditions, underlining the importance of dietary modifications, such as changing salt, fat, and saturated fat to address cardiovascular risk, or changing sugar and saturated fat intake for T2D risk.

Based on this, Imperial spinout DnaNudge developed the framework for providing personalized diet plans based on people's genetic profiles, which could be obtained from a sample of saliva.

To test the effects of DNA-based diets on pre-diabetes, the researchers recruited 148 people with high blood sugar levels and took baseline measurements of fasting plasma glucose (FPG—levels of sugar in the blood between meals) as well as glycated hemoglobin (HbA1c) blood sugar levels. Participants also completed a questionnaire outlining how often they consumed certain foods.

The team then randomized participants to one of three groups: the

control group, whose subjects received NICE-guided coaching from a dietician only; the intervention group, whose subjects received coaching and a DNA-based diet; and the exploratory group, whose subjects received no coaching but were self-guided by DnaNudge's app and wearable device that enabled them to scan barcodes and receive DNA-personalized food and drink recommendations while shopping.

They tested participants' FPG and HbA1c again at six, 12, and 26 weeks.

They found no statistically significant difference between the groups at six weeks, but a significant reduction in both FPG and HbA1c in participants using the DNA-based diet, both with and without the DnaNudge app, compared to the control group at 26 weeks.

At 26 weeks, compared with the control group, the intervention group saw an average reduction in FPG of 0.019 mmol/L and reduction in HbA1c by 0.038 mmol/mol, while the exploratory group saw a 0.021 mmol/L reduction in FPG with no reduction in HbA1c.

Opportunities to reduce risk

Joint senior author Professor Nick Oliver, a clinical consultant in diabetes and endocrinology from Imperial College London's Department of Metabolism, Digestion and Reproduction, said, "Prior to progression to type 2 diabetes, people and their health care professionals have an opportunity to reduce their risk. The NICE guidance for lifestyle change—for example, the inclusion of fruits, vegetables, healthy fats and whole grains—are evidence-based and effective for a population, but our findings suggest that personalization by genetically tailoring dietary advice to an individual might have an even greater effect."

The researchers say their results should be treated with caution because of the study's small size of 148, and that the results warrant confirmation

in a larger randomized controlled trial.

They also note that any genetic risk factors for T2D could have limited effects when compared with other biological or socioeconomic vulnerabilities, as well as inequalities in access to health care, associated with race and ethnicity.

They now intend to run a larger, multi-national trial with thousands of participants to validate the results. The larger sample size will also allow them to include results within diverse ethnic groups and genders, which can affect the likelihood of developing T2D.

Joint first author Dr. Maria Karvela, from Imperial College London's Department of Electrical and Electronic Engineering and DnaNudge, said, "Though clinical research into personalized nutrition and type 2 diabetes is still developing, our study adds to evidence that supports the value of such personalized approaches. If validated, our intervention could provide a cost-effective, widely distributable, and easily scalable prevention tool for improving glucose regulation in high-risk individuals."

More information: Maria Karvela et al, Assessment of the impact of a personalised nutrition intervention in impaired glucose regulation over 26 weeks: a randomised controlled trial, *Scientific Reports* (2024). DOI: 10.1038/s41598-024-55105-6

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