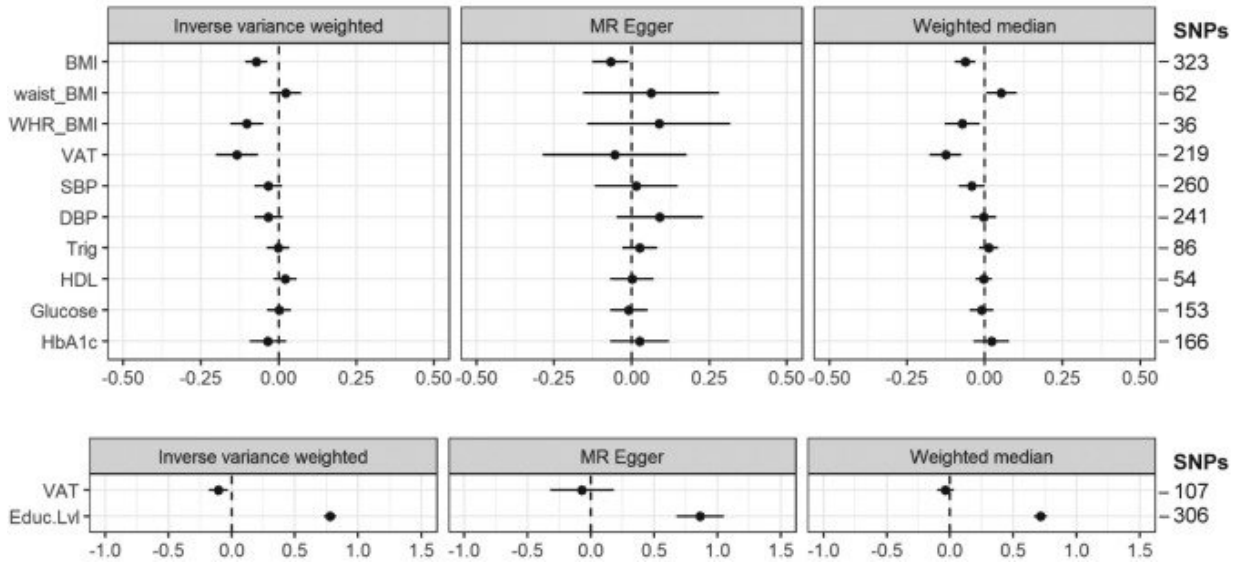
Scientists find link between excess visceral fat and cognitive performance

May 3 2023



Two-sample Mendelian Randomization reveals causal evidence for visceral adiposity in influencing general cognition. The forest plots illustrate standardized beta (95% Confidence Interval) for each two-sample MR in inverse variance weighted, MR Egger and weighted median. BMI = Body Mass Index; waist_BMI = Waist Circumference adjusted for BMI; WHR_BMI = Waist Hip Circumference adjusted for BMI; VAT = Visceral Adipose Tissue; SBP = Systolic Blood Pressure; DBP = Diastolic Blood Pressure; Trig = Triglycerides; HDL = High-density lipoproteins; Educ.Lvl = Education levels. VAT_no_BMI refers to two-sample MR performed without SNPs that are also genetic variants for BMI. Credit: *The Lancet Regional Health - Western Pacific* (2023). DOI: 10.1016/j.lanwpc.2023.100710

Scientists from the Lee Kong Chian School of Medicine (LKCMedicine) at Nanyang Technological University, Singapore (NTU Singapore) have found that Asians with an excess amount of visceral fat tend to have a poorer ability to think, learn, and remember.

This finding is based on an analysis of the health data of close to 9,000 multi-ethnic Singaporeans and permanent residents collected for the Health for Life in Singapore (HELIOS) study between 2018 and 2021.

The scientists found that an increase in the type of fat wrapped around the internal organs—known as visceral fat—is associated with poorer performance in cognitive tests of memory, executive function, processing speed, and attention.

When the scientists conducted a deeper dive into the relationship between body fat and cognition, using statistical analysis of genetic data from global databases, they found that a higher body mass index (BMI) and BMI-adjusted waist-to-hip ratio were also linked to a fall in cognitive performance.

These findings, published in the April edition of the journal *The Lancet Regional Health—Western Pacific*, highlight the impact that preventing obesity could have on maintaining cognitive function, said the scientists.

NTU LKCMedicine's Professor John Chambers, senior author of the study and HELIOS study's lead investigator, said, "With dementia expected to afflict 78 million people in 2030, and 139 million people by 2050, understanding and addressing the determinants of cognitive function is a major public health priority.

"Through our Asian population health study, we observed a link between visceral fat and poorer cognitive performance, which was subsequently confirmed with a statistical analysis of global genetic data. These

findings raise the possibility that the prevention and control of obesity in Asian populations could play a critical role in maintaining cognitive function and protecting against the future risk of dementia."

The study supports one of the goals outlined in NTU 2025, the University's five-year strategic plan, to respond to the needs and challenges of healthy living and aging, one of humanity's grand challenges. It was led by NTU LKCMedicine scientists, some of whom hold joint appointments at Singapore's National Healthcare Group, in collaboration with scientists at Imperial College London.

Observations from a population cohort study

While earlier studies have shown that metabolic disorders could be risk factors for cognitive decline, scientists have been less certain that body fat is a risk factor for it.

Most of these earlier studies were performed in western populations of older individuals, leaving out Asians, who make up 60% of the world's population and whose health and disease are determined by a different combination of factors.

To assess the link between body fat and cognitive function in an Asian population, the scientists studied the health data of 8,769 participants living in Singapore of Chinese, Malay, or South-Asian ethnicity recruited for the Health for Life in Singapore (HELIOS) study.

The HELIOS study, which began in 2018, is a population-cohort study led by NTU LKCMedicine and carried out in partnership with the National Healthcare Group and Imperial College London.

The participants, aged between 30 and 84 years old, were evaluated through a series of cognitive tests, whole-body scans, physiological and

biochemical assessments to derive a series of body fat and metabolic parameters.

Evaluation of HELIOS data revealed that three parameters are consistently associated with a lower cognitive performance: reduced high-density lipoprotein (or "good" cholesterol), increased visceral fat mass index (a measure of visceral fat mass relative to body mass), and increased waist-to-hip ratio.

In contrast, parameters such as triglyceride levels (fat content in blood), blood pressure and glycemic indices showed no association with cognitive performance.

Establishing a biological link between body fat and cognition

To form a clearer picture of the link between body fat and cognitive function, the scientists turned to Mendelian randomization, a statistical approach that makes use of small snippets of genes that vary from person to person.

Through large-scale genetic studies—also known as genome-wide association studies—scientists have associated many of these snippets with specific health behaviors and risks. Such genetic variants are present in humans at birth at random and are not altered by the environment or a person's upbringing. Any difference observed in the health outcomes can be attributed to the presence or absence of specific genetic variants.

Dr. Theresia Mina, NTU LKCMedicine Dean's Postdoctoral Fellow and lead author of the study, explained, "Some people may have more visceral fat than others due to genetic reasons. If we can show that these people are more likely to experience reduced cognitive function, that

would give us evidence that visceral fat is more directly related to cognitive aging, and not because of lifestyle or environmental factors."

To carry out their Mendelian randomization analysis, the NTU LKCMedicine team used data acquired from a number of genome-wide association studies conducted on various populations, focusing on genetic variants that predict visceral fat and body mass index (BMI).

They found that genetic variants predicting excess visceral fat, elevated BMI, and increased BMI-adjusted waist-to-hip ratio are related to reduced cognitive performance.

Following these findings, the NTU LKCMedicine scientists are now looking at how excess visceral fat across Asian ethnicities contributes to traits related to one's metabolism, such as insulin resistance, that are a result of a combination of factors, including genes, lifestyle, and the environment. An example of a metabolic trait is insulin resistance.

The scientists are also trying to understand the impact of metabolic traits on specific areas of cognition.

More information: Theresia Mina et al, Adiposity impacts cognitive function in Asian populations: an epidemiological and Mendelian Randomization study, *The Lancet Regional Health—Western Pacific* (2023). DOI: 10.1016/j.lanwpc.2023.100710

Provided by Nanyang Technological University