Horizon
The EU Research & Innovation Magazine

European Commission

Food for thought: obesity may affect the brain too

Calorie-filled meals with little nutrition are suspected of having an impact on decision-making and of causing an overweight trap.

14 February 2024 - By PIETER DEVUYST AND HORIZON STAFF

Esther Aarts has a warning for fast-food lovers around the world: such diets not only expand waistlines but also cause brain inflammation.

A professor of nutritional neuroscience at Radboud University in the Netherlands, Aarts calls the double whammy an 'obesity spiral' that traps people in unhealthy eating habits.

Trouble a head

She leads a research project that received EU funding to explore the impact of people's diets on their decision-making.

'The foods that we choose have an effect on our body and on our brain,' said Aarts. 'This creates an obesity spiral where what we eat can have an effect on our immune system and this, in turn, can affect our brain.'

Her project is called OBESITY_SPIRAL and runs for five years through October 2025. The presumption is that people with brain inflammation resulting from fast food meals such as hamburgers, chips and soft drinks have less energy to prepare or seek out other dishes.

'There is a lot of evidence that, if there's inflammation in the brain, you don't feel like doing anything, you don't feel like expending effort,' Aarts said.

Obesity is a rapidly growing phenomenon in the EU, which now lags only the US in the proportion of the population either clinically obese or overweight.

Almost 60% of adults in Europe and one in three children are afflicted by troubles with overweight, according to a 2022 report by the World Health Organization.

In response, healthier diets have become a top EU policy goal including through a range of research initiatives grouped under a framework called Food 2030.

Calorie craze

Fast food, which also commonly includes pizzas, sandwiches, muffins and milkshakes, are generally high in refined sugars and unhealthy fats and low in vitamins, minerals and fibres.

'There are lots of calories but not a lot of nutrition,' said Aarts. 'With fast food, you could get all your calories for the day in one meal but be hungry one hour later.'

People who eat large amounts of this kind of food are more likely to have chronic inflammation, also reaching the brain, as a result of increased fat tissue in the belly. This can lead to changes in dopamine processes, which give feelings of pleasure, satisfaction and motivation.

'With obesity, there's a 50% chance of having low-grade inflammation in the body,' said Aarts. 'This can consume 30% of your energy, so there's just less energy to expend effort on other things.'

Her interest in how food affects the brain started during a postdoctoral position at the University of California in the US from 2010 to 2012.

The growing obesity trend in the US as well as in certain parts of Europe prompted Aarts to focus on how people perceive food as a reward and how diets can change decision-making in ways that reinforce unhealthy eating habits.

Laziness link?

OBESITY_SPIRAL is zeroing in on the links between what people eat, the effect on the immune system and the impact on decision-making.

The team is using brain scans and biological measurements to observe what goes on in the brain when people make decisions about food – and what impact this has on the body.

'We just want to see the links with inflammation and understand how the dopamine system is involved,' said Aarts.

She suspects that body inflammation resulting from unhealthy diets causes people to make less effort when choosing food.

So, for example, rather than shop and make a meal, the choice would be to go for the easy and quick option with more calories and fewer nutrients. That in turn leads to more body fat and inflammation.

'Sometimes people think obesity is about people being lazy and I really want to show whether or not there is a biological reason behind the decision not to exert effort,' said Aarts. 'Then perhaps we can find solutions for this.'

Global costs

Because it significantly increases the risk of chronic illnesses including type 2 diabetes, cardiovascular disease and some types of cancer, obesity has a significant cost for society as a whole.

Aarts said people need to be aware of mental-health risks too resulting from obesity.

'It's also linked to depression,' she said. 'And it's linked to Alzheimer's disease later on in life.'

Under current trends, overweight and obesity could cost the global economy in 2035 more than €3.7 trillion of potential income, or nearly 3% of worldwide gross domestic product, according to a 2023 report.

Cells study

The connections among food, inflammation and health are also of interest to Professor Nicola Gagliani at the University Medical Center Hamburg-Eppendorf, or UKE, in Germany.

Gagliani is an expert on T cells – one of the immune system's two main cells. The others are B cells.

B cells produce antibodies that attack invading bacteria, viruses and toxins. T cells protect the body in a different way: by destroying cells that have themselves been taken over by viruses or become cancerous.

Gagliani led EU-funded research into the impact of food on the activity of T cells. Called Diet-namic, the project ran from December 2016 through November 2022.

'I was curious about diet because eating is something that we do every day, several times a day,' Gagliani said. 'I wanted to see how rapid the impact of food intake is on the T cells.'

The Diet-namic team already knew that the intestinal microbiota are highly connected with T cells and, in particular, with immune response.

Gagliani was curious whether dietary changes could also alter the microbiota and, as a result, the immune system.

Consequential choices

'What wasn't clear was how rapid the connection was between what you eat and how your immune system responds to that,' he said. 'T cells are the orchestrator of the immune response. They can basically decode the environment and tell the immune system how to respond.'

Through studies with mice as well as a study on six human volunteers, the researchers discovered that, indeed, the immune system changes quickly and significantly in response to changes in diet.

'We show in the mice studies that, as soon as you change from a good diet to a bad diet, the T cells are impaired and the likelihood of infection increases,' said Gagliani.

In this research, a good diet was one high in fibres, which are metabolised by the microbiota into short-chain fatty acids. These are fundamental for T cell function.

A second study focused on patients with pancreatic cancer and monitored how this related to their intestinal microbiota.

Certain combinations of microbes in the gut produce a metabolite of tryptophan that boosts the efficacy of chemotherapy. Tryptophan is an essential amino acid that can be obtained only through food.

This confirms a link between diets and the immune system and signals that choices about food can cause rapid changes in people's health. It also suggests a potential for using dietary recommendations as part of medical treatments.

'This research suggests to us that what you eat matters,' said Gagliani. 'And it's not just over a period of years, but every time that you choose what to eat probably matters.'

Research in this article was funded by the EU's Horizon Programme via the European Research Council (ERC). The views of the interviewees don't necessarily reflect those of the European Commission. If you liked this article, please consider sharing it on social media.

Watch the video

More info

- OBESITY_SPIRAL
- Diet-namic
- Food 2030

- Food-based dietary guidelines in Europe