

Unhealthy Diet May Shrink the Brain

Liam Davenport | September 22, 2015

Consumption of an unhealthy Western diet characterized by meat, hamburgers, chips, and soft drinks, may reduce the volume of the left hippocampus, whereas a healthy diet of fresh vegetables and fish may increase hippocampal volume.

In a study of more than 250 individuals, investigators found that during a period of 4 years, there was a difference of more than 200 cubic millimeters in hippocampal volume between individuals who ate a healthy diet and those who consumed an unhealthy diet.

"To our knowledge, this is the first human study to demonstrate associations between diet and hippocampal volume concordant with data previously observed in animal studies," investigators led by Felice N. Jacka, PhD, associate professor in the Division of Nutritional Psychiatry Research at Deakin University, Geelong, Australia, and president of the International Society for Nutritional Psychiatry Research, write.

"These findings suggest the potential for dietary interventions to promote hippocampal health, decrease age-related atrophy, and prevent negative health outcomes associated with hippocampal atrophy," they add.

The research was published online September 8 in *BMC Medicine*.

Diet and Brain Health

Previous studies have shown that quality of diet is associated with depression and cognitive health. Animal research indicates that this may be mediated by changes in the hippocampus.

Specifically, a high-fat diet reduces brain-derived neurotrophic factor levels, which impairs neuronal plasticity, learning, and behavior.



Dr Felice Jacka

For the current study, the researchers examined data from the Personality and Total Health Through Life Study on 255 individuals aged 60 to 64 years at baseline who had completed the Commonwealth Scientific and Industrial Research Organisation Food Frequency Questionnaire.

Participants were classified as consuming either a "prudent/healthy diet," consisting of fresh vegetables, salad, fruit, and grilled fish, or a "Western/unhealthy diet," consisting of roast meat, sausages, hamburgers, steak, chips, crisps, and soft drinks. A 1-point difference on an 11-point scale of consumption of each type of diet corresponded to 1 standard deviation difference.

In addition, the individuals underwent two T1-weighted three-dimensional structural MRI scans approximately 4 years apart to measure changes in left and right hippocampal volumes.

The investigators found that for each standard deviation increase in consumption of the "prudent diet," there was a 45.7 cubic millimeter increase in left hippocampal volume ($P = .032$).

In contrast, each standard deviation increase in consumption of the Western diet was independently associated with a 52.6 cubic millimeter decrease in the volume of the left hippocampus ($P = .05$).

Independent Effect

The impact of diet on hippocampal volume was independent of age, sex, education, labor-force status, depressive symptoms, use of medication, physical activity, smoking, hypertension, and diabetes.

The difference in left hippocampal volume between those with a healthy diet and those with an unhealthy diet was 203 cubic millimeters, which accounted for 62% of the average decline in left hippocampal volume during the 4-year study period.

Interestingly, there were no significant associations between right hippocampal volume and dietary patterns, although there was a nonsignificant relationship.

In an interview with *Medscape Medical News*, Dr Jacka pointed out that the research was observational in nature, and therefore it cannot be stated for certain that the Western diet is causing the hippocampus to shrink.

"However, there have been many studies in animals that show that a diet high in saturated fats and refined sugars has a very potent negative impact on the brain proteins (neurotrophins) that both protect neurons from oxidative stress and promote the growth of new neurons in the hippocampus," she said.

"Similarly, there are many studies that show that food components high in antioxidants or protective lipids, such as omega-3 fatty acids, increase levels of these proteins. There are also many studies showing that the animal equivalent of 'junk food' diets impair hippocampal-dependent learning and memory."

Crucially, Dr Jacka believes that switching from a Western to a "prudent" diet would lead to increases in hippocampal volume.

"From what we know so far, it seems that neurotrophin levels and hippocampal volume and function are relatively labile and readily influenced by environmental exposures, including both diet and physical activity," she said.

"So there is every reason to believe that the noxious impact of unhealthy diets can be reversed by dietary improvement and vice versa."

This is of particular importance given that the latest Global Burden of Diseases data from *The Lancet* indicate that unhealthy diets are the leading cause of early mortality worldwide and that mental disorders are the leading cause of global disability.

"Enormous" Public Health Implications

With a growing body of evidence showing that unhealthy diets are linked to mental, neurodegenerative, and neurodevelopmental disorders, Dr Jacka said the findings have "enormous implications for public health."

"Firstly, it tells us that the costs associated with unhealthy diets have been underestimated, as they have not taken into account the impact of unhealthy diets on mental disorders. Secondly, it gives us, in many ways for the first time, a clear, modifiable target for prevention of these disorders at the population level."

However, it is clear that public health messages urging a more healthy diet to improve health have so far had limited success. Does Dr Jacka believe that focusing on mental health could persuade more people?

"On an individual level, we believe that there may be greater traction from focusing the dietary discussion on mental and brain health. This is because for many people, the threat of possible heart disease, diabetes, or cancer is perceived as being sometime in the future. This makes it easier for people to ignore the health messages and continue to eat badly, particularly when they are young," said Dr Jacka.

She added that public health messages highlighting the link between a healthy diet and mental and brain health may "have more salience and relevance to people in the here and now."

"The new insights we are now gaining into the importance of the gut in both physical and mental health may also allow us to make more specific food recommendations — for instance, around fiber and fermented foods and avoidance of fats, sugars, emulsifiers, and artificial sugars — and this may also help people to make concrete changes to their diets," she said.

Exciting Results

Commenting on the findings for *Medscape Medical News*, Drew Ramsey, MD, an assistant clinical professor of psychiatry at Columbia University College of Physicians and Surgeons in New York City, described the study as "exciting."

"It's the first time that a dietary pattern has been linked to specific changes in the brain. We've known for a long time that there's a correlation between dietary pattern and the risk of a number of brain illnesses, like depression and dementia, and the mechanism behind this, we believe, involves neuroplastic processes of how food affects brain growth. This is the first study that's really shown that quite conclusively," he said.

Dr Ramsey added that nutrition should be incorporated into mental health clinical practice.

"This is something that my group and I have been working on for the last 5 years," he said.

"We've given a number of workshops at the American Psychiatric Association annual conference and developed tools to help clinicians recommend foods, and do that with confidence. Food is something mental health clinicians should be talking about, because it's really the largest risk factor over which patients have total control.

"In my experience of this clinically, it's not only effective but it's a lot of fun, because a lot of our treatments in psychiatry take a lot of time, like psychotherapy, or they take money, like medication, or they have side effects.

"Food is really a different way to engage patients and help them enhance their self-care while decreasing their risk of mental health symptoms. Psychiatrists that I speak to both feel this makes common sense, and it's not very hard to incorporate into their practices," said Dr Ramsey.

The next step, he added, is to teach psychiatrists and other mental health professionals about nutrition and incorporate it as a central part of residency training.

In terms of talking about nutrition with patients, Dr Ramsey said that it is "straightforward" and can achieve substantial results. "For those of us who focus on getting patients into full recovery from depression, it's very rare that a medication is all that's required," he added. "Oftentimes, patients have to make substantial changes in their lifestyle."

Noting that antidepressants take around a month to be effective, he said: "If you can help someone change their food for a month, both the mechanistic data and now the clinical data we are seeing suggest that you can have a very powerful effect.

"I have a number of cases in my practice of people who just didn't plan their food, who didn't think about how their nutrition is related to their psychiatric condition, and have really changed their lives by enhancing their self-care more nutrient-dense brain food," Dr Ramsey concluded.

The authors and Dr Ramsey report no relevant financial relationships.

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