THE HIGH HEALTH RISKS OF HIGH FAT DIETS

Continued from page 21.

Many of us do not follow a nutritious diet and instead choose junk foods that cater to our taste buds. Vegetables are often pushed to a small corner on our plates or even worse—limited to a small piece of lettuce on a burger.

It is well documented that high fat diets (HFDs) consumed over years can lead to cardiac dysfunction, obesity and diabetes. The excessive consumption of fat is also known to alter brain and gene function. But recent studies indicate that poor food choices can have a more immediate impact on physical and mental functioning.

Lazy Rats

It took only nine days for researchers to see reduced cellular activity, leading to several functional disorders, in rats given a diet where just over half of the calories came from fat. This study, funded by the British Heart Foundation, was an eye-opener for those who consume HFDs, athletes looking to optimize their training diets and those with metabolic disorders.

As part of his experiment, Dr. Andrew Murray first fed rats a low-fat diet (LFD). He measured their physical endurance using a treadmill test and their working memory through a maze task. Later, half the rats were given HFDs and comparative studies were conducted. Results showed that the test group exhibited lower physical endurance with poor cognitive abilities as compared to their counterparts.

While conducting metabolic studies, researchers found high levels of uncoupling proteins in the muscle and heart cells. These proteins dismantle the mechanism used to turn food into energy in the cells, thereby reducing the efficiency of the heart and the muscles. This phenomenon may be responsible for the sluggish behavior of rats on HFDs. Similar studies are being carried out on humans to obtain information on exercise and cognitive abilities. The results will help identify healthy foods for athletes in training and develop targeted diets for patients with metabolic disorders. Prof. Kieran Clarke, the lead investigator at Oxford University, states that even a short-term indulgence in an HFD can significantly alter gene expression, metabolism and physical performance.

'Stop Snacking'

Dr. Mihai Covasa, assistant professor of nutritional sciences and a member of the Penn State Neuroscience Institute, conducted studies on rats to understand their responses to 'stop eating' hormones. Once injected with the hormones, rats on LFDs suppressed their food intake, but this response was not seen in HFD-fed rats. The consumption of additional fat over time seemed to interfere with the feedback signal that controls eating. The cholecystokinin (CCK) hormone used for the study is released by cells in the small intestine when fat or protein is present. The hormone's release activates nerves that connect the intestine with the brain where the decision to stop eating is made. Human studies have shown increased CCK levels in subjects who enjoy an HFD, but these participants appear to have a reduced sensitivity to it. This insensitivity leads to a greater consumption of snacks, leading to weight gain. Unlike humans, rats adjust their food intake in order to maintain a constant body weight, says Covasa. Therefore, little difference in weight was observed between the two groups.

The Brain's Pleasure Centers

The brain pleasure centers in rats fed an HFD also became progressively less responsive over time. As a result, the rats developed compulsive overeating habits and became obese.

Paul J. Kenny, a senior author at the Scripps Research Institute in Jupiter, Fla., believes that the animal's brain reward circuits operate less efficiently as it continues to overeat. He points out that the decreased reactivity is similar to results of studies previously conducted on rats addicted to heroin or cocaine. The data indicate that common neuroadaptations could lead to obesity and addiction.

These findings may hold significance for humans as the rats were fed a diet that is all too similar to the eating habits of millions of people in developed countries. Such diets are a primary cause of the present obesity crisis in the U.S.

Memory Impairment

Amy Ross, a graduate student in the lab of Marise Parent, Associate Professor at Georgia State's Neuroscience Institute and Department of Psychology, fed Sprague-Dawley rats a high fructose diet. Rats were then placed in a pool of water to examine their ability to learn to find a submerged platform. Two days later, the rats were returned to the pool, but without the platform, to see if they could remember to swim to the platform's previous location. Results showed that although the fructose diet had no effect on the rats' ability to learn, they could not seem to relocate the platform. The test group also appeared to be swimming more randomly as compared to the rats on a controlled diet.

Unlike glucose, fructose is processed in the liver and produces large amounts of triglycerides – fat which enters the bloodstream. These triglycerides interfere with the insulin-signaling in the brain, which has a key role in the survival and plasticity (the ability of the brain to change based on newer experiences) of brain cells. Similar results were observed in adolescent rats, but it is not yet clear whether high fructose consumption has a permanent effect, says Parent. Parent's lab works with Timothy Bartness, Regents' Professor of Biology, and John Mielke of the University of Waterloo, Ontario, Canada, to investigate how diet affects the functioning of the brain.

High dietary fructose levels are believed to lead to various health issues, including insulin insensitivity, Type II diabetes, obesity and cardiovascular diseases. Although studies in rats have clearly shown the negative effects of an HFD, more human trials are needed to evaluate the full impact.

These studies provide valuable insights into the effects of high fat diets and the nutritional precautions that athletes, as well as those suffering from diabetes and metabolic disorders, should consider. In addition, the results reinforce the need for everyone to follow a low fat diet in order to preserve mental and physical health.

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