

Another reason to avoid high-fat diet -- it can disrupt our biological clock

December 29 2008

Indulgence in a high-fat diet can not only lead to overweight because of excessive calorie intake, but also can affect the balance of circadian rhythms - everyone's 24-hour biological clock, Hebrew University of Jerusalem researchers have shown.

The biological clock regulates the expression and/or activity of enzymes and hormones involved in metabolism, and disturbance of the clock can lead to such phenomena as hormone imbalance, obesity, psychological and sleep disorders and cancer.

While light is the strongest factor affecting the circadian clock, Dr. Oren Froy and his colleagues of the Institute of Biochemistry, Food Science and Nutrition at the Hebrew University's Robert H. Smith Faculty of Agriculture, Food and Environment in Rehovot, have demonstrated in their experiments with laboratory mice that there is a cause-and-effect relation between diet and biological clock imbalance.

To examine this thesis, Froy and his colleagues, Ph.D. student Maayan Barnea and Zecharia Madar, the Karl Bach Professor of Agricultural Biochemistry, tested whether the clock controls the adiponectin signaling pathway in the liver and, if so, how fasting and a high-fat diet affect this control. Adiponectin is secreted from differentiated adipocytes (fat tissue) and is involved in glucose and lipid metabolism. It increases fatty acid oxidation and promotes insulin sensitivity, two highly important factors in maintaining proper metabolism.

The researchers fed mice either a low-fat or a high-fat diet, followed by a fasting day, then measured components of the adiponectin metabolic pathway at various levels of activity. In mice on the low-fat diet, the adiponectin signaling pathway components exhibited normal circadian rhythmicity. Fasting resulted in a phase advance. The high-fat diet resulted in a phase delay. Fasting raised and the high-fat diet reduced adenosine monophosphate-activated protein kinase (AMPK) levels. This protein is involved in fatty acid metabolism, which could be disrupted by the lower levels.

In an article soon to be published by the journal *Endocrinology*, the researchers suggest that this high-fat diet could contribute to obesity, not only through its high caloric content, but also by disrupting the phases and daily rhythm of clock genes. They contend also that high fat-induced changes in the clock and the adiponectin signaling pathway may help explain the disruption of other clock-controlled systems associated with metabolic disorders, such as blood pressure levels and the sleep/wake cycle.

Source: The Hebrew University of Jerusalem

Citation: Another reason to avoid high-fat diet -- it can disrupt our biological clock (2008, December 29) retrieved 24 April 2024 from <https://medicalxpress.com/news/2008-12-high-fat-diet-disrupt-biological.html>

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