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Too much sugar turns off gene that controls the effects of sex steroids

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Eating too much fructose and glucose can turn off the gene that regulates the levels of active testosterone and estrogen in the body, shows a new study in mice and human cell cultures that's published this month in the Journal of Clinical Investigation. This discovery reinforces public health advice to eat complex carbohydrates and avoid sugar.

Table sugar is made of glucose and fructose, while fructose is also commonly used in sweetened beverages, syrups, and low-fat food products. Estimates suggest North Americans consume 33 kg of refined sugar and an additional 20 kg of high fructose corn syrup per person per year.

Glucose and fructose are metabolized in the liver. When there's too much sugar in the diet, the liver converts it to lipid. Using a mouse model and human liver cell cultures, the scientists discovered that the increased production of lipid shut down a gene called SHBG (sex hormone binding globulin), reducing the amount of SHBG protein in the blood. SHBG protein plays a key role in controlling the amount of testosterone and estrogen that's available throughout the body.

If there's less SHBG protein, then more testosterone and estrogen will be released throughout the body, which is associated with an increased risk of acne, infertility, polycystic ovaries, and uterine cancer in overweight women. Abnormal amounts of SHBG also disturb the delicate balance between estrogen and testosterone, which is associated with the development of cardiovascular disease, especially in women.

“We discovered that low levels of SHBG in a person’s blood means the liver’s metabolic state is out of wack – because of inappropriate diet or something that’s inherently wrong with the liver – long before there are any disease symptoms,” says Dr. Geoffrey Hammond, the study’s principal investigator, scientific director of the Child & Family Research Institute in Vancouver, Canada, and professor in the Department of Obstetrics & Gynecology at the University of British Columbia.

“With this new understanding, we can now use SHBG as a biomarker for monitoring liver function well before symptoms arise,” says Dr Hammond, who is a Tier 1 Canada Research Chair in Reproductive Health. “We can also use it for determining the effectiveness of dietary interventions and drugs aimed at improving the liver’s metabolic state.”

Physicians have traditionally measured SHBG in the blood to determine a patient’s amount of free testosterone, which is key information for diagnosing hormonal disorders. In addition, SHBG levels are used to indicate an individual’s risk for developing type 2 diabetes and cardiovascular disease.

The discovery dispels the earlier assumption that too much insulin reduces SHBG, a view which arose from the observation that overweight, pre-diabetic individuals have high levels of insulin and low levels of SHBG. This new study proves that insulin is not to blame and that it’s actually the liver’s metabolism of sugar that counts.

Source: Child & Family Research Institute