Fructose: Is public health action necessary?

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Public health policies should focus on promoting a healthy lifestyle that includes physical activity, fresh fruits and vegetables, and a moderate caloric intake, rather than targeting fructose in the diet. This is the conclusion of two recent publications by researchers from the University of Lausanne, Switzerland, which look at the scientific basis behind claims that fructose is toxic. This Science Brief is based on those publications.

Recently, fructose has been the focus of attention in a debate on the potential adverse health effects of sugars. It has been suggested that fructose is involved in the development of obesity and associated metabolic diseases such as heart disease, fatty liver, and diabetes mellitus. In their reviews, the Swiss researchers present scientific evidence demonstrating a trade-off between potential risks and benefits of fructose consumption. They also highlight a number of knowledge gaps.

Fructose is a sugar which is naturally present in fruits and honey. Today, the bulk of our dietary fructose comes from sucrose (also known as 'table sugar'), although it is also present in glucose-fructose syrup, a liquid sweetener used in the manufacturing of foods and beverages.

It has been suggested that fructose or sucrose may encourage us to eat more because they are less satiating than other nutrients, potentially increasing the risk of obesity. However, the significance of this has not been demonstrated in practice. A number of small studies which have looked at the effect of meals with different glucose:fructose ratios on satiety have found no strong evidence of this. The authors point out that body weight is dependent on the balance between energy consumed and energy expended. It is likely, therefore, that any effect of fructose on body weight is the result of an increased total energy intake which has not been balanced with increased physical activity.

Studies have shown that large doses of fructose (1.5–3 g/kg body weight/day) over the short term can increase levels of triglycerides (fats) in the blood. Elevated blood triglycerides are a risk factor for developing atherosclerosis – a vascular condition in which fatty deposits accumulate in the walls of arteries. A meta-analysis of small trials in healthy volunteers indicated that blood triglyceride concentrations were increased with fructose intakes greater than 50g per day. Similarly, moderate amounts of 40 g fructose per day tended to lead to undesirable changes in cholesterol. Given that average daily fructose consumption across America, Europe and Oceania is 50 to 75 g, a part of the population may be exposed to such effects. It has also been proposed that fructose, when combined with excess energy intake, could preferentially increase visceral fat (this is fat which collects around the organs). However, the authors point out that this is based on a single study and has yet to be confirmed in larger, well-controlled studies.

According to the Swiss researchers, the notion that fructose may be implicated in increased fat storage in the liver and in the development of non-alcoholic fatty liver disease (NAFLD) is based mainly on animal experiments. In human studies, intakes as high as 30% of daily energy from fructose were necessary to

increase fat storage in the liver, while lower intakes did not produce significant effects. There is currently no epidemiological data from large studies on the relationship between fructose or sucrose intake and NAFLD.

Finally, it has been suggested that fructose leads to impaired insulin sensitivity. Insulin is a hormone which stimulates the body to metabolise glucose. In cases where the body becomes less sensitive to insulin, there is an increased risk of developing metabolic diseases such as type 2 diabetes. Studies show that providing people with 20-30% extra energy as fructose over a short period appears to lead to some impairment of insulin sensitivity in the liver, but does not result in any significant whole body insulin resistance. This suggests that fructose is unlikely to be adversely implicated in the ability of insulin to regulate glucose metabolism.

To what extent high fructose consumption may affect metabolic risk factors is very much influenced by one's level of physical activity, conclude the Swiss researchers. High intakes of fructose appear to have no negative health effects on triglyceride concentrations in very physically active people, while in athletes such intakes may even enhance performance (such as by ensuring high glycogen stores in the liver). At the same time, it is important to point out that energy excess from any food source is likely to lead to undesirable metabolic changes.

The authors emphasise that further research is needed on the physiological effects of fructose before public health action is warranted. In their words, "it appears sound to limit consumption of sugar as part of any weight loss program and in individuals at high risk of developing metabolic diseases. There is no evidence, however, that fructose is the sole, or even the main factor in the development of these diseases, nor that it is deleterious to everybody." Too much of any energy source is associated with excess body weight and metabolic changes, and fructose is no exception. Instead of homing in on this nutrient, the authors recommend that public health policies focus more broadly on encouraging healthy lifestyles that include physical activity, nutritious diets and moderate caloric intakes.

Further information

Tappy L & Mittendorfer B (2012) Fructose toxicity: is the science ready for public health actions? Curr Opin Clin Nutr Metab Care 15:357-61.

Tappy L (2012) Q&A: 'Toxic' effects of sugar: should we be afraid of fructose? BMC Biology 10:42.