



What is Fructose and Is It Bad for You?

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Fructose has undergone a lot of scrutiny regarding its impact on health. We looked at what fructose is, how fructose is digested and what it does in the body and the current evidence of how this affects health.

Fructose vs glucose, and where does fructose come from?

Fructose is the main naturally found sugar in honey and fruits (e.g. dates, raisins, figs, apples, and freshly pressed fruit juices) and in small amounts in some vegetables (e.g. carrots). Fructose is like glucose a mono-saccharide sugar and the sweetest of all naturally occurring carbohydrates; a glucose and fructose molecule together make table sugar (sucrose) which is half fructose and half glucose (see also article on [‘The functions of carbohydrates in health’](#)). Table sugar is used at home, ‘at the table’, and for cooking and baking, and is used as a sweetener in the manufacturing of foods and drinks. Another source of fructose are glucose-fructose syrups (of which high fructose corn syrup is one: see our materials on [glucose-fructose syrups](#)), which are made from corn and wheat and used as sweeteners in a variety of foods such as jams, preserves and confectionary. Their fructose content can range from 5% to 50%. If the fructose makes up more than 50% of the syrup, the name on the ingredient listing should read ‘Fructose-Glucose Syrup’. Fructose provides the same caloric energy per gram as any other sugar or digestible carbohydrate, i.e. 4 kilocalories per gram.

Fructose functions in the body

Fructose is digested in the liver to produce mainly glucose (~50%), and minor amounts of glycogen (>17%), lactate (~25%) and a small amount fatty acids. ¹ Glucose travels through the bloodstream to all organs and muscles, where it is transformed into energy. Lactate and fatty acids are also energy sources for the body.

Some studies show that high intakes of fructose may cause changes to the energy metabolism of the

body. Many of these studies are done in animals, or are short-term trials in humans, with levels of fructose much higher than consumed in an average diet. This approach called hyper-dosing provides energy above normal needs and causes an increase in blood lipids, which is a risk factor for metabolic diseases like heart disease, stroke and type 2 diabetes.^{2,3} In general, increased dietary intake from any energy source above energy needs will eventually lead to weight gain, unless balanced by increased physical activity. Obesity by itself, particularly excess belly fat and independent of blood lipids, is clearly associated with metabolic disease. However, in studies that do not hyper-dose fructose and use fructose at levels which are in line with normal, daily consumption of fructose (including as part of fruit and vegetables), fructose neither causes non-alcoholic fatty liver disease,^{4,5} nor an increase in blood lipids that may have a negative effect on health.⁶ There is still some debate around fructose as part of soft drinks and the development of type 2 diabetes: the scientific evidence at this moment is not yet sufficient to draw a clear picture as to whether a link exists.⁷

Fructose and exercise

Athletes engaged in high intensity and endurance sports often benefit from a higher than normal fructose intake during exercise sessions for increased performance and decreased fatigue, particularly in hot and humid conditions⁸ (see also our article on '[Optimum nutrition for sports performance: macronutrients and micronutrients](#)'). Usually, fructose intake is increased in sports drinks which combine the sugars glucose and fructose and which help to replace fluids, salt and carbohydrates lost during physical activity of high intensity or long duration. This means that athletes often have a higher than normal fructose intake when supplementing their diet with sports drinks during exercise yet they tend to have less metabolic and cardiovascular disease than sedentary individuals due to the overall beneficial effects of physical activity.⁹

So, is fructose bad for you?

There is currently little evidence to suggest that fructose itself causes health problems in the amounts eaten within a general European diet.⁴⁻⁶ To protect health, avoiding excessive energy intake (whether from fructose or other sources), engaging in regular physical activity, maintaining a healthy body weight, reading food labels for fructose syrup contents and eating a healthy, varied diet is still the best advice.¹

References

1. [Mirtschink P, et al. \(2018\). Fructose metabolism, cardiometabolic risk, and the epidemic of coronary artery disease. European Heart Journal 39:2497-2505.](#)
2. [Macedo RCO, et al. \(2018\). Effects of fructose consumption on postprandial TAG: an update on systematic reviews with meta-analysis. British Journal of Nutrition 120:364-372.](#)
3. [ter Horst KW, et al. \(2016\). Effect of fructose consumption on insulin sensitivity in nondiabetic subjects: a systematic review and meta-analysis of diet-intervention trials. American Journal of Clinical Nutrition 104:1562-1576.](#)
4. [Chung M, et al. \(2014\). Fructose, high-fructose corn syrup, sucrose, and nonalcoholic fatty liver disease or indexes of liver health: a systematic review and meta-analysis. American Journal of Clinical Nutrition 100:833-849.](#)
5. [Chiu S, et al. \(2014\). Effect of fructose on markers of non-alcoholic fatty liver disease \(NAFLD\): a](#)

[systematic review and meta-analysis of controlled feeding trials. European Journal of Clinical Nutrition 68:416-423.](#)

6. [Chiavaroli L, et al. \(2015\). Effect of fructose on established lipid targets: A systematic review and meta-analysis of controlled feeding trials. Journal of the American Heart Association 4\(9\):e001700.](#)
7. [Tsilas CS, et al. \(2017\). Relation of total sugars, fructose and sucrose with incident type 2 diabetes: a systematic review and meta-analysis of prospective cohort studies. CMAJ 189\(20\):E711-E720.](#)
8. [Stellingwerff T & Cox GR \(2014\). Systematic review: Carbohydrate supplementation on exercise performance or capacity of varying durations. Applied Physiology, Nutrition and Metabolism 39:998-1011.](#)
9. [Tappy L \(2012\). Q&A: 'Toxic' effects of sugar: should we be afraid of fructose? BMC Biology 10:42.](#)