

Fructose

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Health effects

Fructose absorption occurs via the GLUT-5^[2] (fructose only) transporter, and the GLUT2 transporter, for which it competes with glucose and galactose. A deficiency of GLUT 5 may result in excess fructose carried into the lower intestine.^[citation needed] There, it can provide nutrients for the existing gut flora, which produce gas. It may also cause water retention in the intestine. These effects may lead to bloating, excessive flatulence, loose stools, and even diarrhea depending on the amounts eaten and other factors.

Excess fructose consumption has been hypothesized to possibly cause insulin resistance, obesity,^[3] elevated LDL cholesterol and triglycerides, leading to metabolic syndrome. Short term tests, lack of dietary control, and lack of a non-fructose consuming control group are all confounding factors in human experiments. However, there are now a number of reports showing correlation of fructose consumption to obesity,^{[4][5]} especially central obesity which is generally regarded as the most dangerous type.^[citation needed]

There is a concern with Diabetic 1 patients and the apparent low GI of fructose. Fructose gives as high blood sugar spike as that obtained with glucose. In fact, GI only applies to high starch foods. The basic GI definition is chemically incorrect. This is because the body blood glucose response is "standardized" with 50g of glucose, while the GI Researchers use 50g of digestible carbohydrate as a reference quantity. Although all simple sugars are isomers, each have separate chemical properties. This is illustrated with pure fructose. In a study from The American Journal of Clinical Nutrition, "fructose given alone increased the blood glucose almost as much as a similar amount of glucose (78% of the glucose-alone area)".^{[6][7][8][8][9]}

A study in mice suggests that fructose increases obesity.^[10]

One study concluded that fructose "produced significantly higher fasting plasma triacylglycerol values than did the glucose diet in men" and "if plasma triacylglycerols are a risk factor for cardiovascular disease, then diets high in fructose may be undesirable".^[11] Bantle et al. "noted the same effects in a study of 14 healthy volunteers who sequentially ate a high-fructose diet and one almost devoid of the sugar."^[12]

Studies that have compared high fructose corn syrup (an ingredient in soft drinks sold in the US) to sucrose (common cane sugar) find that they have essentially identical physiological effects. For instance, Melanson et al (2006), studied the effects of HFCS and sucrose sweetened drinks on blood glucose, insulin, leptin, and ghrelin levels. They found no significant differences in any of these parameters.^[13] This is not surprising since sucrose is a disaccharide which digests to 50% glucose and 50% fructose; while the high fructose corn syrup most commonly used on soft drinks is 55% fructose.

Fructose also chelates minerals in the blood. This effect is especially important with micronutrients such as copper, chromium and zinc. Since these solutes are normally present in

small quantities, chelation of small numbers of ions may lead to deficiency diseases, immune system impairment and even insulin resistance, a component of type II diabetes.^[14]

Fructose is often recommended for diabetics due to its glycemic index being significantly lower than both glucose, sucrose and starches.^[citation needed]

"The medical profession thinks fructose is better for diabetics than sugar," says Meira Field, Ph.D., a research chemist at the USDA, "but every cell in the body can metabolize glucose. However, all fructose must be metabolized in the liver. The livers of the rats on the high fructose diet looked like the livers of alcoholics, plugged with fat and cirrhotic."^[15] This is not entirely true as certain other tissues do use fructose directly, notably the cells of the intestine, and sperm cells (for which fructose is the main energy source).

Fructose is a reducing sugar, as are all monosaccharides. The spontaneous addition of single sugar molecules to proteins, known as glycation, is a significant cause of damage in diabetics. Fructose appears to be as dangerous as glucose in this regard and so does not seem to be a better answer for diabetes for this reason alone.^[16] This may be an important contribution to senescence and many age-related chronic diseases.^[17]

Fructose is used as a substitute for sucrose (composed of one unit each of fructose and glucose linked together with a relatively weak glycosidic bond) because it is less expensive and has little effect on measured blood glucose levels. Often, fructose is consumed as high fructose corn syrup, which is corn syrup (glucose) that has been enzymatically treated by the enzyme glucose isomerase. This enzyme converts a portion of the glucose into fructose thus making it sweeter. This is done to such a degree as to yield corn syrup with an equivalent sweetness to sucrose by weight. While most carbohydrates have around the same amount of calories, fructose is sweeter and manufacturers can use less of it to get the same result. The free fructose present in fruits, their juice, and honey is responsible for the greater sweetness of these natural sugar sources.

Some studies point to fructose as key factors in hyperactivity and tooth decay in children^[citation needed].

Unlike glucose, fructose is almost entirely metabolized in the liver. "When fructose reaches the liver," says Dr. William J. Whelan, a biochemist at the University of Miami School of Medicine, "the liver goes bananas and stops everything else to metabolize the fructose." Eating fructose as compared to glucose results in lower circulating insulin levels, leptin, and ghrelin levels postprandially.^[18] These hormones are implicated in the control of appetite and satiety, and it is hypothesized that eating lots of fructose could increase the likelihood of weight gain.^[19]

It has been suggested in a recent British Medical Journal study that high consumption of fructose is linked to gout. Cases of gout have risen in recent years, despite commonly being thought of as a Victorian disease, and it is suspected that the fructose found in sweet drinks is the reason for this.^[20]