

## ***Fructose is fruit sugar.***

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In the limited quantities of fruit we recommend for our patients, fructose is rarely a problem. However, in a marketing scheme to convince the public that fruit sugar is somehow better than table sugar (dextrose), large quantities of fructose are being consumed, typically as high fructose corn sweetener. The consequences of fructose consumption in a concentrated form may have significant effect on the metabolism of carbohydrates, uric acid, etc.

### ***Function:***

Humans have a limited ability to metabolize fructose (fruit sugar). Fructose is metabolized differently from other sugars. A fructose load leads to accumulation of fructose-1-phosphate in cells, which may partially deplete intracellular ATP levels in susceptible individuals. Decreased cellular ATP causes disturbances in protein, DNA and RNA synthesis, interferes with cyclic AMP formation, and reduced ammonia detoxification. Elevations of lactate, uric acid, and triglycerides may result with implications for gout and cardiovascular disease. Several forms of hereditary fructose intolerance have been described.

### ***Fructose Intolerance Symptoms:***

Since fructose intolerance is a cellular event, rather than a single nutrient deficiency, symptoms may vary widely among persons. Preliminary evidence suggests clinical symptoms of fructose intolerance may include fatigue, headaches, weakness, dizziness, behavioral changes, and depressed immune function. Medical literature suggests that certain individuals with fructose intolerance may show hypertriglyceridemia, elevation of uric acid, and interference with copper metabolism.

### ***Fructose Overload:***

Dietary sources of fructose are numerous; however, an excess intake of fructose should be avoided. It is usually not necessary to have an absolute removal of dietary fructose. In this manner, whole foods containing fructose (fruits and some vegetables) may be consumed in modest quantities in order to benefit from their overall nutritional value. Foods very rich in fructose include table sugar, high fructose corn syrup, corn syrup, fruit juice concentrates, and a large list of prepared foods containing sucrose and/or corn syrup.

### ***Fructose Overload effects on biochemical pathways:***

The metabolism of glucose and fructose is similar. However, fructose can induce numerous abnormalities that include fatty liver, which in turn could eventually lead to impaired liver function, cell damage, and fibrosis. Fructose metabolism has the ability to induce generation of reactive oxygen species due to increased activity of xanthine oxidase and generation of glyceraldehyde, which is an inducer of free radicals. The liver may be exposed to oxidative stress following the consumption of fructose.

"Nutritional Factors Adversely Influencing the Glucose/Insulin System"

Fields, M. J Am Coll Nutrition, 1998;17(4):317-321.

In another scientific article from the American Journal of Clinical Nutrition (Nov 2002;76(5):911-22), the metabolism of fructose was again discussed. The report indicated that fructose, compared with glucose, is preferentially metabolized to fat in your liver. In animal models fructose produced:

- **Insulin resistance**
- **Impaired glucose tolerance**
- **High insulin levels**
- **High triglycerides**
- **Hypertension**

Americans' consumption of fructose, as a combination of sucrose and high-fructose corn syrup, has increased by 26 percent from 1970 to 1997. Dietary fructose has increased markedly in part due to the notion that fructose was considered to be beneficial to diabetes mellitus and insulin resistance because ingesting it results in smaller rises in glucose and insulin after consumption compared to glucose and complex carbohydrates. However, when hormonal factors are considered, fructose not only seems to actually promote disease more than even glucose, but fructose in contrast to glucose is metabolized to fat in your liver.

Small amounts of fructose are probably acceptable and may even have some favorable metabolic effects. However, on the basis of the available data regarding the endocrine and metabolic effects of consuming large quantities of fructose such as in high fructose corn syrup, and the potential to exacerbate components of insulin resistance syndrome, there is no advantage of fructose compared to glucose (free glucose and starch). This is particularly important for those with high cholesterol levels or insulin resistance who may be more susceptible to the negative metabolic effects of fructose.