

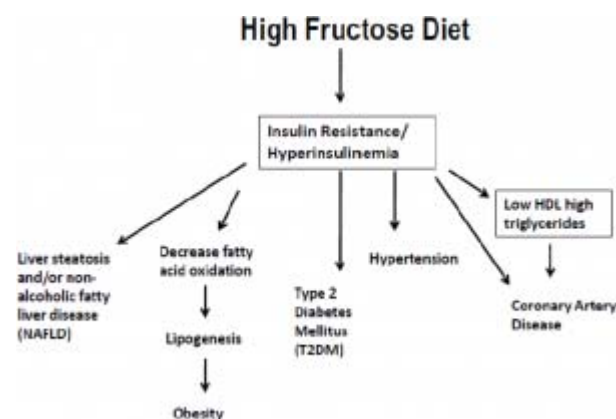
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CHECKOUT



Fructose May be a Major Cause of Metabolic Disorders



Excessive intake of added sugar is associated with various chronic diseases.

Added sugar is usually made of up of two simple sugars, glucose and fructose. Growing evidence suggests that fructose is the worse of the two.

Some scientists are even convinced that excessive fructose is largely responsible for several chronic, lifestyle diseases, such as heart disease and type 2 diabetes.

Recently, a scientific review on the health effects of fructose was published in *Trends in Endocrinology & Metabolism*. Below is a summary of the review's main points.



Article

Researchers from Harvard Medical School and Yale University School of Medicine reviewed the scientific literature on the effects of fructose on liver fat synthesis, blood lipids, visceral fat and insulin sensitivity.

The Sweet Path to Metabolic Demise: Fructose and Lipid Synthesis.

What is Fructose?

Fructose is a common type of sugar.

It is found in small amounts in various plant foods, but the largest dietary source is added sugar in processed foods. For example, fructose makes up 50% of white sugar (sucrose) and around 55% of high-fructose corn syrup.

In the US, fructose accounts for roughly 10% of people's total calorie intake, or 50-60 grams per day, on average. Most of it comes from sugar-sweetened beverages (1).

Bottom Line: Fructose is a type of sugar. It usually makes up roughly 50% of added sugar (in the form of sucrose) or high-fructose corn syrup.

Does Fructose Lead to Metabolic Disorders?

Eating small amounts of fructose, such as in fruits and vegetables, is not a health concern.

In contrast, excessive intake of fructose from sugar-sweetened foods and beverages has been associated with various health problems.

Observational studies suggest that eating too much fructose may lead to increased visceral obesity, high levels of triglycerides and insulin resistance (2, 3).

Intervention studies have confirmed most of these observational findings. They have shown that consuming excessive fructose causes:

- Increased lipogenesis (fat formation) in the liver (4, 5).
- Increased visceral fat (4).
- Worsened blood lipid profile (4, 6, 7, 8, 9).
- Decreased insulin sensitivity in the liver (4, 5, 6, 10).

Bottom Line: High intake of fructose leads to various metabolic disturbances or imbalances. For example, it may worsen the blood lipid profile and disrupt blood sugar control.

Lipogenesis

When you eat more calories than your body needs the excess calories are stored as fat.

All dietary sources of calories can be stored as fat, including sugar. The process of converting sugar into fat is known as **lipogenesis**, and takes place in your liver.

Not all sugar is the same when it comes to lipogenesis. Fructose seems to cause much more lipogenesis, compared to an equal amount of glucose (4).

One study showed that when healthy men followed a high-fructose diet (25% of calories as fructose) for 9 days lipogenesis increased by roughly 60%, compared to a diet consisting of complex carbs (5).

Additionally, animal experiments indicate that lipogenesis increases even further when high amounts of fructose are consumed for long periods (11, 12).

Studies in mice have shown that high fructose consumption increases the activity of a protein known as SREBP1c, also called “the master regulator of lipid synthesis.” This protein promotes the conversion of fructose into fat (13, 14).

Bottom Line: High fructose intake increases lipogenesis (the formation of fat) in the liver.

Visceral Fat

Visceral fat accumulates in the abdominal cavity, filling up the space around the intestines and the liver, causing the belly to expand. It is also known as intra-abdominal fat mass.

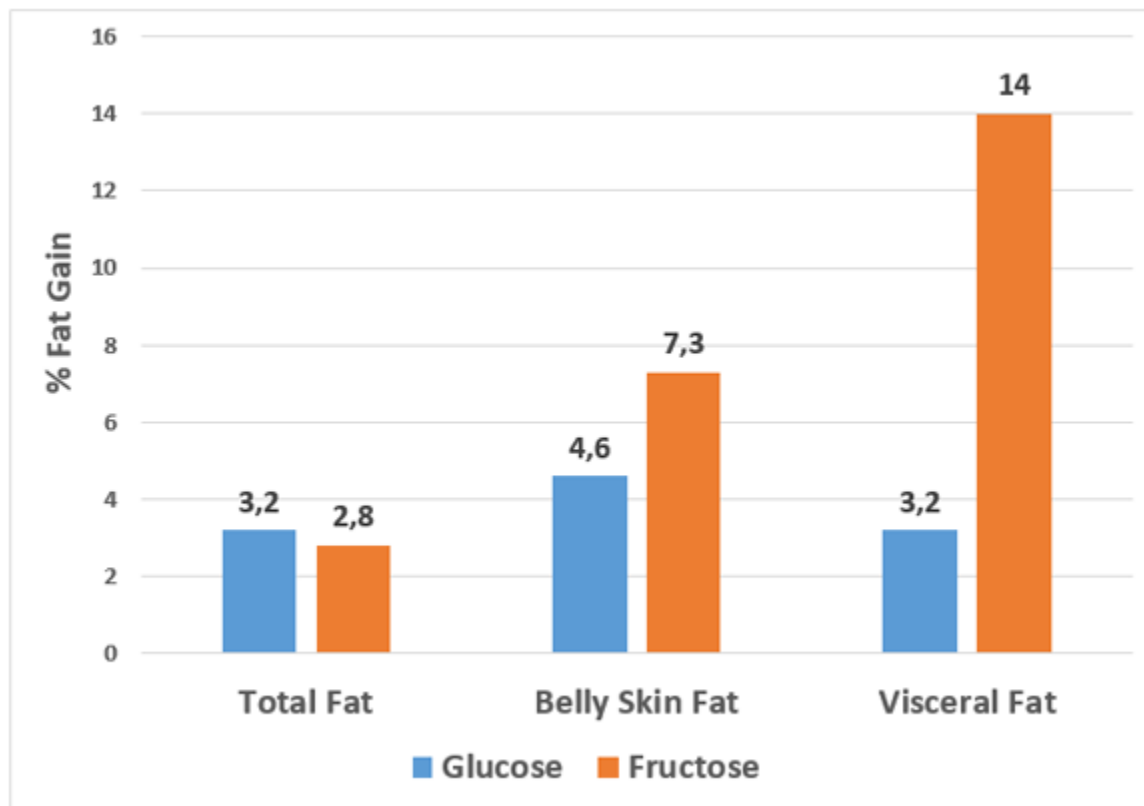
Men are predisposed to accumulating visceral fat, whereas it is less of a problem in women. In fact, many men tend to primarily gain fat in the belly area.

Visceral fat, as opposed to skin fat, is associated with adverse health effects and metabolic disease.

A few human intervention studies have examined the effects of a high-fructose diet on visceral fat.

One 10-week study fed overweight and obese individuals fructose or glucose amounting to 25% of their daily calorie intake (4).

Weight gain was similar in both groups. However, those who got fructose gained significantly more visceral body fat, as shown in the chart below.



Bottom Line: Excessive consumption of fructose may promote accumulation of visceral fat, which is a risk factor for type 2 diabetes and heart disease.

Blood Lipids

Not only does excessive sugar intake increase your blood sugar levels, it may also increase the amounts of fat circulating in your blood.

This is because excess sugar is converted to fatty acids by the liver. The process is known as lipogenesis (described above).

Triglycerides are the most common form of fat in your body, making up body fat and most of the fat that circulates in your bloodstream. They are made up of three fatty acids connected to a glycerol backbone.

Fructose has a much greater lipogenic effect than glucose. Accordingly, researchers have discovered that fructose causes a higher rise in circulating triglyceride levels, compared to glucose (4, 7).

Bottom Line: Eating a lot of fructose raises of your blood levels of triglycerides, which is a risk factor for heart disease.

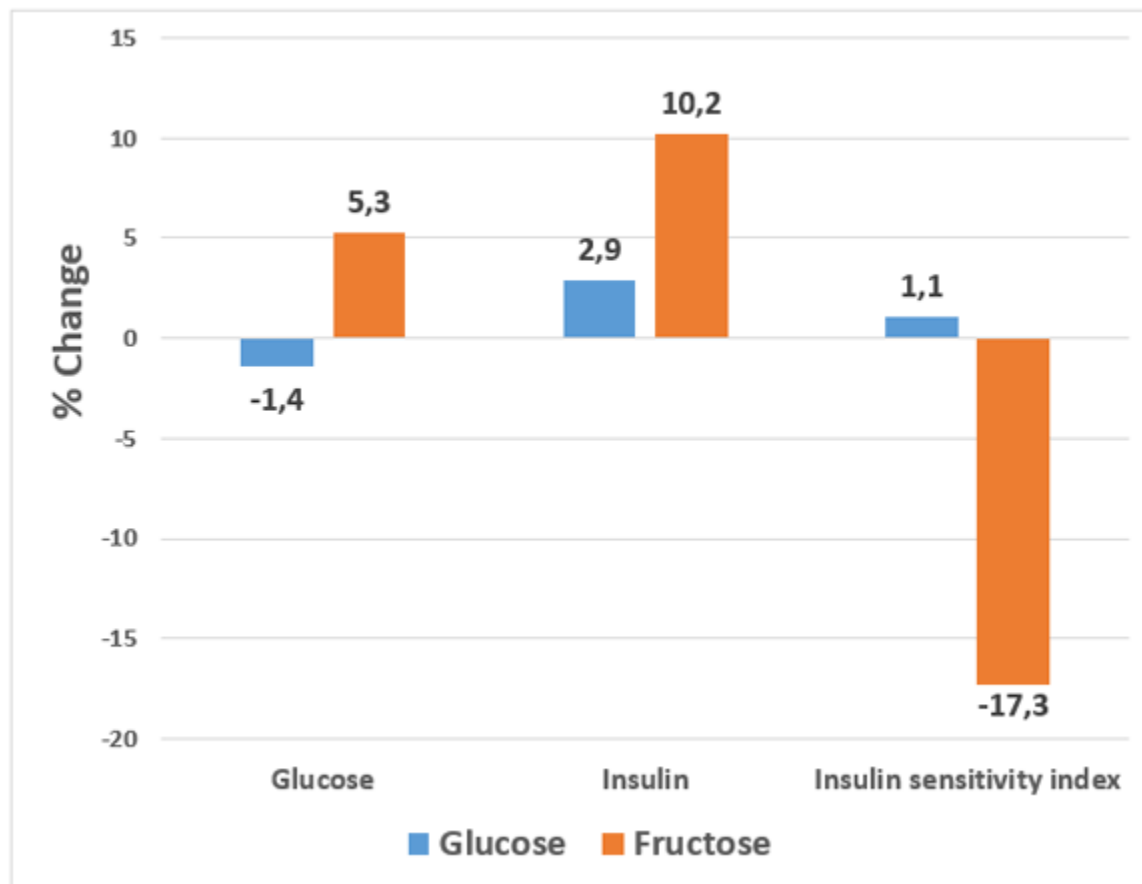
Blood Sugar Control

Blood sugar control refers to the body's ability to keep blood sugar levels within healthy limits.

Poor blood sugar control is associated with worsened insulin sensitivity, also called insulin resistance.

Several human trials have shown that excessive fructose consumption leads to insulin resistance in the liver (4, 5, 10).

One 10-week intervention study in overweight and obese individuals showed that following a high-fructose diet, with 25% of its total calories in the form of fructose, significantly increased fasting blood sugar levels and insulin levels, as seen below.



This rise in blood sugar and insulin was accompanied with worsened insulin sensitivity (4).

Another 3-week study tested the effects of a diet high in sugar-sweetened beverages, providing either 40 or 80 grams of fructose per day, and compared it with 80 grams of glucose (10).

The amount of fructose corresponded to 9 and 14% of the total calorie intake, respectively.

Insulin resistance was evident in those who got 80 grams of fructose per day, whereas the same amount of glucose had no significant effects (4).

Bottom Line: Regularly eating high amounts of fructose leads to insulin resistance, contributing to the development of type 2 diabetes.

How Much Fructose is Too Much?

Most interventional studies have tested the health effects of high amounts of fructose, corresponding to 25-35% of people's daily calorie intake (4, 5, 8).

In comparison, the average intake of fructose in the US is approximately 50-60 grams per day, corresponding to roughly 10% of people's total calorie intake (1).

For this reason, some people have questioned the findings. Recent studies have acknowledged the issue and examined the effects of lower doses of fructose.

One study in young, lean subjects compared the effects of 4 diets providing varying amounts of fructose: 0%, 4.5%, 7.9% and 11% of calories.

The study showed dose-dependent increases in weight gain and blood lipid changes, suggesting that even low doses of fructose make a difference (9).

Another study examined the effects of a single meal containing roughly 30 grams of fructose (7.3% of the daily calorie requirements).

Several hours after the high-fructose meal, the researchers detected adverse changes in the participants' blood lipid profile (15).

Simply put, fructose intake corresponding to the average intake in the US — 10% of total calories or 50-60 grams per day — may have adverse health effects.

Additionally, the negative health effects of high fructose intake appear rapidly, or in just a few days (5, 6, 7).

However, long-term studies are needed to fully evaluate the impact of high-fructose diets.

Bottom Line: Studies show that fructose has dose-dependent effects on the blood lipid profile. Even relatively low amounts of fructose, well below average intakes, may have adverse health effects.

Summary and Real-Life Application

In short, high fructose intake may contribute to several chronic diseases, such as heart disease and type 2 diabetes.

It increases fat (triglyceride) formation in the liver, impairs the blood lipid profile, promotes the accumulation of belly fat (visceral fat) and leads to insulin resistance in the liver.

The richest dietary sources of fructose are sugar-sweetened beverages, sweets and processed foods with added sugar.

Cutting down on sugar-sweetened foods has [multiple health benefits](#) and is probably one of the best things you can do for your health.

[Community Food Projects](#)[Irregular Eating Habits Adversely Affect Metabolism](#)

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POPULAR – NAD+ ARTICLES

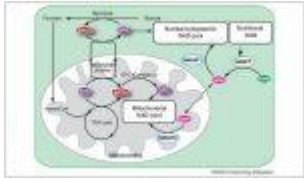
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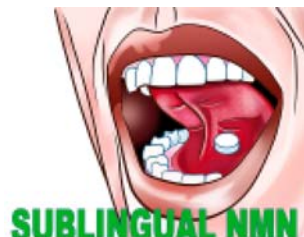
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Long term human study proves Nicotinamide Riboside safely elevates NAD⁺



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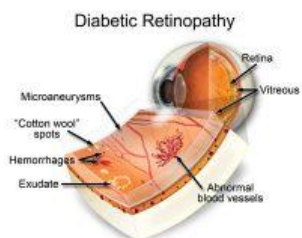
The Secret NAD⁺ Boosting Protocol



Is Basis by Elysium Health a Hoax?



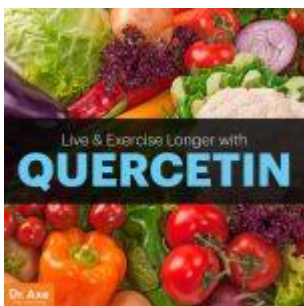
Supplementation to correct NAD⁺ deficiency repairs vision damage in Mice



Anti-aging effect of NAD⁺ boosters



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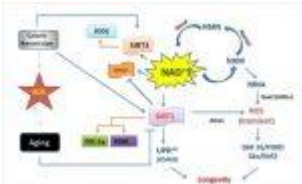


Nicotinamide Riboside Benefits and Side Effects





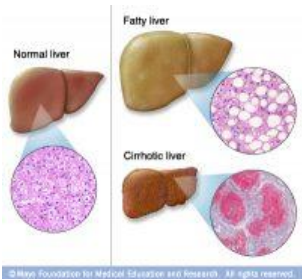
Nicotinamide Riboside shown to increase NAD⁺ in first clinical study with humans



New Study finds Nicotinamide Riboside safe at typical dosages



Research shows Nicotinamide Riboside may prevent Liver Disease



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Evidence Based Reviews - Fructose May be a Major Cause of Metabolic Disorders - Evidence Based Reviews
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