



# IMAGE AWARENESS WELLNESS INSTITUTE

## *High Fructose Corn Syrup*

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December 2009

Volume 5 : Issue 12

### HIGH FRUCTOSE CORN SYRUP

In 1970 the consumption of High Fructose Corn Syrup (HFCS) was 0.4 lb a year. By 2004 this consumption had risen to 42.3 lb. That represents over a 60-fold increase. Because this is average consumption one can be assured that many people consume far more than 42 lbs a year. This is especially true of those consuming large quantities of soft drinks. This fructose is in addition to what one finds in fruits.

In the 1950's Coca Cola was sold in dainty 6.5 ounce bottles with perhaps 10 grams of sugar. (A level teaspoon is about 4 grams and a heaping teaspoon about 6 grams.) The standard serving size today is a 20-ounce bottle with about 32 grams of fructose. It is not uncommon for fast-food restaurants, movie theaters, and convenience stores to sell fountain beverages in containers which contain between 32 and 52 ounces. A 52 ounce fountain drink contains about 85 grams of fructose.

It became economically viable to produce HFCS in 1971 as a result of Japanese research. This new raw material made foods softer and chewier, prevented spoilage, and prolonged the shelf life of foods. It is now present in almost all foods produced in the United States.

#### REFERENCE:

Johnson, Richard, *The Sugar Fix*, New York: Rodale, Inc., 2008, 23-25.

### TOO MUCH OF A GOOD THING

Fructose has been a part of the human diet for thousands of years. Nature put it in foods to encourage us to eat foods high in nutrients. Fruits in particular, nature's best source of antioxidants like vitamin C and carotenoids, are rich in fructose. It is largely fructose that makes an apple or an orange palatable.

Fructose guides the human palate to foods high in vitamin C. Any reading of the history of nutrition with one epidemic of scurvy after another should provide one with an appreciation of the wisdom of hardwiring the human body with a compulsion to seek out foods high in vitamin C.

Vitamin C has a short half-life in the blood. It takes only a few weeks of a diet low in vitamin C for scurvy to develop. Once the disease appears death can occur within a short period of time. One early researcher on vitamin C deficiency deliberately deprived himself of vitamin C. He died as a consequence of his experiment.

The human being is one of the few creatures on planet earth with the inability to manufacture vitamin C within our own bodies. This may be why we have the strong compulsion to consume sweet foods that we do.

Man's problem is not with his compulsion to consume sweet things. The problem is that we consume too

many of them. We have also learned to process these foods so that the sugar is separated from both fiber and from vitamin C. This has resulted in an epidemic of diseases associated with excessive refined sugar intake and severe deficiency of the life preserving and protecting antioxidants.

Fructose was long thought to be the sugar least likely to create problems because it has a low glycemic index. Recent research suggests that excess intake of fructose can create problems like other sugars, but in a slightly different manner.

### INSULIN RESISTANCE

Excess fructose intake can lead to problems of insulin resistance. Danish researchers asked seven men to consume 1,000 calories of extra fructose every day. This is about 200 grams (about 50 teaspoons) of fructose which is quite a bit, but not impossible for someone consuming large quantities of sodas with high fructose corn syrup. After one week their insulin had become 25 percent less effective. The high fructose intake had created insulin resistance. A similar intake of glucose did not create this problem.

Unfortunately, insulin resistance is associated with weight gain, high blood pressure, elevated blood sugars, and elevated blood fats. Fructose overload has the potential to create health problems, possibly because it leads to elevated levels of uric acid

production in the body--especially when vitamin C intake is inadequate.

**REFERENCE:**

Johnson, Richard J., *The Sugar Fix*, 55.

**HIGH FRUCTOSE BEVERAGES**

8 oz Serving	Grams of Fructose
Lemonade	10.5
Orange juice	10.7
Cherry drink	11.3
Pineapple juice	11.4
Cranberry juice	13.0
Cherry juice	14.0
Apple juice	16.0
Grape juice	18.8
Cola	20.2
Root beer	22.2
Chocolate malt (small)	42.0

**HIGH FRUCTOSE FOODS**

Serving Size	Grams of Fructose
Cherry pie	21.0
Pecan pie	22.0
Carrot cake	27.0
Double Chocolate Cake	37.0
Banana Split	34.5

**URIC ACID ACCUMULATION**

Humans do not have an enzyme (uricase) present in most mammals, fish, and amphibians which allows them to convert uric acid into another substance called allantoin. This is a harmless compound widely used in cosmetics. Most animals are therefore not subject to uric acid accumulation. Humans are.

Uric acid in smaller quantities acts as an antioxidant, but as levels increase it can become quite harmful. One of the problems associated with excess uric acid accumulation is gout which I will discuss in a minute.

Fructose can be metabolized into uric acid. A diet high in fructose, especially if combined with beer consumption and foods high in purines (organ meats), can lead to excessive uric acid levels. Consuming two or more beers a day increases risk of developing gout two and a half times. Beer is particularly rich in a type of purine which is converted to uric acid.

Uric acid was discovered in 1776 by Karl Scheele, a German pharmacist. Gout is one of the oldest and most painful afflictions of mankind. It was known as a disease of the wealthy and the privileged through much of history. This was probably because the wealthy were the only ones who could afford a diet of purine rich meats and refined sugar until relatively recently. In the United States today even the poor can easily afford the foods we know cause uric acid buildup and promote gout.

When one has gout, uric acid crystals form in joints. Three quarters of those with gout develop unbearable pain in the big toe. The pain can be so intense and a joint with uric acid crystals so sensitive that the weight of a bedsheet can cause a victim to writhe in agony.

Gout and high uric acid levels are associated with many other health problems. Seventy percent of gout sufferers are obese, over half suffer with high blood pressure, half have chronic kidney disease, and nine out of ten go on to develop heart disease.

**REFERENCE:**

Johnson, Richard, *The Sugar Fix*, New York: Rodale, Inc., 2008, 55, 60, 66-68.

**BOWEL FUNCTION**

Malabsorption of fructose is one of the most common causes or irritable bowel conditions. One study found that 145 of 197 patients with severe abdominal pain of unknown cause were suffering with fructose malabsorption. Excessive consumption of high fructose beverages and

foods was a common cause of gas, bloating, and diarrhea symptoms.

The stomach lining can only absorb a limited amount of fructose at one time. Exceeding this limit leaves the fructose in the digestive tract where it is broken down by bacteria causing bacterial overgrowth and digestive upset. The researchers note that high fructose corn syrup has increased from 5% of sugar consumed in the 1970's to 55% as of 2001.

Digestive disturbance from fructose intake is usually dosage related. In a study by Beyer and associates 25 grams of fructose at one time resulted in malabsorption by half of the study group. When the dose was increased to 50 grams two-thirds of the subjects evidenced malabsorption. The evidence of bacterial overgrowth as measured by breath hydrogen was found to be significantly greater after the 50 gram dose. Symptoms of gas and pain were somewhat worse after the 50 gram dose than the 25 gram dose.

**REFERENCES:**

Johlin FC Jr, Panther M, Kraft N, Dietary Fructose Intolerance: Diet Modification Can Impact Self-Rated Health and Symptom Control, *Nutr Clin Care*, July-September 2004;7(3):92-97.

Beyer PL, Caviar EM, McCallum RW, Fructose intake at current levels in the United States may cause gastrointestinal distress in normal adults, *J Am Diet Assoc.*, 2005; 105(10): 1559-66.

**FRUCTOSE AND ENERGY**

The body uses a great deal of energy to metabolize fructose. The energy currency of the body is called ATP. The depletion of ATP is not a problem with small intakes of fructose, but with large intakes fructose can deplete cells of energy. In one study doctors gave surgery patients an intravenous dose of 50 grams of fructose. ATP in the liver cells dropped in half. Without ATP cells can not function properly or function only poorly.

This erosion of ATP levels in the liver resulting from fructose loads may help explain the abnormal liver function which is characteristic of those who develop what in everyday

parlance is called the beer belly and what doctors call central adiposity.

One study found that individuals with non-alcoholic fatty liver disease consumed two to three times as much fructose as healthy controls.

#### REFERENCES:

Johnson, Richard, *The Sugar Fix*, New York: Rodale, Inc., 2008, 90.

Stranges, Saverio, et al, Body fat distribution, relative weight, and liver enzyme levels: A population based study, *Journal of Hepatology*, March 2004; 39(3):754-763.

Ouyang X, Cirillo P, et al, Fructose consumption as a risk factor for non-alcoholic fatty liver disease, *Journal of Hepatology*, 2008; 48(6): 993-999.

## WEIGHT GAIN

Fructose, particularly in the form of beverages like soda pop, tends to promote rapid and excessive weight gain. The body does not tend to register calories consumed in liquid form. Fructose appears to contribute to weight gain in another manner.

Recent research suggests that elevation of uric acid is associated with and may promote weight gain. Mice lacking an enzyme called XO (xanthine oxidoreductase) which makes uric acid do not become fat. They have half the fat of mice which have the enzyme.

This uric acid mechanism may be a means by which high fructose or high purine intake promotes weight gain. When rats are fed a drug which hinders the formation of uric acid they do not gain weight even when fed a high-fructose diet.

Most fructose in a meal ends up in the liver after a meal. It is processed by an enzyme called fructokinase which breaks up fructose into smaller molecules. The body converts these smaller molecules into either glycogen, a form of glucose which can be stored or burned for energy, or triglycerides which are readily stored as fat. A high intake of fructose can thus raise triglyceride levels contributing to increased likelihood of weight gain.

An excessively high intake of fructose actually upregulates the activity of the fructokinase enzyme. It

becomes ever more effective at converting fructose to fat and its other metabolites including uric acid.

The only means of slowing this process is by reducing the intake of fructose for a period of time. This downregulates the activity of the fructokinase enzyme so the body is less efficient at converting fructose to fat and uric acid. Downregulation of the fructokinase enzyme can often be accomplished by restricting fructose to no more than about 20-25 grams a day for a couple of weeks.

Leptin is a hormone that delivers the message to stop eating. Obese people often manifest leptin resistance--their appetite fails to respond to leptin's message to quit eating. High fructose intake for a prolonged period of time has been shown to lead to leptin resistance.

#### REFERENCE:

Johnson, Richard, *The Sugar Fix*, New York: Rodale, Inc., 2008, 52, 86-87.

## VITAMIN C

I have long observed that vitamin C is of special benefit to diabetics and to those who consume large quantities of sugar. Vitamin C and glucose share a common transport mechanism. For this reason, high blood sugars can interfere with the delivery of vitamin C to the tissues. The result is a weakening of tissues when blood sugars are high.

The relationship of uric acid to fructose consumption provides yet another argument for regular vitamin C intake by those who consume large quantities of fructose. Vitamin C is the most effective nutrient for lowering uric acid levels in the body. It often works as well as the medication Probenecid in lowering uric acid according to Dr. Jonathan Wright.

Fructose elevates sorbitol production in the body as well as uric acid. High sorbitol is common in diabetics and is believed to be a factor in the causation of damage to the nerves, eyes, and kidneys.

Vitamin C inhibits the production

of sorbitol in the body. A combination of highly active flavonoids with vitamin C as found in GNLD Super C was found by Vinson and his associates to protect against sorbitol more effectively than vitamin C alone.

Anyone consuming large quantities of high fructose corn syrup or other sugars should take the simple protective measure of a regular intake of vitamin C. The dose of vitamin C should increase as the intake of sugar increases.

#### REFERENCES:

Wright, Jonathan, Lithium, vitamin C and gout, *Nutrition and Healing*, September 1998; 5(9):7.

Cunningham, Hohn L., et al, Vitamin C: An aldose reductase inhibitor that normalizes erythrocyte sorbitol in insulin-dependent diabetes mellitus, *Journal of the American College of Nutrition*, 1994; 13(4):344-350.

Vinson, J.A., et al, Comparison of two forms of vitamin C on galactose cataracts, *Nutrition Research*, 1992; 12:915-922.

Fields, Meira, The metabolic effects of fructose, *The Nutrition Report*, June 1991;9(6):41,48.

## OTHER NUTRIENTS

Refined sugars increase nutrient requirements. Fructose appears to increase requirement for chromium, iron, copper, selenium, phosphorus, magnesium and calcium. The impact of fructose on copper nutrition has been a particular object of focus. Copper deficiency can lead to anemia, high cholesterol, poor glucose tolerance, atrophy of the pancreas, deterioration of the health of the heart muscle and risk of sudden death. Low copper is a great risk for a healthy pregnancy outcome.

Fructose often replaces other foods in the diet. Marginal intake of the nutrients mentioned can lead to deficiencies when intake of high fructose corn syrup is excessive.

Fructose also alters hormone production. Hormones altered include those of the pancreas, thyroid, and adrenal. All of these nutritional and hormonal effects are related to the total amount of sugar consumed.

Fish oil supplementation has been shown in the laboratory to counteract the tendency of fructose to raise triglyceride levels and promote fat accu-



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mulation on the body. A high fructose diet increased triglyceride levels by 79% while fish oil supplementation after a high fructose diet lowered triglycerides by 37%. the study suggested that fish oil supplementation could be protective against some of the worst consequences of a high fructose diet. The fish oil also tended to reduce the production of more body fat when fructose was consumed.

GNLD supplements which would be of benefit if excess fructose is being consumed would include Salmon Oil Plus, Super C, and a multiple with minerals like Sports 30 or Formula IV Plus with Chelated Cal-Mag.

It would also be wise to restrict foods and beverages loaded with high fructose corn syrup and refined sugar.

### REFERENCES:

Fields, Meira, The metabolic effects of fructose, *The Nutrition Report*, June 1991;9(6):41,48.

Faeh D, Minehira K, et al, Effect of fructose overfeeding and fish oil administration on hepatic de novo lipogenesis and insulin sensitivity in healthy men, *Diabetes*, 2005; 54(7): 1907-13.

### MERCURY AND HFCS

A study published January 26, 2009 in *Environmental Health* disclosed that corn syrup is often contaminated with mercury. Caustic soda and hydrochloric acid are used

to convert corn kernels into the food additive. Several plants across the nation make soda and acid by a process which involves the use of mercury. Traces of the metal show up in the end product. Nine of twenty samples of high-fructose corn syrup were found to be contaminated with mercury.

The average American consumes 12 teaspoons of this food additive every day. The elemental form of mercury was found in corn syrup. The researchers noted that there is no established safe dose for elemental mercury.

If a woman regularly consumed corn syrup at the highest levels of contamination found in this study she would be consuming five times the levels of mercury considered safe by the EPA from this source alone.

While the highest levels of mercury were found in plants using older technology which will eventually be replaced, the Chlorine Institute, a chemical industry trade group, said, "It is conceivable that measurable mercury content can be found in high-fructose corn syrup regardless of how it is processed."

Contamination with mercury is only one of the reasons for avoiding excessive in-

take of high fructose corn syrup.

### REFERENCE:

Hawthorne, Michael, Mercury in corn syrup? Food made with ingredient may have traces of toxic metal, *Chicago Tribune*, Jan. 27, 2009.

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