The Health Risks from Corn and Agave Sweeteners

Recent studies show that refined sweeteners like high-fructose corn syrup and agave "nectar" are neither safe nor natural alternatives to ordinary sugar and are more damaging to your health.

by Sally Fallon Morell and Ramiel Nagel

Web page:
http://www.westonaprice.org/Agave-Nectar-Worse-Than-We-Thought.html

The Lowdown on High-Fructose Corn Syrup

High-fructose corn syrup (HFCS) entered the marketplace in the early 1970s and within 20 years accounted for over half the refined sweeteners used in the US food supply. Produced mainly by the two food-processing giants Archer Daniels Midland and Cargill, it is the main sweetener in soft drinks and is increasingly replacing sugar in baked goods, bread, cereals, canned fruits, jams and jellies, dairy desserts and flavoured yoghurts. Sweeter and less expensive than sugar, HFCS represents the major change in the American diet over the last 40 years. Although the food industry made this change very quietly, consumers are beginning to ask a lot of loud questions about this sweetener as research accumulates to indicate that it is much worse for us than we thought.

Although the corn industry claims that HFCS received GRAS (Generally Recognized as Safe) status when it filed for it in 1983, the US Food and Drug Administration (FDA) did not grant GRAS status until 1996 after considerable pressure from the industry, which was becoming nervous with the publication of negative research findings described in the first anti-HFCS articles.[1]

Growing consumer resistance to HFCS is the likely explanation for a recent industry campaign to put the new sweetener in a favourable light. Ads run on television and in popular magazines portray HFCS as benign and its critics as bossy, overbearing, unqualified and misinformed. For example, a full-page ad in *Better Homes and Gardens* portrays a man and a woman engaged in the following conversation. He states: "My dry cleaner says high fructose corn syrup is loaded with calories." Her reply: "A registered dietitian presses your shirts?" Then comes the official statement: "There's a lot of misinformation out there about sugars made from corn. Truth is, high fructose corn syrup is nutritionally the same as table sugar. The same number of calories, too. As registered dietitians recommend, keep enjoying the foods you love, just do it in moderation. We welcome a healthy discussion. Get the facts. You're in for a sweet surprise. www.SweetSurprise.com"[2]

On the surface, the official statement is true. Both HFCS and sugar, which are refined carbohydrates, have approximately the same number of calories, and both are virtually devoid of vitamins and minerals. For this latter reason alone, HFCS should be strictly avoided. Since refined carbohydrates, sugar and HFCS included, tend to be addictive, it is difficult to follow the platitudinous advice of registered dietitians who urge us to consume them in moderation. In fact, the entire food industry has succeeded very well over the past 30 years in getting Americans to consume far more than moderate amounts of refined sweeteners, particularly high-fructose corn syrup. Between 1970 and 2000, the per-capita consumption of HFCS in the US increased from less than one pound (0.45 kilograms) per person to over 60 pounds (27 kg) yearly.[3]

There can be no debate about the fact that both sugar and HFCS, with

their empty, depleting, addictive calories, are bad for you. But the real question is whether HFCS is actually *worse* for you—more depleting and more damaging—than ordinary sugar. The research indicates that it is.

The Obesity Debate

The public became aware of the possible downside of HFCS with the publication of a paper in the April 2004 edition of *The American Journal of Clinical Nutrition*.[4] Authors Bray and others noted the parallel increase in obesity and HFCS consumption in the US, and a number of columnists publicised his theory that, calorie for calorie, HFCS is more likely to cause weight gain than sugar.

The Bray paper provides an explanation for the mechanism whereby fructose would be more fattening. Sugar is a disaccharide that breaks down into two monosaccharides—glucose and fructose—in the intestinal tract. After absorption, fructose must pass through the liver. Small amounts of fructose added to glucose in the diet increase the production of glycogen (stored sugar) and reduce the release of glucose into the bloodstream, an outcome that is theoretically helpful to those suffering from type 2 diabetes. However, large amounts of fructose in the diet rapidly turn into fatty acids—a process called *de novo lipogenesis*—which are then stored as fat or released into the bloodstream as triglycerides.

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Small amounts of L-fructose—the type of fructose that human beings have traditionally consumed in fruit—can actually be beneficial to diabetics because L-fructose does not stimulate insulin secretion. However, research indicates that insulin concentrations in the central nervous system have a direct inhibitory effect on food intake: when insulin secretions increase, food consumption declines. Furthermore, insulin increases the release of leptin, a hormone that also inhibits food intake. Individuals who are genetically unable to produce leptin are massively obese; low leptin concentrations are associated with increased hunger and gains in body fat.

Thus, to the extent that fructose inhibits insulin and leptin levels, one would expect an increase in food intake in a diet that includes HFCS. Bray *et al*. cite a 2002 study by Teff and others, published in *Diabetes*, in which consumption of high-fructose meals reduced 24-hour plasma insulin and leptin concentrations and increased triglyceride levels in women.[5] (Although published in a major medical journal, this study does not appear in a MEDLINE search.) According to the Bray paper: "Because insulin and leptin act as key afferent signals in the regulation of food intake and body weight, this suggests that dietary fructose may contribute to increased energy intake and weight gain."[6]

There is another difference between fructose and glucose metabolism: glucose enters the cells through the action of insulin; fructose enters the cells through the action of something called a GLUT5 transporter, which does not depend on insulin. This transporter is absent from pancreatic B-cells and the brain, which indicates limited entry of fructose into these tissues. Glucose provides "satiety" signals to the brain that fructose cannot provide because it is not transported into the brain. Once inside the cells, fructose facilitates the formation of triglycerides more efficiently than does glucose.

The Bray paper references a study by Bantle and others in which a diet containing 17 per cent fructose (very typical of today's consumer) caused a highly significant increase of 32 per cent triglyceride levels in the blood in male subjects, although not in female subjects.[7] The paper also discusses the fact that sweetened beverages in general, as compared to sweeteners added to solid foods, have a greater tendency to cause weight gain, citing a randomised, double-blind European study by Rabin and others which found that drinking calorically sweetened beverages resulted in greater weight gain over the 10-week study than did drinking diet drinks.[8] Since the beverages in this study were sweetened with sucrose, Bray *et al*. called for a second randomised controlled study to compare sucrose- and HFCS-sweetened beverages.

Industry Response

But instead of providing support for such a study, the industry responded with a wallop of damage control in the form of a report by the University of Maryland's Center for Food, Nutrition and Agriculture Policy (CFNAP),[9] aided by a gift from British sweetener company Tate & Lyle PLC.

The magnitude of the deleterious effects of fructose varies depending on such factors as age, sex, baseline glucose, insulin and triglyceride concentrations, the presence of insulin resistance and the amount of dietary fructose consumed.[10] Some are more sensitive to fructose than others: people who are hypertensive, hyperinsulinaemic or hypertriglyceridaemic; non-insulin dependent diabetics; people with functional bowel disease; and postmenopausal women.[11] The CFNAP expert panel was able to confuse the issue by citing studies carried out with individuals known to be less sensitive to fructose. Conspicuously absent in its review are the Teff, Bantle and Rabin studies cited by Bray and others. The report dismisses both the epidemiological correlation and the large amount of research showing

that HFCS is metabolised differently from sucrose. It also dismisses the fact that US fructose consumption has increased over 30 per cent since 1970, claiming instead that the fructose to glucose ratio (F:G) in the US food supply has not appreciably changed since the introduction of HFCS in the 1960s—an amazing claim, given that the HFCS used in sodas has an F:G ratio of 55:45 and the HFCS in diet foods has a F:G ratio of 90:10.

While admitting that "studies analyzing the differences between HFCS and sucrose consumption and their contributions to weight gain do not exist", the authors do not join Bray *et al.* in calling for such a study. Instead, they conclude that HFCS "does not appear to contribute to overweight and obesity any differently than do other energy sources".

The Big Dirty Secret About HFCS

Many researchers have pointed out that the fructose in HFCS is free, unbound fructose, which is not the same as the fructose in fruit, which is bound to other sugars and is part of a complex that includes fibre, fatty acids, vitamins and minerals.

Leaving this obvious difference aside, the industry would have the public believe that the fructose in fruit and in HFCS are chemically identical. However, most of the fructose in fruit is in the form of L-fructose or levulose, but the fructose in HFCS is a different isomer, D-fructose. Small amounts of D-fructose do occur in fruit, but the D-fructose in HFCS has the reversed isomerisation and polarity of a refined fructose molecule.[12]

As explained by Russ Bianchi, Managing Director and CEO of Adept Solutions, Inc., a globally recognised food and beverage development company, the fructose in HFCS is therefore not recognised in the human Krebs cycle for primary conversion to blood glucose in any significant quantity, and therefore cannot be used for energy utilisation.[13] Instead, these refined fructose sweeteners are primarily converted into triglycerides and adipose tissue (body fat). In fact, a recent study by Teff and others, published in *The Journal of Clinical Endocrinology and Metabolism* (2009; 94[5]:1562-69), found that obese people who drank a fructose-sweetened beverage with a meal had triglyceride levels almost 200 per cent higher than obese people who drank a glucose-sweetened beverage with a meal.[14]

Chronic high-triglyceride levels translate into increased insulin resistance, inflammation and heart disease. Thus, according to Bianchi, HFCS is a recipe for obesity, lack of energy and metabolic syndrome—the very portrait of the modern American addicted to a diet of HFCS-sweetened sodas.

Agave "Nectar" to the Rescue?

As the educated public has shied away from foods containing HFCS, the industry has brought a new sweetener onto the scene—one used especially in foods aimed at the health-conscious consumer: agave "nectar". Agave nectar is advertised as a "diabetic friendly", "raw" and "100% natural sweetener". Yet it is none of these. Agave nectar is found on the shelves of health food stores primarily under the labels "Agave Nectar 100% Natural Sweetener" and "Organic Raw Blue Agave Nectar". It can also be found in foods labelled as organic or raw, including ketchup, ice cream, chocolate and health food bars.

Its name, along with the pictures and descriptions on the product labels, creates the impression that agave is an unrefined sweetener that has been used for millennia by native people in central Mexico. "For thousands of years, natives to central Mexico used different species of agave plants for medicine, as well as for building shelter." Thus reads the copy on an agave package. And it is true that natives would also allow the sweet sap or liquid of one species of agave to ferment naturally, which created a mildly alcoholic beverage with a very pungent flavour, known as *pulque*. They also made a traditional sweetener, called *miel de agave*, from the agave sap or juice by simply boiling it for several hours. But, as one agave seller explains, the agave nectar purchased in stores is neither of these traditional foods: "Agave nectar is a newly created sweetener, having been developed during the 1990s."[33]

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The Big Dirty Secret About Agave

In spite of manufacturers' claims, agave "nectar" is not made from the sap of the agave or yucca plant but from the starch of its giant pineapple-shaped root bulb. The principal constituents of the agave root are starch, similar to the starch in corn or rice, and a complex carbohydrate called inulin, which is made up of chains of fructose molecules. Technically, this highly indigestible fibre, inulin, which does not taste sweet, comprises about half the carbohydrate content of agave.[34]

The process by which agave glucose and inulin are converted into "nectar" is similar to the process by

which corn starch is converted into HFCS.[35] The agave starch is subjected to an enzymatic and chemical process that converts the starch into a fructose-rich syrup—anywhere from 70 per cent fructose and higher, according to the agave nectar chemical profiles posted on agave nectar websites.[36] (One agave manufacturer claims that his product is made with "natural" enzymes.) That's right; the refined fructose in agave nectar is much more concentrated than the fructose in HFCS. For comparison, the high-fructose corn syrup used in sodas is 55 per cent refined fructose. (A natural agave product does exist in Mexico: a molasses-type syrup from concentrated plant nectar, but its availability is limited and it is expensive to produce.)

According to Bianchi, agave "nectar" and HFCS "...are indeed made the same way, using a highly chemical process with genetically modified enzymes. They are also using caustic acids, clarifiers, filtration chemicals and so forth in the conversion of agave starches." The result is a high level of highly refined fructose in the remaining syrup, along with some remaining inulin.

In a confidential letter dated 15 May 2000, Dr Martin Stutsman of the FDA explained the FDA's food labelling codes relating to HFCS and agave nectar: corn syrup treated with enzymes to enhance the fructose levels should be labelled as "high fructose corn syrup", and agave sweetener requires the label "hydrolyzed inulin syrup".[37] Even though, like corn, agave is a starch and fibre food processed with enzymes, it does not have to be labelled as "high fructose agave syrup", which would make it clearer for consumers. "Agave nectar" is a misnomer; at the very least, it should be labelled "agave syrup".

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Agave syrup comes in two colours: clear or light, and amber. What is this difference? Russ Bianchi explains: "Due to poor quality control in the agave processing plants in Mexico, sometimes the fructose gets burned after being heated above 140 degrees Fahrenheit, thus creating a darker, or amber color." However, the labels create the impression of an artisan product—like light or amber beer. As consumers are learning about problems with agave syrup, the label "chicory syrup" is beginning to appear as a non-conforming word for the product. Consumers beware!

The Saponins Problem

Yucca species are known to contain large quantities of saponins. The industry describes saponins in agave syrup as beneficial: "Agave's rich density of saponins increases hydration as the soapy, surfactant nature of saponins change[s] the wetting angle of water it contacts. This eases and accelerates cellular water uptake, especially when used with a high-quality salt."[38]

However, the truth is that the saponins found in many varieties of agave plants are toxic steroid derivatives, capable of disrupting red blood cells and producing diarrhoea and vomiting.[39] They are to be avoided during pregnancy or breastfeeding because they might cause or contribute to miscarriage by stimulating blood flow to the uterus.[40] At the very least, agave products should carry a warning label indicating that the product may cause miscarriage.

Just Say No to Agave

Since the FDA makes no effort to enforce food-labelling laws, consumers cannot be certain that what they are eating is what the label says it is. New sweeteners like agave syrup were introduced into the market to make a profit, not to make consumers healthy. Clever marketing has led many consumers to believe that the high level of fructose in agave syrup makes it a safe and a natural sweetener. Agave syrup labels do not conform to FDA labelling requirements, thus deepening the false illusion of an unprocessed product. As we have demonstrated here, if a sweetener contains manufactured fructose, it is neither safe nor natural, especially at levels up to 70 per cent.

Agave syrup is a man-made sweetener which has been through a complicated chemical refining process of enzymatic digestion that converts the starch and fibre into the unbound, man-made chemical, fructose. While high-fructose agave syrup won't spike your blood glucose levels, the fructose in it may cause mineral depletion, liver inflammation, hardening of the arteries, insulin resistance leading to diabetes, high blood pressure, cardiovascular disease and obesity.

If you want something sweet, eat a piece of fruit, not a candy bar labelled as a "health food". If you want to create something sweet, use sweeteners that are known to be safer. For uncooked dishes, unheated raw honey and dates work well. For cooked dishes or sweet drinks, a good organic maple syrup or even freshly juiced apple or orange juice can provide delicious and relatively safe sweetness; dehydrated cane sugar juice or maple sugar may be used in moderation in cookies and desserts that contain nutritious ingredients and good fats such as butter, egg yolks and nuts.

However, to be healthy, you cannot eat sugar all day, no matter how natural the form. You should limit total sweetener consumption to less than five per cent of daily

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calories. For a diet of 2,500 calories per day, that's less than three tablespoons of honey, maple syrup or dehydrated cane sugar juice or several pieces of fruit. And many people do best by avoiding sweeteners completely.

The lack of standards in the health food world comes as depressing news; but let this news encourage you to consume more pure and unrefined foods and sweetener sources. Good health depends on wise food choices, and wise food choices depend on constant vigilance. ∞

Authors' Note:

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Editor's Note:

Because of space constraints, we are unable to publish the references and sidebars accompanying this article. To view these, go to the web page http://www.westonaprice.org/Agave-Nectar-Worse-Than-We-Thought.html.