



Health Connections

LINKING NUTRITION RESEARCH TO PRACTICE

HIGH-FRUCTOSE CORN SYRUP —

A Sugar By Any Other Name

High-fructose corn syrup (HFCS) is definitely news. “HFCS: Why is it so bad for me?” and “Sickeningly Sweet: The effects of HFCS” are among the 311,000 mentions from a Google search. HFCS is proclaimed to affect diabetes, cancer, dental caries and blood lipid levels. The coincidental rise in obesity along with HFCS’s introduction in the food supply makes it a leading dietary scapegoat.

Consumers equate HFCS with “toxic waste” when listed on a food label;¹ regulators seek to tax HFCS products and beverages sold in their locale; and policy makers attempt to limit its availability through nutrition standards in schools. To single-out HFCS as the culprit in the rise in obesity is overly simplistic, as there are multidimensional determinants of obesity. A reductionist approach that focuses on one food or one component in the food supply, in the presence of just too much food and too little activity, is unlikely to succeed.² This issue of *Health Connections* provides some background on HFCS and shows how health professionals can more realistically focus on nutrient quality to evaluate HFCS-containing foods in clients’ diets.

The Rise, Leveling Off and Potential Decline of HFCS Use

HFCS was developed in the late 1960s by corn processors to provide the same sweetness as sucrose (cane or beet sugar) so consumers would notice no difference in taste. HFCS is corn syrup processed to increase the fructose content and then blended with pure corn syrup. The term “high-fructose” corn syrup is somewhat of a misnomer, but was needed to distinguish this newly developed HFCS from traditional, all-glucose corn syrup.² Most formulations are nearly identical in composition to table sugar or sucrose: a 50/50 mixture of fructose and glucose with the same caloric density of 4 calories per gram.³ The primary difference is that

these monosaccharides exist free in solution in HFCS, but they are in disaccharide form in sucrose. The U.S. Food and Drug Administration granted HFCS “Generally Recognized as Safe (GRAS)” status in 1983 and reaffirmed that ruling in 1996.³

HFCS’s lower cost on a sweetness-equivalent basis is one reason for its substitution for sucrose. HFCS also provides some functionalities such as maintaining moisture, particularly in baked foods. As a liquid, HFCS blends easily and is commonly used to sweeten soft drinks, sports drinks, and some other processed foods. Flavored milk, some yogurt and ice cream products may also contain HFCS.

HFCS usage* rose after its introduction in 1967, yet a sharp rise did not occur until 1980 when leading beverage companies began adding HFCS to soft drinks. Over the same period of time, per-capita availability of refined cane and beet sugars (sucrose) declined 33 percent.⁴ Thus, HFCS has substituted for sucrose as a caloric sweetener rather than used in addition to sucrose.²

Since peaking in 1999 at about 64 pounds per person annually, HFCS available for use dropped to 59 pounds per person in 2005, as bottled water and diet soft drinks replaced regular carbonated soft drinks.⁴ If the price rises due to higher

continued on page 2

**Availability/disappearance data on HFCS has been used to generate hypotheses regarding the association between HFCS and various health effects. Availability data (calculated by dividing the total annual supply of a product/commodity by the U.S. population for that year) do not directly measure actual quantities ingested because such data do not take into account processing, waste and individual food choice; but can indicate whether Americans on average are consuming more or less of certain foods over time.*



Mary Jo Feeney, MS, RD, FADA

HEALTH CONNECTIONS EDITOR

Mary Jo Feeney specializes in nutrition communications and marketing. With over 30 years experience in public health nutrition and education, she currently is a leading consultant to the food, agriculture and health care industries. A charter Fellow of the American Dietetic Association, Mary Jo served on the Board of Directors of both the American Dietetic Association (ADA) and its Foundation (ADAF) and received the association’s Medallion Award in 1996.

REFERENCES

- ¹ The Sweet Truth. Eatingwell.com. September/October 2007.
- ² Anderson, GH Editorial. Am J Clin Nutr. 2007;86:1577-8.
- ³ Corn Refiners Association. www.HFCS.com.
- ⁴ Amber Waves February 2008. www.ers.usda.gov/AmberWaves/February08/Findings/HighFructose.htm.
- ⁵ Bray et al. Am J Clin Nutr. 2004;79:537-43.
- ⁶ Forshee RA et al. Crit Rev Food Sci Nutr. 2007;47:561-82.
- ⁷ AMA Report: Health Effects of High Fructose Syrup. <http://www.ama-assn.org/ama/pub/category/print/18641.html>.
- ⁸ Monsivais P et al. Am J Clin Nutr. 2007;86:116-23.
- ⁹ Akhavan T and Anderson GH. Am J Clin Nutr. 2007;86:1354-1363.
- ¹⁰ Soenen S and Westterter-Plantenga MS. Am J Clin Nutr. 2007;86:1586-1594.
- ¹¹ Johnson RK et al. J Am Diet Assoc. 2002; 102:853-855.
- ¹² National Health and Nutrition Examination Surveys I, II, III and 1999-2004. Summarized by Schorin.

demand for other corn-based products (e.g., corn-based ethanol), use of HFCS in food products may continue to drop.

HFCS, Appetite and Weight Gain: Any Link?

It has been suggested that HFCS consumption may influence obesity due to the body's response to fructose,⁵ which is metabolized differently than other sugars. Entering the portal circulation, fructose may increase triglycerides when consumed in excess and does not stimulate insulin release to the same degree as other sugars. The lack of insulin-mediated leptin stimulation is one theory of how fructose may lead to obesity. HFCS, however, is not the same as pure fructose, as it contributes an almost equal amount of glucose. Because HFCS and refined sugars have similar compositions, the fructose to glucose ratio in the United States food supply has not appreciably changed since its introduction.⁶

An expert panel reviewed the scientific literature examining the relationship between consumption of HFCS or "soft drinks" (proxy for HFCS) and weight gain. The panel stated it was unclear why HFCS would affect satiety or absorption and metabolism of fructose any differently than would sucrose, and concluded that HFCS does not appear to contribute to overweight/obesity any differently than other energy sources.⁶ In addition, after studying current research, the American Medical Association (AMA) concluded that HFCS does not appear to contribute more to obesity than other caloric sweeteners. It said there was currently insufficient evidence to restrict the use of HFCS or label products that contain it with a warning.⁷

Several short-term studies suggest that any potential contribution of sugars to obesity is unlikely due to HFCS's unique effects on subjective and physiological measures of appetite regulation:

- There was no difference in perceived sweetness, hunger, satiety profiles or energy intake at a lunchtime meal after isocaloric commercial beverages containing sucrose or HFCS were consumed.⁸
- Pre-meal solutions containing sucrose, HFCS or various ratios of glucose to fructose were found to have similar effects on subjective measures and physiologic signals of satiety and food intake in young men.⁹
- Despite differences in the properties of preloads containing sucrose, HFCS or milk—and differences in mechanisms underlying satiety—no differences were observed in perceived fullness or in insulin, glucose and ghrelin concentrations. Compensatory energy intake

did not differ between the three preloads, but ranged from 30 to 45 percent, suggesting that longer-term studies should be undertaken to assess impact on body-weight regulation.¹⁰

Diet Quality — The Main Issue

Concern about HFCS and added sugars arises when nutrient-poor foods are consumed at the expense of nutrient-dense foods, resulting in micronutrient dilution of the total diet. The Dietary Guidelines Advisory Committee 2005 (www.health.gov/DIETARYGUIDELINES/dga2005/report) noted that sedentary lifestyles and typical food choices that are energy-dense rather than nutrient-dense leave most consumers with little flexibility for consuming foods that provide only calories. While not including a message specifically directed toward sugars, the Committee suggested limiting intake of added sugars with the recommendation to "choose carbohydrates wisely for good health."

However, not all foods with added sugars are devoid of nutrients. Sugars, in fact, can improve the palatability and increase intake of certain healthful foods and beverages. Flavored milk has the potential to increase children's milk consumption and thereby calcium intake, a shortfall nutrient identified by the Dietary Guidelines Advisory Committee. Although

PRACTICE POINTS FOR THE HEALTH PROFESSIONAL

- Evaluate each individual's total diet and lifestyle to determine whether energy intake is balanced with physical activity. If not, what factors unique to that individual need to be addressed?
- Consider that sugar is not a "bad" nutrient that must be avoided. The challenge lies in recognizing that sweeteners in moderation can improve the nutrition value of the diet, but when consumed in excess simply add to the caloric load.
- Help clients use the Nutrition Facts panel to identify foods with HFCS that have little nutrient value and suggest more nutrient-dense choices.
- Educate clients that some HFCS foods can provide high levels of important nutrients and are not necessarily to be avoided. Flavored milk, for example, may contain HFCS but can offer an accepted, nutritious alternative to the wide array of beverages available and provides the nutrients often lacking in their diets.
- When evaluating research around the effects of HFCS on health, remember that HFCS does not equate to pure fructose, and that it is actually very similar in composition to sucrose or normal table sugar.
- Encourage clients to be discerning when reading or hearing about unfavorable effects of a single nutrient or food on health. Health issues are generally the result of years of unhealthful dietary and lifestyle habits rather than a single dietary component.

some parents and school nutrition personnel may be reluctant to offer flavored milk due to its higher sugar content, analysis of data from the USDA Continuing Survey of Food Intakes of Individuals (CSFII 1994-96 and 1998) indicates that children who consumed flavored milk had higher total milk and calcium intakes, lower soft drink/fruit drink intake, yet percent energy from fat and added sugars was similar compared to nonconsumers.¹¹

In summary, excessive energy intake from any source, lack of physical activity, genetics and changes in the food and social environments all can contribute to an individual's risk for obesity. Health professionals can assist clients to evaluate their food choices relative to nutrient contribution, and when consuming foods with HFCS or sucrose to do so consistent with the U.S. Dietary Guidelines as well as their individual health goals.

Interview — Marilyn Schorin, Ph.D., R.D., F.A.D.A., Schorin Strategies, LLC, Louisville, KY, shares her insights about HFCS and its effects on our health based on her 30 years of experience with the food industry.

Q. What are the key points health professionals should know about HFCS?

A. Two areas of confusion need clarification. First, let's not make HFCS something it isn't. HFCS is not some 'demon' ingredient cooked up—its components are already in the diet. HFCS is made up of two simple sugars found in nature: fructose and glucose. Fructose is found in honey, fruit and table sugar; glucose is found in grains, vegetables, beans, legumes and table sugar—and of course, glucose is also blood 'sugar.' HFCS is basically the same as sugar and should not be singled out as having a major causal role on certain health effects, particularly obesity, since total nutrient and calorie intake matter.

Second, HFCS is not the same as fructose, although it is metabolized as the two simple sugars, glucose and fructose. Sometimes 'fructose' and 'HFCS' are referred to interchangeably, or HFCS is confused with fructose due to terminology. Some studies linking corn sweeteners with obesity came from animal studies using pure fructose—and at levels not relevant to normal consumption patterns.

Q. What is your assessment on the role of HFCS and obesity?

A. Epidemiological studies suggesting an increase in obesity with the introduction of HFCS can help generate hypotheses to be tested. Such studies, however, indicate an association, not causation, nor do they demonstrate a mechanism of action. In the 30 years over which the incidence of obesity has increased, consumption of calories from every macronutrient has increased. Obesity rates for children began to rise in the early 1970s,¹² about a decade before HFCS became the dominant sweetener in soft drinks. The obesity trend is global. The lack of

causality between HFCS intake and obesity is evident when the prevalence of obesity in the United States is compared with that of other countries where HFCS is limited (see side bar).

Q. What suggestions do you have for health professionals when discussing HFCS with clients?

A. Knowing what HFCS is and isn't (discussed in Q1) prepares health professionals to guide consumers in their food choices. Use and consumption of foods containing HFCS is a contextual issue. HFCS use in flavored milk enhances a product with a very different nutrient profile than an HFCS-sweetened beverage with no nutrients, but only calories. HFCS is listed on ingredient labels and the Nutrition Facts panel is useful to identify and compare HFCS-containing foods for calories and nutrients. Using these tools, health professionals can help consumers use nutrient quality to moderate their intake of HFCS in foods and beverages when necessary.



Marilyn Schorin, Ph.D., R.D., F.A.D.A.

Side Bar: Increased Prevalence of Obesity: U.S. compared to countries not using HFCS

