

# High Fructose Corn Syrup – How sweet it is

## Corn has many uses

A number of products can be made from corn. Corn is used as animal feed to produce food products such as beef, pork, chicken, eggs, and dairy products. Starch manufactured from corn is used for industrial purposes—including adhesives, biodegradable plastics, rubber, paper, and textiles.

Edible forms of cornstarch are used in baking powder, soups, gravies and sauces, pancake and waffle mixes, baby food, and chewing gum. Corn is a component of food products such as cereals (corn flakes), snacks (corn chips), tortillas, sodas and other sweetened beverages, ice cream and other frozen foods. It also is used in the production of some beers and ales.

Since the 1970s, corn also has become widely available to consumers in the form of high fructose corn syrup. The table below shows the amount of U.S. corn production used for various products in 2006-07.

Use	U.S. corn production (in bushels)
Animal Feed	5.6 billion
Exports	2.1 billion
Ethanol	2.1 billion
Corn Sweeteners	753 million
Starch for food and industrial uses	272 million
Corn Foods (cereals, snacks, tortillas, etc)	190 million
Alcoholic Beverages	137 million

Source: [www.iowacorn.org/](http://www.iowacorn.org/)

## How is corn processed?

Corn is converted to other products using either a wet milling or dry-grind process. Iowa has four wet milling plants in southeastern Iowa and about 60 dry-grind plants located across the state. The wet milling process can make corn sweetener or ethanol. The dry-grind process can make only ethanol—about 2.8 gallons per bushel plus carbon dioxide, distillers grains, distillers soluble, and distillers grains with solubles.

In the wet milling process, a single bushel of corn produces three primary products:

- corn oil (1.6 pounds) used for cooking oil, margarine, mayonnaise, salad dressing, shortening, soups, printing ink, soap, and leather tanning  
*plus*
- 21% corn protein gluten feed (13.5 pounds) used for livestock and poultry feed and pet food  
*plus*
- 60% corn gluten meal (2.6 pounds) used for pre-emergence herbicide, poultry feed, and fur cleaner

plus **one** of three alternatives:

- 33 pounds of corn sweetener used in a variety of food and beverage products  
*or*
- 32 pounds of cornstarch used in such products as adhesives, batteries, cardboard, crayons, degradable plastics, dyes, plywood, paper, antibiotics, chewing gum  
*or*
- between 2.5 and 2.7 gallons of ethanol or alcohol used for motor fuel additive, alcoholic beverages, industrial alcohol

## Did you know?

A 2-liter bottle of soda contains more corn than an 18-ounce box of corn flakes? (15 ounces compared to 12.9 ounces)

When corn sells for \$7 per bushel, an 18-ounce box of corn flakes contains 10 cents worth of corn. At the same price, a 2-liter bottle of soda contains 12 cents worth of corn.

When priced at \$2.28 per bushel, the value of the corn contained in an 18-ounce box of corn flakes is 3 cents.

## For more information, visit the following Web sites:

Iowa State University Nutrition Resources

[www.extension.iastate.edu/healthnutrition/](http://www.extension.iastate.edu/healthnutrition/)

Iowa State University Extension Publications

[www.extension.iastate.edu/store](http://www.extension.iastate.edu/store)

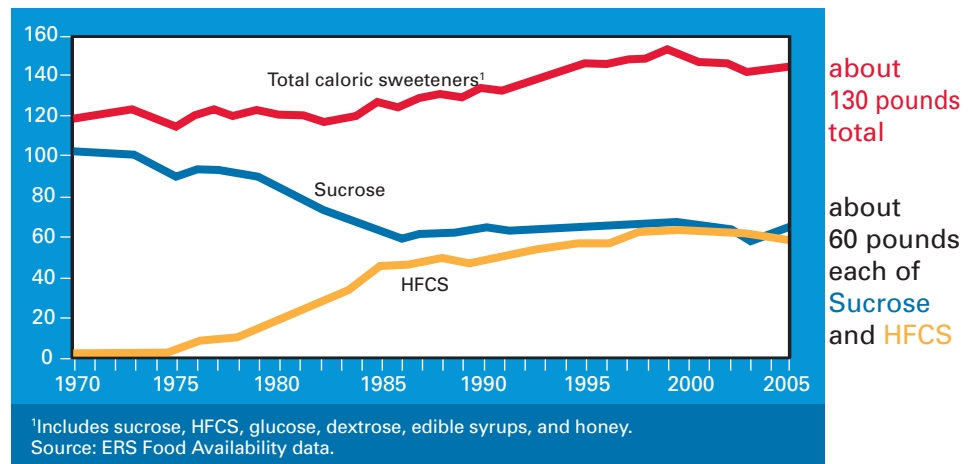


## What is the difference between corn syrup and high fructose corn syrup (HFCS)?

Corn syrup is made by breaking the long chains of molecules that form cornstarch into shorter chains, such as glucose and maltose. The more cornstarch is hydrolyzed, the higher the corn syrup's glucose content.

High fructose corn syrup is made from corn syrup that has a high amount of glucose. Additional enzymes are used to convert some of the glucose into fructose, resulting in a sweeter corn syrup. High fructose corn syrup has several characteristics that make it a popular ingredient for food manufacturers.

- As a liquid, it is easily incorporated into beverages and also stays in solution better—making a higher quality product.
- As a form of invert sugar, fructose combines with protein in the presence of heat to give browning—toasted bread is an example. Because it has a higher amount of fructose, HFCS provides better browning in baked products.
- Using HFCS instead of granular sugar helps lock in moisture in baked products. This extends shelf life by keeping the baked product fresher for a longer time period. This same moistness also gives cookies and snack bars a softer texture.
- Because it is a syrup (rather than granules), the fructose and glucose molecules do not form undesired crystals in candies and ice cream—giving those foods a smoother mouth feel and a more desirable product.
- HFCS contributes thickness, or viscosity, to condiments and salad dressings.
- Historically, HFCS costs about 30 percent less than sugar. This price difference has decreased, however, as corn prices and demand for ethanol have increased.



Per person consumption of high fructose corn syrup has increased and replaced sucrose (table sugar). Total sweetener consumption has increased 20 percent.

## How do sugar and high fructose corn syrup compare?

Both products are used as sweeteners. High fructose corn syrup and table sugar (sucrose) are similar in chemical composition—both contain fructose and glucose—and are metabolized in a similar way by the body. Each contributes the same amount of energy (4 calories per gram or 16 calories per teaspoon).

Table sugar has equal amounts (50 percent each) of glucose and fructose. High fructose corn syrup also has glucose and fructose but in different proportions. Most is 55 percent fructose and 45 percent glucose but the percentages can vary depending on how the product will be used. The name “high fructose corn syrup” is an umbrella term for several, slightly different products.

High fructose corn syrup and table sugar also offer different characteristics to food manufacturers (see list at left).

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## Is high fructose corn syrup responsible for the obesity epidemic?

The causes of obesity and overweight are multi-faceted and cannot be attributed to any one single factor. Weight gain occurs when there is an imbalance of energy intake and energy output—consuming more calories than are used in activity. As an ingredient in food and beverage products, high fructose corn syrup contributes to the energy intake.

The increase in high fructose corn syrup consumption over the past 20 years has been mirrored by a decrease in sugar (sucrose) consumption. However, total sweetener intake also has increased more than 20 percent over the past 20 years. Consequently, the increase in total calories has contributed to the energy imbalance leading to overweight and obesity.

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