

# High Fructose Corn Syrup – How sweet it is

## Corn has many uses

A number of products can be made from corn. The largest single use of corn is energy production. Almost half (44%) of all corn is used to produce ethanol and fuel. The second largest use of corn is for animal feed. One-fourth (25%) of all corn is used as animal feed to produce food for humans including beef, pork, chicken, eggs, and dairy products.

Edible forms of cornstarch are used in baking powder, soups, gravies and sauces, pancake and waffle mixes, baby food, and chewing gum. Corn is also 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 may also be used in some beers and ales. Since the 1970s, corn has also become widely available to consumers in the form of corn sweetener (syrup).

Corn also has industrial uses. Starch made from corn is used in adhesives, plastics, rubber, paper, and textiles.

## U.S. Corn Usage

- 39% Feed
- 27% Ethanol and Fuel
- 16% Exports
- 9% Food and Industrial
- 9% Residual

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

## How is corn processed?

Corn is processed using either a dry-grind or wet milling process. Iowa has 36 dry-grind plants across the state, which can only make ethanol (2.8 gallons per bushel). Other by-products include carbon dioxide, distiller grains, distillers soluble, and distillers grains with solubles. Iowa has just six wet milling plants in southeast Iowa, which can make corn sweetener or ethanol.

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
- 21% corn protein gluten feed (13.5 pounds) used for livestock and poultry feed and pet food
- 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
- 32 pounds of cornstarch used in products such as adhesives, batteries, cardboard, crayons, degradable plastics, dyes, plywood, paper, antibiotics, chewing gum
- 2.5 to 2.7 gallons of ethanol or alcohol used for motor fuel additive, alcoholic beverages, industrial alcohol

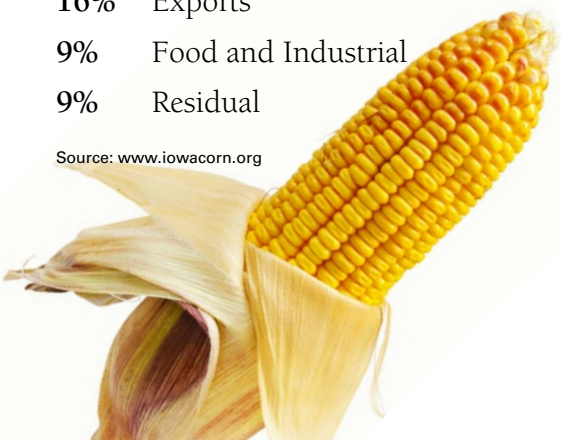
## What is the difference between corn syrup and high fructose corn syrup (HFCS)?

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 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 less than sugar. This price difference varies depending on the demand and price for corn.

### How do sugar and corn sweeteners compare?

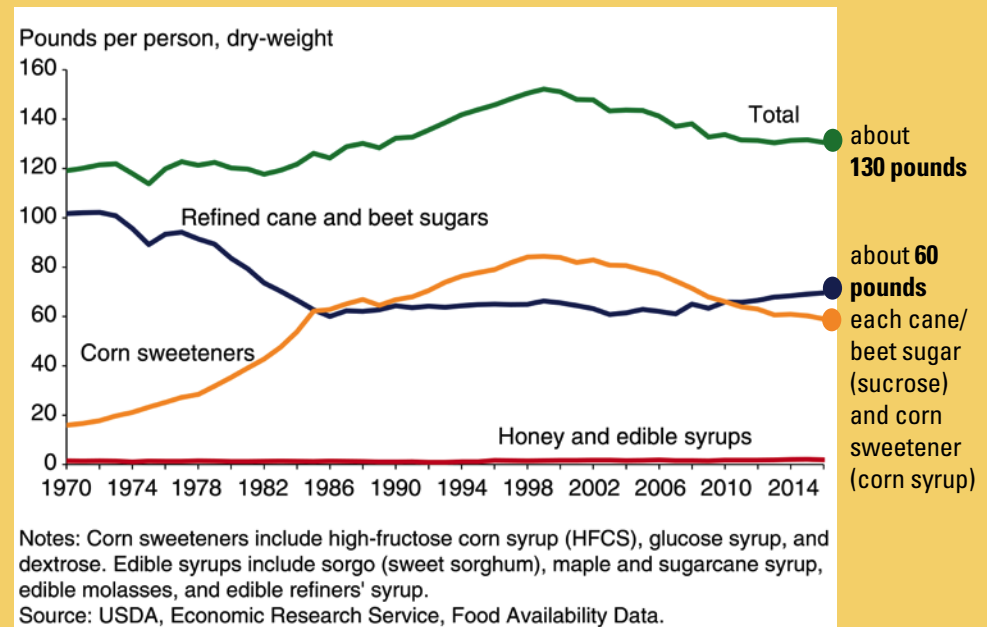
Both products are used as sweeteners. Refined sugar (sucrose) and corn sweeteners are similar in chemical composition—both contain fructose and glucose—and are metabolized in a similar way by the body. Each contributes the same amount of energy (4 calories per gram or 16 calories per teaspoon). Refined sugar has equal amounts (50 percent each) of glucose and fructose. Corn sweeteners also have glucose and fructose but in different proportions. The percentage can vary but most is either 42% or 55% fructose, with the remaining being glucose (58% or 45%). The name “high fructose corn syrup” is a bit of a misnomer. **It is really an umbrella term for sweeteners that vary in fructose and glucose content.**

### Are corn sweeteners 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—

### U.S. per capita caloric sweetener availability, 1970-2016

Total sugar availability increased about 20% between 1970 and 2000, where it peaked at 152 pounds per person annually. Since 2000, total sweetener has decreased slightly. Refined sugar (cane and beet) and corn sweetener availability is similar at about 60 pounds per person annually.



consuming more calories than are used in activity. As an ingredient in food and beverage products, corn sweeteners can be commonly found in less nutrient-dense foods and contribute to energy intake.

The intake of corn sweeteners and refined sugars peaked about 2000 and have declined slightly since that time. Currently, availability of refined sugar and corn sweeteners is about the same. Total calories from refined sugar and corn sweeteners has contributed to the energy imbalance leading to overweight and obesity.

### 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 (4 cents in the soda).

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