Fructose, Glucose, and Sucrose In Nature

By Rex Mahnensmith | Submitted On July 04, 2016

Fructose, glucose and sucrose are often referred to as fruit sugars, and indeed they are. These sugars exist in virtually all tree fruits, in virtually all vine fruits, and in virtually all berries. Fructose, glucose, and sucrose exist in most root vegetables, as well.

Fructose and glucose are circular molecules, very similar to each other. Each has 6 carbon atoms, 6 oxygen atoms, and 12 hydrogen atoms. However, the compounds differ slightly in the arrangements of these atoms. Both exist as straight chain molecules and as circular molecules. Both are highly reactive and will react with each other easily, forming sucrose.

Glucose and fructose are two products of photosynthesis, whereby plants inspire carbon dioxide from the atmosphere and react this carbon dioxide molecule with water, forming simple single sugars or "monosaccharides." The photosynthetic steps are complex yet precise, yielding glucose principally, then fructose, and ultimately sucrose, which is the result of fructose combining with glucose to form a double sugar or "disaccharide."

In the experimental setting, under direct observation, glucose, fructose, and sucrose appear almost simultaneously through the photosynthetic process.

The sugar compositions of glucose, fructose, and sucrose differ from plant to plant.

For example, apples, figs, bananas, grapes, and pears are relatively rich with free fructose sugars when fructose-to-glucose ratios within these fruits are analyzed.

Yet, apricots, peaches, pineapples, and oranges contain lower amounts of free fructose relative to free glucose per fruit. Each of these fruits contain sucrose as well, but the ratio of sucrose to free fructose and free glucose varies fruit to fruit.

Apricots, oranges, pineapples, and peaches each show sucrose as being the dominant sugar form contained within, meaning that more than 50% of total sugar is sucrose, not free fructose nor free glucose, whereas pears, apples, bananas and grapes contain much less sucrose per gram of total sugar and more of the monosaccharide sugar forms: glucose and fructose.

Vegetables also vary considerably. Beets have a very low content of free fructose and free glucose; but sucrose comprises more than 95% of the sugar units in beets, which explains why the beet is considered as a rich source of commercial sucrose.

Carrots are similar: sucrose comprises approximately 75% of the total sugar units in carrots, and free fructose and free glucose contribute very little. Yet, peppers, and yams, and onions contain less than 20% sucrose; the remainder is free fructose and free glucose.

What we call the sweet potato contains over 60% sucrose; yet what we call the yam - a very similar root vegetable - has very little monosaccharide or disaccharide sugar of any species. Yams are fundamentally fibrous and starchy, so their carbohydrate is complex, not simple, and thus called polysaccharide or starch. The same is true for the other fibrous vegetables: Brussel Sprouts, broccoli, asparagus, artichokes, celery, and the leafy green group, such as spinach and kale are considered richly fibrous.

The fig is wholly unique: richer in total sugar per gram than any other fruit or vegetable, yet containing less than 1% sucrose. Glucose and fructose are equally represented in the fig, comprising 99% of this fruit's sugar composition, but figs are not considered sweet fruits. The fig is a dry fruit in its essence - without much resident water compared to other fruits. Hence, its dense fiber characterizes its nature.

Corn has captured attention for decades, being the source of high fructose corn syrup which has been commercially introduced as a sweetener additive to various foods and beverages. Sweet corn has less total sugar that virtually all fruits. Sweet corn contains twice as much free glucose as fructose, and corn contains more fiber grams than sucrose and fructose and glucose grams combined. Yet, corn is shouted out as a sweet and relatively unhealthy vegetable. In truth, it is not so when compared to many other vegetables and fruits. Nevertheless, corn has been a commercial choice for refining and processing in order to yield a sweet liquid additive to various beverages and thus is viewed negatively by many folk.

What we know as "sweet corn" is deliberately harvested while the corn kernels are plump and still laden with syrupy water. The sugars still reside in the sweet corn kernels as dissolved fructose and glucose monosaccharides and sucrose disaccharides when ripe for harvest. But, should the kernel mature further and not be harvested, the sweet corn kernels would shrink and harden. This change represents the kernels' transformation of its glucose, fructose, and sucrose to polysaccharides - i.e. to long-chain carbohydrates called simply starch and fiber. Now the kernels are well-suited for animal feed but are not as an attractive human food - fascinating. Corn can be and is genetically modified to mature between these two different forms: fibrous "field or feed corn" used for animal consumption or future seeds for sowing; or the much-less fibrous and soft "sweet corn" used for human nutrition in various forms.

Fructose has received an unwarranted negative reputation. It is not deserved nor appropriate. Fructose, like glucose, serves as a unique energy molecule in the support of life, both plant and animal. What humans have done with fructose - and glucose - and sucrose - in terms of over-consumption and commercial processing - is what underlies the obesity epidemic - not its production in nature.

Rex L Mahnensmith, M.D. is a practicing Primary Care Internist with a special interest in metabolism, healthy living, optimal nutrition, vegetarian foods, best eating, wellness, and best health. He has had a long standing interest and fascination with agriculture and plant variety. He hopes this essay will stimulate interest and enthusiasm for healthy vegetarian living.

Article Source: http://EzineArticles.com/expert/Rex_Mahnensmith/2250521