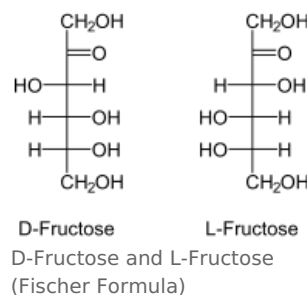


Fructose

Fructose (*fruit sugar*) is an important **monosaccharide** with 6 carbon atoms (**hexose**), which contains a keto group (C=O) inside the chain and is classified as a **ketose**. Fructose can therefore be referred to as a *ketohexose*. Its general formula is $C_6H_{12}O_6$.

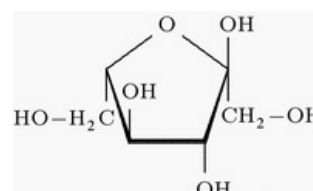
Physico-chemical properties

- It is the sweetest sugar, by combining with glucose and breaking off water it forms sucrose
- It is derived from the five-membered heterocycle of furan - it belongs to the furanoses
- Well soluble in water
- Decomposes (caramelizes) when heated
- The presence of a carbon chiral center enables the formation of Template:D- and Template:L-enantiomers (oppositely twists the plane of polarized light)
- Each of the enantiomers can form α and β *anomers* (according to the orientation of the hemiacetal hydroxyl)
- It is usually Template:D-fructose, as mammals are mainly equipped with enzymes capable of metabolizing this isomer
- Depending on the position of the OH and H groups on other carbon atoms, numerous **epimers can form**



Occurrence and meaning

- Bee Honey (50%) and fruit
- It is produced by the hydrolysis of cane sugar and inulin
- In the food industry, its mixture with glucose (invert sugar) is used
- It can be used as a source of alcohol during ethanol fermentation - use in the production of **alcoholic beverages**
- In the human organism, its phosphorylated form is an important intermediate product of several metabolic pathways
- It can be part of *disaccharides*, *oligosaccharides*, or *polysaccharides*
- Reduction of the carbonyl group to secondary hydroxyl produces so-called sugar alcohols (alditols); Template:D-glucose and Template:D-fructose yield Template:D-sorbitol (Template:D-glucitol) by this reaction



α -L-Fructose, Haworth formula (hydrogen atoms on the cycle are sometimes omitted for simplicity)

Pathobiochemistry

Initially, the breakdown of fructose is not dependent on glucose, subsequent metabolic steps can enter glycolysis. A possible complication is *hereditary fructose intolerance* caused by the absence of liver aldolase B, which metabolizes fructose-1-phosphate to glyceral and glycerone-3-phosphate, or a defect in fructose-1,6-bisphosphatase, which causes the accumulation of fructose-1-phosphate leading to the inhibition of glycolysis and glycogenolysis and subsequently leads to hypoglycemia. Although fructose is then phosphorylated, the cell does not have enough ATP and phosphate and fructose cannot be broken down further. Chronic intake of fructose can cause irreversible liver damage. The treatment consists in a diet regime with its reduced content.



Crystalline fructose

Resorption

Fructose and other monosaccharides are absorbed in the cells of the small intestines (enterocytes, brush border) by facilitated diffusion and are released into the bloodstream using specific GLUT-5 and GLUT-2 transporters.

Metabolism

After consuming a large amount of sucrose (beet or cane sugar), its subsequent decomposition leads to an increased level of fructose. Fructose is broken down by glycolysis in the liver much faster than glucose, which results in a rapid flow through some liver metabolic pathways, and subsequently there is an increased formation of fatty acids, their esterification, and the secretion of VLDL - **an increase of triacylglycerol serum level increase**. An excess of contained glucose intensifies this phenomenon.

Fructose derived from sucrose can be converted to glucose and lactate in humans before entering the portal circulation. Together with glucitol, fructose is contained in the human lens, where it can accumulate in diabetes and cause diabetic cataracts. It is also contained in the seminal plasma and secreted into the fetal circulation of ungulates and cetaceans, where it functions as an important source of energy.

Links

Related articles

- Carbohydrates
- Glucose
- Fructose metabolism
- Disorders of fructose metabolism
- Glycolysis
- Gluconeogenesis
- Glycemia

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