Overview of Carbohydrates

Monosaccharides and disaccharides

These are white crystalline substances soluble in water, of a neutral nature, which do not dissociate in aqueous solutions. They have a ``polar character *and −OH groups cause their sweet taste and strong hydration in solution.*

The most important **monosaccharides** in food are glucose, fructose and galactose. Of the **disaccharides**' sucrose α-Glc (1→2) β-Fru used as a sweetener, beet sugar, lactose, β-Gal (1→4) β-Glc, present in milk and maltose, α-Glc (1→4) β-Glc, present in malt.

Sugar alcohols

Sugar alcohols are formed by the '*reduction* of a carbonyl group to a hydroxyl group. For example, glucitol, or sorbitol, which is produced by the reduction of glucose or fructose.

> *Cataracts in diabetics are caused by a long-term increased concentration of glucose, which is reduced to glucitol in the lens. Its removal is slow, and since it is strongly osmotically active, it changes the osmolarity of the lens. Lens proteins (crystallins) precipitate in such an environment and form strongly light-scattering foci.*

Polyhydroxy derivatives of carboxylic acids

They are formed by the oxidation of monosaccharides. During oxidation with a weak reagent, the aldehyde group is oxidized and **aldonic acids** are formed. Stronger reagents oxidize not only the aldehyde group, but also the primary − OH group at the end of the molecule, so that dicarboxylic **aldaric acids** ***are formed. Oxidation of only the primary − OH group of aldoses in the body takes place enzymatically to form*** *uronic acids*. For example, glucose produces glucuronic acid, an important conjugation agent in the liver that aids in the excretion of poorly water-soluble substances.

Deoxysugars

They are formed by the '*reduction of the hydroxyl group* of a saccharide. An example is deoxyribose, an important component of nucleic acids.

Amino sugars

They are formed by **substitution of a hydroxyl group**' for a $-NH_2$ group. Important amino sugars in the body include, for example, Template:D-glucosamine, a component of intercellular mass molecules.

Esters

They are formed by the **esterification of the hydroxyl group** H_3PO_4. For example, the formation of glucose-6-phosphate from a glucose molecule. Or H_2SO_4 components of proteoglycans.

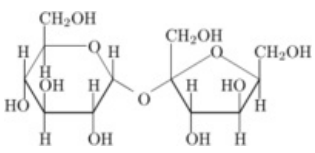
Glycosides

They are formed by the '*reaction of the hydroxyl group* with:

1. Alcohol - formation of an O-glycosidic bond. For example, the formation of di- and polysaccharides, or the binding of monosaccharides to proteins via the amino acids serine and threonine.
2. Aminem – formation of **N-glycosidic bond**'. An example is the binding to proteins via aspartate or the binding of ribose in nucleotides.

The most reactive group in the monosaccharide molecule is the anomeric group **−OH**.

'*Non-reducing* disaccharides are formed when a *glycosidic bond* is formed between the anomeric hydroxyls of both monosaccharides, as for example with sucrose. The disaccharide does not react with the oxidizing agent.

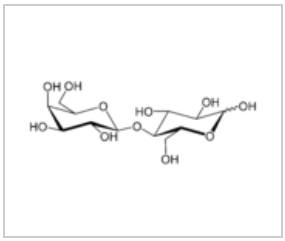


Sucrose

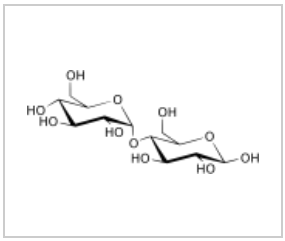
'*Reducing* disaccharide is formed when the anomeric hydroxyl of one monosaccharide reacts with a non-

anomeric hydroxyl of the other monosaccharide. Free aldoses, monosaccharides, are all reducing, disaccharides are reducing for example lactose or maltose.

Aglycones are substances that are attached to monosaccharides via a glycosidic bond and are not carbohydrates themselves.



Lactose



Maltose

Polysaccharides and fiber

Polysaccharides tend to be amorphous substances and are either ``insoluble in water *or form ``colloidal solutions*. They are generally referred to as **glycans*. They can be made of only one type of monosaccharide, for example glucose as in starch and glycogen. We refer to these polysaccharides as "glucans". If the monosaccharide is fructose, we call this polysaccharide* *fructan*. Or they are made up of various monosaccharides and their derivatives, such as glycosaminoglycans.

Storage polysaccharides such as starch or glycogen are partially soluble in water, while structural polysaccharides such as cellulose have many intra- and intermolecular hydrogen bonds in their structure and are insoluble in water. '.

Fiber

It consists of a heterogeneous group of structural polysaccharides that human enzymes cannot split, and therefore it is a **non-absorbable** ***part of food. However, it is*** *very important'* ***for digestion - it increases the volume of digestate, which*** **accelerates intestinal peristalsis** ***and thus harmful substances stay in the digestive tract for a shorter time. At the same time, it binds to itself some foreign and endogenous substances, thereby increasing their excretion from the organism. This applies, for example, to bile acids formed from cholesterol - consumption of fiber therefore*** *reduces the amount of cholesterol* in the body.

We divide the fiber:

1. **Soluble fiber'** (hemicellulose, pectins).

   It is broken down by colon bacteria into short-chain fatty acids, acetic, propionic, butyric acid, which are an important source of energy for colonocytes.

File:Pectins.jpg

Pectins

1. **Insoluble fiber'** (cellulose).

   Even bacterial enzymes cannot break down cellulose and it leaves the body undigested. Its importance lies in increasing the volume of digestion and supporting peristaltic movements.

File:Celulosa-stabilizace.jpg

Cellulose stabilization

Heteroglycosides

Proteoglycan structure

Substances containing, in addition to the carbohydrate part, another type of compounds are called '*aglycons*. Includes:

1. **Proteoglycans**

   They contain linear long polysaccharide chains bound to a protein. The chains are made up of repeating '*dimers* of *aminosugar-uronic acid* - these are referred to as glycosaminoglycans (GAGs).

2. **Glycoproteins**

   Glycoproteins, i.e. proteins **glycosylated'** in various places (O– or N– glycosidic bond) by short branched molecules of **oligosaccharides**, unlike proteoglycans, do not contain uronic acids.

3. **Glycolipids**

    Glycolipids, substances of a lipid nature, have one or several "monosaccharide units" in the molecule.

[[Category:FBLT]

This article has been translated from WikiSkripta; ready for the **editor's review**.