

## Not all carbohydrates are created equal

Plants are the main source of carbohydrates for both human food and other commercial uses. They synthesise carbohydrate from carbon dioxide and water (photosynthesis) and use it as an oxidisable fuel (source of energy to the plant), store it for later use as a fuel (for example, starch in potatoes) or convert it into structural material (for example, cellulose). Most animals obtain their carbohydrate by eating plant material directly or indirectly

The monomeric units of carbohydrates are called monosaccharides. When two monosaccharides are condensed together by elimination of a molecule of water, a disaccharide is formed. Together the monosaccharides and the disaccharides are known as the sugars. They are crystalline solids which dissolve readily in water. Polysaccharides are formed when many hexose units are joined. They may be extremely insoluble in water (such as cellulose) or rather soluble (such as glycogen).

The most important monosaccharides are glucose and fructose. Glucose is a white crystalline solid, soluble in water but insoluble in most organic solvents. Glucose is commonly used as a source of energy by plants, animals and bacteria. Animals normally ingest it in the form of starch and sucrose (cane sugar) which are hydrolysed to glucose by enzymes. Mammals do not possess

an enzyme capable of hydrolysing cellulose to glucose, which is why cellulose is useless as a foodstuff. Energy is obtained from glucose by oxidation which occurs in the cell by a sequence of enzyme-catalysed reactions.

Human beings obtain most of their energy from oxidising fat rather than carbohydrates. But the use of carbohydrate can provide a supply of energy during particularly intense muscular activity when oxygen cannot be obtained rapidly enough.

Disaccharides consist of two monosaccharide molecules joined together with the loss of a molecule of water. Naturally occurring disaccharides are maltose, lactose and sucrose. They all have similar physical properties, being white crystalline solids which are soluble in water. Polysaccharides are polymers, made up of monosaccharide units, which occur in both animals and plants. The two most widely occurring polysaccharides are starch and cellulose. Starch is the main carbohydrate reserve of plants. It is also an important ingredient of animal foods since it provides a source of glucose; it is hydrolysed to glucose by enzymes in saliva. Cellulose is the principal constituent of the cell walls of plants.

(From: Norman-Waddington, *Modern Organic Chemistry*, Bell & Hyman)

1

Answer these questions about Not all carbohydrates are created equal.

- Where do we get the carbohydrates we need from?
- What do plants synthesise carbohydrates from?
- How do animals get the carbohydrate they need?
- What are monosaccharides?
- When is a disaccharide formed?
- What are sugars like?
- When are polysaccharides formed?
- What are the physical properties of glucose?
- How is energy obtained from glucose?
- What are the naturally occurring disaccharides?
- What is the nutritive value of starch?
- Where is cellulose found?

**2** Use these words to complete the concise summary of Not all carbohydrates are created equal: bloodstream, disaccharides, enzyme, glucose, molecular size, monosaccharides, photosynthesis, polymers, polysaccharides, starch.

Carbohydrates are formed in plants by the process of (1) ..... from carbon dioxide, water and sun energy. Carbohydrates are placed in one of the three classes, depending on their (2) ..... (3) ....., like glucose and fructose, are the simplest monomeric units and are the building blocks of (4) ....., like sucrose, which contain two monosaccharide units, and of (5) ....., like cellulose, starch and glycogen, which are (6) ..... of monosaccharides. Since we lack the necessary (7) ....., we cannot digest cellulose, therefore we must rely partly on (8) ..... as a source of glucose. Starch is broken down by amylase, an enzyme present in saliva and pancreatic juice, into (9) ..... which is then absorbed into the (10) .....

**3** Match adjectives a-h, as they are used in the passage Not all carbohydrates are created equal, with their synonyms 1-8. Tip: copy the pairs in your indexed book.

- |               |                          |              |
|---------------|--------------------------|--------------|
| a. empirical  | <input type="checkbox"/> | 1. able      |
| b. several    | <input type="checkbox"/> | 2. analogous |
| c. convenient | <input type="checkbox"/> | 3. numerous  |
| d. main       | <input type="checkbox"/> | 4. practical |
| e. capable    | <input type="checkbox"/> | 5. principal |
| f. useless    | <input type="checkbox"/> | 6. strong    |
| g. intense    | <input type="checkbox"/> | 7. unusable  |
| h. similar    | <input type="checkbox"/> | 8. useful    |

**4** Tick among the following which are the pros and which are the cons of simple sugars in the diet. Add any more you can think of.

	PROS	CONS
a. are a sweet treat	<input type="checkbox"/>	<input type="checkbox"/>
b. boost blood triglycerides	<input type="checkbox"/>	<input type="checkbox"/>
c. cause tooth decay	<input type="checkbox"/>	<input type="checkbox"/>
d. give quick energy	<input type="checkbox"/>	<input type="checkbox"/>
e. if not burned as energy, they accumulate as fat	<input type="checkbox"/>	<input type="checkbox"/>
f. increase blood glucose levels	<input type="checkbox"/>	<input type="checkbox"/>
g. make food tasty	<input type="checkbox"/>	<input type="checkbox"/>
h. weaken the immune system	<input type="checkbox"/>	<input type="checkbox"/>
i. ....	<input type="checkbox"/>	<input type="checkbox"/>
j. ....	<input type="checkbox"/>	<input type="checkbox"/>