

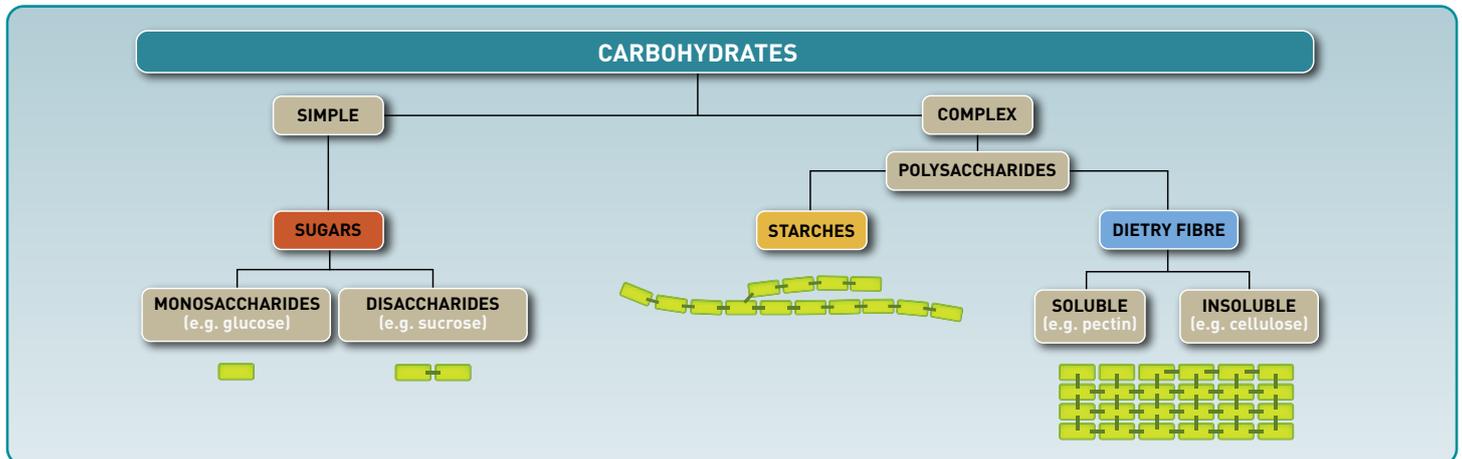
Carbohydrates in Pet Food: sugars, starches and dietary fibre

People often use the terms 'Carbohydrates' or 'Carbs' when they are probably referring to starches! This is not a correct use of the term because starches are only one type of carbohydrates. Sugars, starches and dietary fibres (including prebiotics) are all different types of carbohydrates with different roles in the body of animals. Carbohydrates are one of the three categories of macro-nutrients (along with proteins and fats) in the diet of animals. Carbohydrates are important because they are the main source of energy as well as components of other molecules like DNA.

The image below shows what carbohydrates category includes and how small or big the molecules are.



Basic classification and illustration of carbohydrates



Structure of carbohydrates

Carbohydrates are molecules made from just three elements: carbon, hydrogen and oxygen. The smallest and simplest form of carbohydrates are sugars which are also called Monosaccharides (e.g. glucose) and disaccharides (e.g. sucrose). Other carbohydrate molecules are much larger and include polysaccharides such as starch and dietary fibre.

Sugars

• Monosaccharides

Glucose is the most important fuel (source of energy) in animal cells but it is rarely available in nature. When enzymes break down the larger macro-nutrients in the body, glucose becomes available. Its small size and character allows it to pass through the cell membrane and release energy when metabolised. Other examples of monosaccharides include fructose (also known as fruit sugar) and galactose (a component of the disaccharide, lactose, also known as milk sugar).

• Disaccharides

Most available sugars found in nature are disaccharides. They are made of two monosaccharides that are joined together. Examples are sucrose, lactose and maltose. If a cat or a dog has reduced levels of the specific enzyme to break down disaccharides, they may show signs of sensitivity and intolerance towards food containing it¹.

Starches

As shown in the above illustration, long chains of monosaccharides can form polysaccharides (starch and fibre). Starch is often produced in plant cells as a way of storing energy. Cats and dogs have the enzymes to break them down into smaller molecules, which can then produce energy for their cells.

Can dogs digest cooked starch?

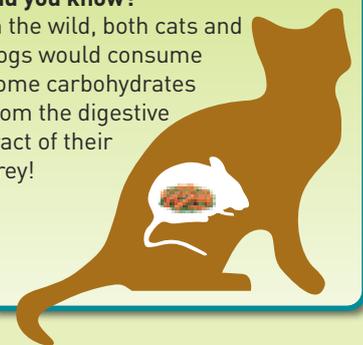
Despite the perception held by some that dogs should eat the same food as wolves, studies have shown they can digest cooked starch. A genome study of dogs and wolves, published in Nature journal in 2013 showed that dogs have genes enabling them to digest cooked starch². The study looked into genomes of 14 different breeds of dogs and compared them to genomes of wolves and indicated that dogs have the ability to digest starches and break them down into sugars as available source of energy. This evolutionary change has occurred in the past 10,000 years of humans farming crops and domesticating dogs, resulting in both humans³ and dogs being able to eat starch.

How about cats?

While cats don't have an absolute requirement for starches, they are able to utilize them as an energy source. Manufacturers of cat food use those carbohydrates that are easily and rapidly broken down in the digestive tract of the cats. This includes the starchy portion of plants such as rice, wheat, corn and barley which are easily digested by cats when cooked.⁴ It is however important to remember cats need a much higher level of protein and fat to remain healthy, compared to dogs.

Did you know?

In the wild, both cats and dogs would consume some carbohydrates from the digestive tract of their prey!



Carbohydrates in Pet Food: sugars, starches and dietary fibre



Dietary Fibre

Dietary fibre is a general term for the edible parts of plants that are resistant to digestion. Like the human, cats and dogs lack enzymes to break down dietary fibre⁵. Dietary fibre has many health benefits for dogs and cats. There are different classifications of dietary fibre⁶, one of which is based on their solubility in water:

- Soluble fibre, which dissolves in water and is fermented in the colon has many benefits for cats and dogs. It keeps the digestive tract healthy by stimulating beneficial bacteria and increased viscosity. Soluble fibre can be found in different quantities in cereals, fruits and vegetables.
- Insoluble fibre, which does not dissolve in water, can be metabolically inert, but may also contain some prebiotic fibre which ferments in the large intestine. Insoluble fibre absorbs water as it moves through the digestive system, providing bulking and easing defecation and improving faecal consistency. Insoluble fibre is not a source of energy for cats and dogs and therefore will not contribute to weight gain. That's why it is used in specially formulated 'light' diets to provide satiety without contributing energy. Insoluble fibre can be found in high concentration in whole grains and fruit skin.

➤ For other pet food and nutrition topics please see www.pfma.org.uk/fact-sheets

¹ Wills, J., and R. Harvey. "Diagnosis and management of food allergy and intolerance in dogs and cats." *Australian veterinary journal* 71.10 (1994): 322-326.

² Axelsson, Erik, et al. "The genomic signature of dog domestication reveals adaptation to a starch-rich diet." *Nature* 495.7441 (2013): 360-364.

³ Perry, George H., et al. "Diet and the evolution of human amylase gene copy number variation." *Nature genetics* 39.10 (2007): 1256-1260.

⁴ De-Oliveira, L. D., et al. "Effects of six carbohydrate sources on diet digestibility and postprandial glucose and insulin responses in cats." *Journal of animal science* 86.9 (2008): 2237-2246.

⁵ Please note some dietary fibre (whether soluble or insoluble) may be fermentable in the digestive tract and release small amounts of energy

⁶ For more information on classification of dietary fibre please visit our website www.pfma.org.uk/carbohydrate-factsheet

Sources of Carbohydrates

It is important to note that most plant based foods will have a combination of different carbohydrates (sugar, starch and dietary fibre) in different amounts. For example:

	Wheat	Oats	dried peas	unmolassed sugar beet pulp
moisture %	15	14	14	10
starch %	60	38	44	4
sugars %	2.5	1.5	4	8
soluble dietary fibre %	0.5	2.9	1	19
insoluble dietary fibre %	6	28	17	40

Labelling of carbohydrates in pet food

According to the EU law, it is mandatory to declare quantity of certain nutrients on all pet food labels, but that depends on the species of animal. For cats and dogs the following nutrients must be declared under Analytical Constituents:

- Protein (or Crude Protein)
- Crude fibres
- Fat content (or Crude oils and fats)
- Crude ash (or Incinerated residue or Inorganic matter)

Crude fibre is a measure that is determined by laboratory testing and needs to be on the label. However, it is not an indication of carbohydrate content of the product.

Although labelling of sugars and starches separately is not mandatory, a simple formula will allow you to work out their total:

$$\% \text{ Carbohydrate} = 100 - (\% \text{ protein} + \% \text{ fat} + \% \text{ moisture} + \% \text{ ash})$$

In this formula, If % moisture is not listed on the label, assume it is 10%

