

## Carbohydrates and the glycaemic index

Food provides fuel for our body in the form of fat, protein, carbohydrates and alcohol. Carbohydrates are the body's preferred fuel source. The glycaemic index (GI) is a way to rate carbohydrates according to how quickly they are absorbed and raise the glucose level of the blood. It has replaced classifying carbohydrates as either 'simple' or 'complex'.

Foods that contain carbohydrates include bread, breakfast cereals, rice, pasta, legumes, corn, potato, fruit, milk, yoghurt, sugar, biscuits, cakes and lollies.

### Digesting and absorbing carbohydrates

The digestive system breaks down carbohydrate-containing foods into simple sugars, mainly glucose. For example, both baked beans and soft drink will be broken down to simple sugars in your digestive system. This simple sugar is then carried to each cell via the bloodstream.

The pancreas secretes a hormone called insulin, which helps the glucose to migrate from the blood into the cells. Once inside a cell, the glucose is 'burned' along with oxygen to produce energy. Our muscles, brain and nervous system all rely on glucose as their main fuel to make energy.

The body converts excess glucose from food into another form called glycogen. This is stored inside muscle tissue and the liver, ready to supplement blood sugar levels should they drop between meals or during physical activity.

### The glycaemic index

Carbohydrate-containing foods can be rated on a scale called the glycaemic index (GI). This scale ranks carbohydrate-containing foods based on their effect on blood sugar levels over a period of time – usually two hours. The GI compares carbohydrate-containing foods gram-for-gram of carbohydrate.

Carbohydrate-containing foods are compared with glucose (although sometimes white bread can be used as reference food), which is given a GI score of 100. Carbohydrates that break down quickly during digestion have the highest glycaemic indexes (GI more than 70). These high GI carbohydrates give a 'quick hit'. The blood glucose response is fast and high.

Carbohydrates that break down slowly release glucose gradually into the bloodstream. They have low glycaemic indexes (GI less than 55). The blood glucose response is slower and flatter.

### Choosing between high and low GI foods

Which carbohydrate foods are best to eat? That depends on the situation. For example, the rate at which porridge and cornflakes are broken down to glucose is different. People with type 2 diabetes, or impaired glucose tolerance, have become resistant to the action of insulin or cannot produce insulin rapidly enough to match the release of glucose into the blood after eating carbohydrate-containing foods. This means their blood glucose levels may rise above the normal level.

Porridge is digested to simple sugars much more slowly than cornflakes so the body has a chance to respond with production of insulin and the rise in blood glucose levels is less. For this reason, porridge is a better choice of breakfast cereal than cornflakes for people with type 2 diabetes. It will also provide more sustained energy for other people as well.

### How much you eat is also important

The amount of the carbohydrate-containing food you eat will also affect your blood glucose levels. For example, even though pasta has a low GI, it is not advisable for people with diabetes or impaired glucose tolerance to have a large serve. This is because the total amount of carbohydrate, and therefore the kilojoules, will be too high.

The glycaemic load (GL) is a concept that builds on GI as it takes into account both the GI of the food and the amount of carbohydrate in a portion. GL is based on the idea that a high GI food consumed in small quantities would give the same effect on blood glucose levels as larger quantities of a low GI food. GL is easily calculated by multiplying the GI by the number of grams of carbohydrate in a serving of food.

### **GI and exercise**

Eating low GI foods two hours before endurance events, such as long distance running, may improve exercise capacity. It is thought that the meal will have left your stomach before you start the event but remains in your small intestine releasing energy for a few hours afterwards. On the other hand, high GI foods are recommended during the first 24 hours of recovery after an event to rapidly replenish muscle fuel stores (glycogen).

### **High GI foods are influenced by low GI foods**

Generally, eating low GI foods slows down the absorption of glucose from any high GI foods eaten at the same time. This is important, as most foods are eaten as part of a meal and this affects the GI value of foods. For example, eating cornflakes (a higher GI food) with milk (a lower GI food) will reduce the effect on blood sugar levels.

If a person with diabetes experiences a 'hypo', where the blood glucose levels fall below the normal range of 3.5–8mmol/L, they need to eat carbohydrate-containing foods (preferably those with a high GI) to restore their blood sugar levels to normal quickly. For example, eating five jellybeans will help to raise blood glucose levels quickly.

### **GI scale examples**

Some examples of the GI rating of various carbohydrates include:

- **Low GI (less than 55)** – soy products, beans, fruit, milk, pasta, grainy bread, porridge and lentils.
- **Medium GI (55 to 70)** – sugar, orange juice, basmati rice and wholemeal bread.
- **High GI (greater than 70)** – potatoes, white bread and long-grain rice.

### **Factors that affect the GI of a food**

Factors such as the size, texture, viscosity (internal friction or 'thickness') and ripeness of a food affect its GI. For instance, an unripe banana may have a GI of 30 while a ripe banana has a GI of 51. Both ripe and unripe bananas have a low GI.

Fat, protein, soluble fibre, fructose (a carbohydrate found in fruit) and lactose (the carbohydrate in milk) also generally lower a food's glycaemic response. Fat and acid foods (like vinegar, lemon juice or acidic fruit) slow the rate at which the stomach empties and so slow the rate of digestion, resulting in a lower GI. Other factors present in food, such as phytates in wholegrain breads and cereals, may also delay a food's absorption and thus lower the GI.

Cooking and processing can also affect the GI – food that is broken down into fine or smaller particles will be more easily absorbed and thus have a higher GI.

### **GI symbol on packaged foods**

A food packaging symbol for comparing the effect of different foods on blood sugar was launched in Australia in July 2002. The GI symbol, **G – Glycemic index tested**, indicates the GI rating of packaged food products in supermarkets. It ranks food products based on the speed at which they break down from carbohydrate to sugar in the bloodstream.

The GI symbol only appears on food products that meet certain nutrient criteria for that food category. High and intermediate GI soft drinks, cordials, syrups, confectionery and sugars are excluded. Jams, honey and other carbohydrate-containing spreads are not necessarily excluded.

### **Using the GI as a guide to healthy eating**

The GI can be used as a guide to healthy eating, as long as you are aware of the limitations. For example, the GI of some fruits, vegetables and cereals can be higher than foods that are considered to be treats, such as biscuits and cakes. This does not mean we should replace fruit, vegetables and cereals with treats, because the former are rich in important nutrients and antioxidants and the latter are not. GI can be a useful concept in making good food substitution choices such as having oats instead of cornflakes, or eating grainy bread instead of white bread.

It is not always possible or necessary to choose all low GI foods. There is room in a healthy diet for moderate to high GI foods and many of these foods can provide important sources of nutrients. If you mix a low GI food with a high GI food, you will get an intermediate GI for that meal.

## Tips for healthy eating

Some practical suggestions include:

- Use a breakfast cereal based on oats, barley and bran.
- Use grainy breads or breads with soy.
- Enjoy all types of fruit and vegetables.
- Eat plenty of salad vegetables with vinaigrette dressing.
- Eat a variety of carbohydrate-containing foods. If the main sources of carbohydrates in your diet are bread and potatoes then try lentils, legumes, pasta, basmati rice and pita breads.

## Expert medical supervision

If you have a medical condition, such as diabetes, it is important to seek the advice of your doctor or specialist before making any changes to your diet.

## Where to get help

- Your doctor
- An accredited practising dietitian (APD) [www.daa.asn.au](http://www.daa.asn.au)
- Nutrition Australia [www.nutritionaustralia.org](http://www.nutritionaustralia.org)

## Things to remember

- The glycaemic index (GI) rates carbohydrates according to how quickly they raise the glucose level of the blood.
- The glycaemic load (GL) rates carbohydrates according to the glycaemic index and the amount of carbohydrate in the food.
- A low GI rating of a food does not mean you can eat a larger serve of that food – the total amount of carbohydrate consumed is still important.
- Choose a diet containing plenty of fruits, vegetables and legumes but with smaller helpings of potatoes and less highly refined grain products and concentrated sugar.

## Want to know more?

For references, related links and support group information, go to More information.

## This page has been produced in consultation with, and approved by:

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