Glycaemic Index

- What is it all about?

Glycaemic Index (GI) is the scientifically proven way of describing how the carbohydrates in foods affect our blood glucose levels.

Carbohydrate foods are those containing starches and sugars and include:

- breads, cereals, grains, pasta and noodles
- starchy vegetables (such as potato, sweet potato, kumera, corn, taro and yam)
- fruits (which contain fructose and glucose)
- milk, yoghurt, custard and ice-cream (which contain lactose)
- refined sugar, honey and other sweeteners.

When we eat foods containing carbohydrates, the carbohydrates are broken down during digestion into glucose, and provide the body with energy. But different carbohydrate foods have different effects on your blood glucose levels. Some carbohydrate foods are quickly digested and absorbed (high GI), while others break down slowly and gradually release glucose into the bloodstream (low GI).

WHAT FACTORS AFFECT THE GI OF A FOOD?

The GI of a food is influenced by many different factors including:

- The type of sugar – for example, fructose, glucose, lactose and maltose all have different GI values
- The type of starch – for example, the proportion of amylose to amylpectin and the gelatinisation of the starch. The more amylose a food contains, the less easily the starch is gelatinised (due to the structure of the glucose molecules) and the slower its rate of digestion. For example, Basmati rice and legumes have a higher proportion of amylose and therefore have a lower GI. Wheat flour and short-grain rice have a higher proportion of amylpectin, which is more easily digested, and therefore have a higher GI.
- The type of fibre – foods high in soluble fibres are more slowly digested than foods high in insoluble fibres. Foods high in soluble fibre include apples, oats and legumes.
- How a food is prepared – processing, cooking, puréeing and grinding all increase the GI of a food by making it more easily digested.
- The presence of fat or protein slows the rate of stomach emptying and therefore slows down starch digestion, as do acids in food (for example, vinegar and lemon juice).

These factors mean that it is very difficult to predict the GI of a food – it really must be tested.

HOW IS THE GI OF A FOOD MEASURED?

The GI ranks foods according to their 'glycaemic' (blood-glucose-raising) potential. It is measured using valid scientific methods and in human subjects (in vivo-testing). It cannot be estimated by looking at the composition of the food, or can it be tested in-vitro (in a test-tube), which explains why we don't see GI on all food labels as we do fat and sugar.

The GI value of a food is determined by feeding 10 or more healthy people a portion of the food containing 50 grams of available carbohydrate and then measuring the effect on their blood glucose levels over the next two hours. For each person, the area under their two-hour blood glucose response (glucose AUC) graph for this test food is then measured. On another occasion, the same 10 people consume an equal-carbohydrate portion of glucose (the standard food), and their two-hour blood glucose response is also measured.

A GI value for the test food is calculated for each person by dividing their glucose AUC for the test food by their glucose AUC for the standard food. The final GI value of the food is the average GI for the 10 people. Having a standard food (glucose) and 10 people testing each food reduces the influence of individual variations in the glucose response. For example, in the diagram below, the area under the curve for lentils is 30% of that for glucose, so lentils have a GI value of 30.

GI values for approximately 1500 foods and beverages have now been determined and are widely available in books and on the web (see www.glycemicindex.com)

WHY SHOULD I CHOOSE LOW-GI CARBS?

There is a growing body of evidence supporting the health benefits of a low-GI diet, particularly in chronic diseases associated with obesity and insulin resistance (Jenkins et al, 2002). Many studies have focused on the benefits of low-GI diets for people with diabetes, and a meta-analysis of 14 studies involving 356 subjects with type-1 and type-2 diabetes found that low-GI diets can improve blood glucose control to a similar extent to that seen with medications which target post-meal blood glucose levels (Brand-Miller et al, 2003).

Low-GI diets have also been associated with:

- a reduced risk of cardiovascular disease (Liu et al, 2000)
- a reduced risk of type-2 diabetes (Salmeron et al, 1997a; Salmeron 1997b)
- shorter hospital stays in CVD patients (Pate et al, 2004)
- a reduction in LDL cholesterol in people with diabetes (Opperman et al, 2004)
- Higher rates of fat burning during exercise (Stevenson et al, 2006)
- A reduced risk of haemorrhagic stroke in women (Oh et al, 2006).

High-GI diets, on the other hand, have been linked to:

- atherosclerotic progression (Mozaffarian et al, 2004)
- a higher risk of prostate cancer (Augustin et al, 2004)
- a worsening of insulin resistance (Brynes et al, 2003)
- high grade liver steatosis (fatty liver) (Valtuena et al, 2006)
- Higher levels of oxidative stress (Hu et al, 2006)
- an increased incidence of metabolic risk factors (Murakami et al, 2006)
- A higher risk of age-related macular degeneration (Chui et al, 2006)
- A higher incidence of the metabolic syndrome (Bexter et al, 2006)

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WHY SHOULD I CHOOSE LOW-GI CARBS?
While more research is still needed, both long-term animal studies and intervention studies in adults and children have shown that weight loss and body-fat loss may be superior on a diet modified to lower GI (Brand-Miller et al. 2002). In fact, a recent study conducted at the University of Sydney and published in the Archives of Internal Medicine in July this year found that of four different diets aimed at weight loss, a high-carbohydrate low-GI diet achieved the best outcomes. Subjects following this diet lost weight and body fat and lowered their levels of LDL cholesterol, while those following a high-protein diet had similar weight and fat loss but increased their cholesterol levels (McMillan-Price et al, 2006)

HOW DO I MAKE THE CHANGE TO A LOW-GI DIET?

Changing to a low-GI diet is not difficult. You don’t need to cut out any foods or food groups, just make better choices. This often means just swapping one food for another, as shown in the table below.

**Substituting low-GI for high-GI foods**

<table>
<thead>
<tr>
<th>High-GI Food</th>
<th>Low-GI Alternative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bread – white or wholemeal</td>
<td>Bread containing lots of grains such as Burgen or 9-grain Multigrain™. Sourdough and pumpernickel breads also have a lower GI</td>
</tr>
<tr>
<td>Processed breakfast cereals</td>
<td>Unrefined cereals such as rolled oats or natural muesli or a low-GI processed cereal like Guardian™ or All Bran™</td>
</tr>
<tr>
<td>Plain biscuits or crackers</td>
<td>Biscuits made with dried fruit, oats and wholegrains, eg., Snackright Fruit Slice™, Highland Oatmeal™ and Ryvita™.</td>
</tr>
<tr>
<td>Cakes and Muffins</td>
<td>Make them with fruit, oats and wholegrains</td>
</tr>
<tr>
<td>Potato</td>
<td>Substitute with baby new potatoes, sweet potatoes and corn</td>
</tr>
<tr>
<td>Rice</td>
<td>Try longer-grain varieties such as Basmati or Doongara rice, or try pearled barley or noodles instead</td>
</tr>
</tbody>
</table>

Start by focusing on the carbohydrate foods that make up a regular part of your diet, and switching these to lower-GI choices. For example, if you eat bread and cereal most days, you could try changing white or wholemeal bread to wholegrain and changing processed breakfast cereals to oats or natural muesli. Or if you are a big rice or potato eater, you could eat more noodles, pasta (choose wholemeal for more fibre and nutrition) or sweet potato instead. Not all food choices need to be low GI – switching just half of the carbohydrate foods you eat in a day from high- to low-GI choices or including one low-GI food at each meal is of benefit.

One thing to keep in mind is that GI should not be used in isolation when making healthy food choices. You may notice that some low-GI foods are high in saturated fat (e.g., chocolates, pizza and potato chips), while some high-GI foods may still be good choices because they are nutritious and relatively low in energy and carbohydrate (e.g., watermelon and pumpkin). So, when applying GI, it should be used to supplement other healthy eating guidelines including eating plenty of fruits, vegetables and wholegrain breads and cereals, eating less saturated fats and limiting foods high in added sugar.

**WHAT IS THE DIFFERENCE BETWEEN GLYCAEMIC INDEX (GI) AND GLYCAEMIC LOAD (GL)?**

The overall effect that a food has on blood glucose levels is dependent on both the nature (GI) of the carbohydrate it contains and the amount. Glycaemic load takes both of these factors into account and is calculated by multiplying the GI of the food by the amount of carbohydrate per serve and then dividing by 100. For example, an apple has a GI of 40 and contains 15 grams of carbohydrate so has a GL of 6 (40 x 15/100).

While foods with high carbohydrate contents and those with higher GI values will generally have the highest GL, it is also true that small amounts of a high-GI food may have only modest effects on blood glucose levels, while large amounts of a low-GI food can still raise blood glucose and insulin levels significantly. What this means in practice, is that there is no need to avoid foods that have a high GI but are low in carbohydrate and are nutrient-dense – a good example of this would be pumpkin. On the other hand, just because a food is low GI, it doesn’t mean you can eat as much as you like, particularly if you are watching your weight or your blood glucose or insulin levels.

**WHERE CAN I FIND OUT MORE?**

Sydney University GI Website www.glycemindex.com
GI Symbol Program www.gisymbol.com.au
Sydney University GI Newsletter http://ginews.blogspot.com/
*The New Glucose Revolution* – Brand-Miller, Foster-Powell and Colaguii
*The Low GI Vegetarian Cookbook* – Brand-Miller, Foster-Powell, Marsh and Sandall (available in NHS Book Shop – see page 70)

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REFERENCES


