

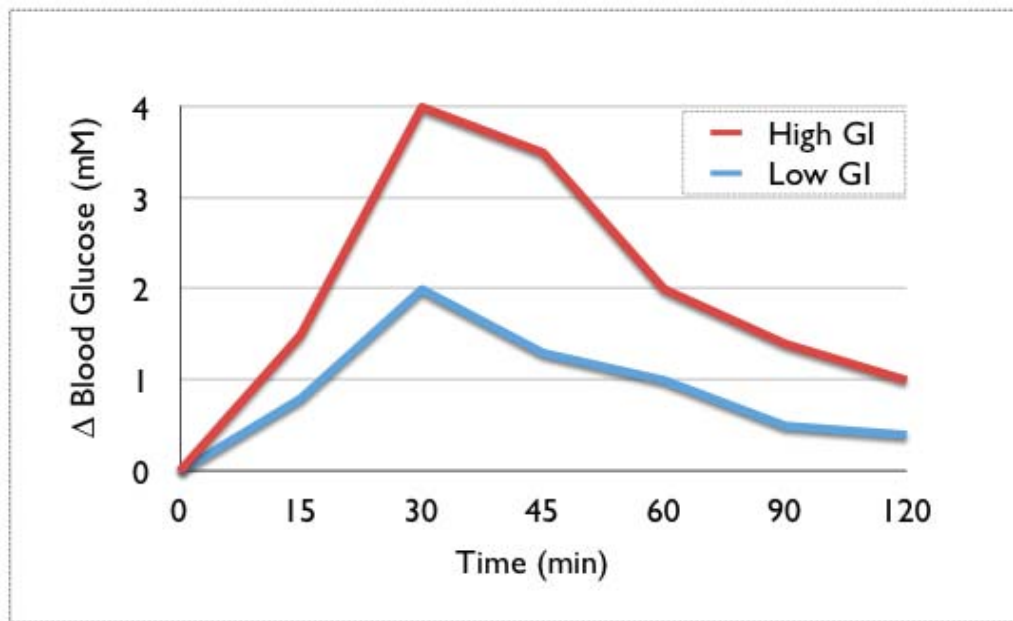
diet
SMART

Understanding the Glycemic index

Glycemic index (also **glycaemic index**, **GI**) is a ranking system for carbohydrates based on their effect on blood glucose levels. It compares available carbohydrates gram for gram in individual foods, providing a numerical, evidence-based index of postprandial (post-meal) glycemia. The concept was invented by Dr. David J. Jenkins and colleagues in 1981 at the University of Toronto.

Carbohydrates that break down rapidly during digestion have the highest glycemic indices. Carbohydrates that break down slowly, releasing glucose gradually into the blood stream, have a low glycemic index. A lower glycemic index suggests slower rates of digestion and absorption of the sugars and starches in the foods and may also indicate greater extraction from the liver and periphery of the products of carbohydrate digestion. A lower glycemic response is often thought to equate to a lower insulin demand, better long-term blood glucose control and a reduction in blood lipids. The insulin index may therefore also be useful as it provides a direct measure of the insulin response to a food.

The glycemic index of a food is defined by the area under the two hour blood glucose response curve (AUC) following the ingestion of a fixed portion of carbohydrate (usually 50 g). The AUC of the test food is divided by the AUC of the standard (either glucose or white bread, giving two different definitions) and multiplied by 100.



The effect on blood glucose from a high versus low glycemic index carbohydrate

The average GI value is calculated from data collected in 10 human subjects. Both the standard and test food must contain an equal amount of available carbohydrate. The result gives a relative ranking for each tested food.

The current validated methods use glucose as the reference food, giving it a glycemic index value of 100 by definition. This has the advantages in that it is universal and it results in maximum GI values of approximately 100. White bread can also be used as a reference food, giving a different set of GI values (if white bread = 100, then

glucose \approx 140). For people whose staple carbohydrate source is white bread, this has the advantage of conveying directly whether replacement of the dietary staple with a different food would result in faster or slower blood glucose response. The disadvantages with this system are that the reference food is not well-defined, and the GI scale is culture dependent.

Glycemic index of foods

GI values can be interpreted intuitively as percentages on an absolute scale and are commonly interpreted as follows:

| Classification | GI range | <u>Examples</u> |
|-----------------------|-------------------|---|
| Low GI | 55 or less | most fruit and vegetables (except potatoes, watermelon and sweet corn), wholegrains, beans, lentils |
| Medium GI | 56 - 69 | sucrose, croissant, basmati rice, brown rice |
| High GI | 70 or more | corn flakes, baked potato, some white rices (e.g. jasmine), white bread, pasta, candy bar |

A low GI food will release glucose more slowly and steadily. A high GI food causes a more rapid rise in blood glucose levels and is suitable

for energy recovery after endurance exercise or for a person with diabetes experiencing hypoglycemia.

The glycemic effect of foods depends on a number of factors such as the type of starch (amylose vs. amylopectin), physical entrapment of the starch molecules within the food, fat and protein content of the food and organic acids or their salts in the meal – adding vinegar for example, will lower the GI. The presence of fat or soluble dietary fibre can slow the gastric emptying rate thus lowering the GI. Unrefined breads with higher amounts of fiber generally have a lower GI value than white breads. Many brown breads, however, are treated with enzymes to soften the crust, which makes the starch more accessible. This raises the GI, with some brown breads even having GI values over 100.

While adding butter or oil will lower the GI of meal, the GI ranking does not change. That is, with or without additions, there is still a higher blood glucose curve after white bread than after a low GI bread such as pumpernickel.

The glycemic index can only be applied to foods with a reasonable carbohydrate content, as the test relies on subjects consuming enough of the test food to yield about 50 g of available carbohydrate. Many fruits and vegetables (but not potatoes) contain very little carbohydrate per serving, or have very low GI values. This also applies to carrots, which were originally and incorrectly reported as

having a high GI. Alcoholic beverages have been reported to have low GI values, however it should be noted that beer has a moderate GI. Recent studies have shown that the consumption of an alcoholic drink prior to a meal reduces the GI of the meal by approximately 15%.

Many modern diets rely on the Glycemic Index, including the South Beach Diet, Transitions by Market America and NutriSystem Nourish Diet.

Disease prevention

Several lines of recent scientific evidence have shown that individuals who followed a low GI diet over many years were at a significantly lower risk for developing both type 2 diabetes and coronary heart disease than others, but the results obviously depend on the two diets being compared. High blood glucose levels or repeated glycemic "spikes" following a meal may promote these diseases by increasing oxidative damage to the vasculature and also by the direct increase in insulin levels. In the past, post-meal hyperglycemia has been a risk factor mainly associated with diabetes, however more recent evidence shows that postprandial hyperglycemia presents an increased risk for atherosclerosis in the non-diabetic population.

On the other hand, there are regions such as Peru and Asia, where people eat high-glycemic index foods such as potatoes and rice, but without a high level of obesity or diabetes. The high consumption of legumes in South America and fresh fruit and vegetables in Asia

likely has a lowering glycemic effect in these individuals. The mixing of high and low GI carbohydrates produces moderate GI values.

The glycemic index is supported by leading international health organizations including the American Diabetes Association.

Weight control

Recent animal research provides compelling evidence that high GI carbohydrate is associated with increased risk of obesity. In human trials, it is typically difficult to separate the effects from GI and other potentially confounding factors such as fibre content, palatability, and compliance. In the study (Pawlak et al, 2004), male rats were split into high and low GI groups over 18 weeks while mean bodyweight was maintained. Rats fed the high GI diet were 71% fatter and had 8% less lean body mass than the low GI group. Postmeal glycemia and insulin levels were significantly higher and plasma triglycerides were threefold greater in the high GI fed rats. Furthermore, pancreatic isletcells suffered "severely disorganised architecture and extensive fibrosis". The evidence in this study showed that continued consumption of high glycemic index carbohydrates would likely have led to the development of severe metabolic abnormalities..

Endurance athletes

Endurance athletes such as ultra-marathoners and Ironman triathletes have become increasingly aware of the glycemic index of

foods taken before and during training and competition. In the hours before a competition athletes may consume foods with a lower GI value so that energy is released more slowly. During competition, the athlete may try to balance the consumption of high and low glycemic index foods to maintain constant energy levels and avoid "energy spikes".

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