



Basic Health Info

Glycemic Index and Glycemic Load

By Chet Zelasko, PhD

Carbohydrates are plentiful in our food supply, and we love them. We love them so much that our carbohydrate intake can make up over half the calories we get every day and in some cases, much more. The problem isn't so much the foods that contain carbohydrates such as grains, dairy, vegetables, and fruits—it's that we refine them in such a way that they enter the bloodstream rapidly. This causes problems for some people who are hypoglycemic or diabetic and can contribute to an increase in triglycerides over time.

Glycemic Index

Scientists have come up with a way to assess how rapidly carbohydrates will enter the bloodstream; it's called the glycemic index (GI). The GI is a scale (0 to 100) that ranks carbohydrates by how much they raise blood glucose (blood sugar) levels compared to a reference food: glucose, one-half of the molecule that makes up table sugar, with a GI of 100. Foods with a high GI are rapidly digested and absorbed and as a result, can cause extremes in blood sugar levels. High-GI foods raise blood sugar rapidly, stimulating a rapid rise in blood insulin. While it doesn't happen to everyone, it can then cause a rapid decline in blood sugar, sometimes called a crash—see Figure 1. On the other hand, low-GI foods are digested and absorbed slowly, resulting in a gradual rise and gradual decline in blood sugar and insulin levels.

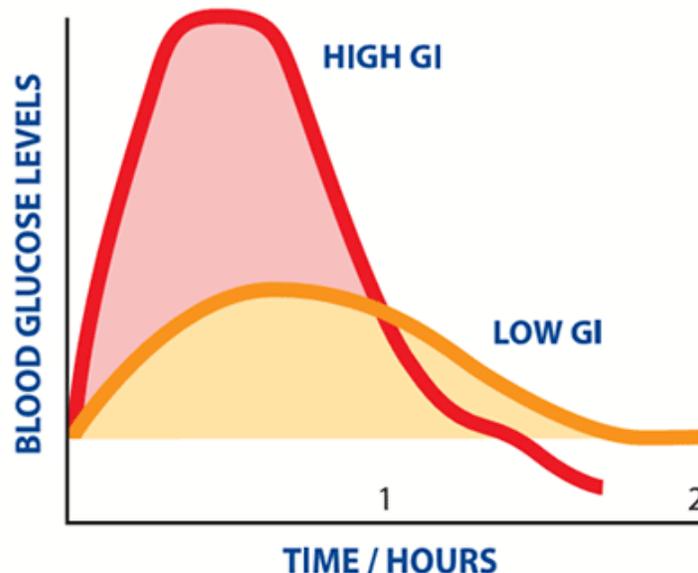


Illustration from www.glycemicindex.com

Diets that maintain a low GI can improve both glucose and lipid levels in people with both type 1 and type 2 diabetes. They have benefits for weight control because they help control appetite and delay hunger. Low-GI diets also reduce insulin levels and insulin resistance.

Discovering the GI of foods is generally done under laboratory conditions. The process starts with a group of volunteers, usually 8–10 adults, taking a specific amount of glucose in a solution; 25 or 50 grams of glucose is the solution that's normally used. Then blood samples are taken to measure blood glucose according to this schedule.

1st hour:	Every 15 minutes
2nd hour:	Every 30 minutes
3rd hour:	Every 30 minutes, but only in diabetics

The values are then plotted on a graph and the area under the curve is calculated.

The process is repeated on another day with the test food, let's say an apple or Almond Joy candy bar. The critical factor is that the amount of carbohydrates in the food must match that used in the glucose test, whether 25 or 50 grams. Blood sugar samples taken at the same times as for the glucose-solution test are plotted and compared to the glucose curve. Let's say that the area under the curve for the apple is 38% that of the glucose. The percentage is converted to a whole number by multiplying by 100 and the GI is assigned. An apple has a GI of 38, a low GI. The following chart shows the GI ranking.

Glycemic Index (GI): Ranking

Low	0 – 55
Moderate	56 – 69
High	70 or more

There's a list of the GIs for commonly eaten foods at the end of this article.

Glycemic Load

With the GI scale in mind, it's easy to select foods that would affect blood sugar the least and eat only those types of carbohydrates. However, there's a complicating factor. What we eat with the carbohydrates may influence how fast it's digested and absorbed when the foods are combined in the digestive system; the effect on blood sugar is called the glycemic load (GL).

Why another scale? Because there are factors that influence the digestion and absorption rate. Here are several of those reasons from a presentation by Johanna Burani, a registered dietician at the American Diabetes Association Southern Regional Conference in May 2006. The explanations are mine.

1. Type of starch: amylose versus amylopectin content

Simply put, foods higher in amylose slow down the rate of carbohydrate absorption while those higher in amylopectin increase the rate of absorption. Foods that are higher in amylose are whole grains, beans and other legumes, long-grain rice, and bananas. Foods higher in amylopectin are white potatoes and glutinous rice. For those of you who cook, Arborio rice, used in making risotto, is high in amylopectin; that's what creates the creaminess along with some texture. Regular rice would release too much starch and become mushy.

2. Physical entrapment

This concept applies to whole grains. In wheat, for example, the bran encapsulates the starch portion; because it takes time for the digestive system to break down the bran, using the whole grain reduces the speed of the carbohydrate absorption. Wheat bread isn't necessarily whole-grain bread—you must check the label. One easy way is to look for the 100% Whole Grain Stamp, administered by the Whole Grains Council; for best results, be sure it says 100%.



3. **Viscosity of fiber**

Soluble fiber absorbs water quickly and forms a gel-like consistency. In effect, it surrounds the starches and sugars, preventing enzymes from breaking them down too quickly. Foods such as apples and rolled oats have more soluble fiber than whole-wheat bread or cereals such as Cheerios.

4. **Sugar content**

The type of sugar can impact the absorption. Cereals with sucrose, a combination of one glucose molecule and one fructose molecule, actually have a lower GI than cereals with a modified starch such as maltose, which has two glucose molecules.

5. **Fat and protein content**

From a candy bar to a sandwich, adding protein and fat slow down the rate at which carbohydrates are absorbed. Peanut M&Ms have a lower GI than jelly beans, which are almost 100% sugar.

6. **Acid content of food**

Acidic food slows down the rate of absorption as well because acid slows the rate that food leaves the stomach.

7. **Food processing**

The more you refine carbohydrates, the closer to sugar it's going to be—and thus, easier to absorb.

8. **Cooking**

The process of cooking a food swells up starch molecules, making them easier to digest and absorb. Pasta cooked al dente has a lower GI than pasta cooked longer.

Those are the factors that can affect the GI of foods and are part of the reason for the development of the glycemic load. The GL measures the degree of glycemic response and insulin demand produced by a specific amount of a specific food.

Glycemic load reflects both the quality and the quantity of dietary carbohydrates. The quality is calculated by dividing the GI of a carbohydrate by 100. Then to reflect the quantity, the quotient is multiplied by the number of grams of carbohydrate per serving.

Here's the formula:

$$\text{GL} = \frac{\text{GI}}{100} \times \text{grams of carbohydrate per serving}$$

To give you an idea of how the GL works, here are two examples comparing whole-grain bread with white bread.

Whole-grain bread: The GI is 69 and the grams of carbohydrates per serving are 14 grams. Doing the math shows that the GL is 9.

White bread: The GI of Italian white bread is 89 and the grams of carbohydrates per serving is 20. Again, doing the math reveals that the GL is higher at 18. That means that twice as much carbohydrate is entering the bloodstream with Italian white bread compared to whole-grain bread.

Benefits

The question: are there any benefits to using the GI and GL in trying to reduce your blood glucose level? The answer is an unqualified yes. The obvious is that you'll reduce your blood sugar level and that's beneficial in reducing your risk of type 2 diabetes—but that's not all. Research has shown that triglycerides will go down, which results in lower cholesterol levels, and that reduces the risk of heart disease. Another benefit: people who follow a low-GI diet are able to lose weight faster and lose more of it. There seems to be little question that the GI and GL have health benefits providing you don't overeat.

The Bottom Line

For some people the GI and GL are just more calculations with more charts to review, and you have to keep track of it to see where you stand during the day. If you had trouble keeping track of calories, how is this going to work?

Don't think of it that way. Once you've looked up a food or foods, you'll know whether it's low or high GI—you don't have to look it up over and over. I think that if you consistently make your selection from foods with lower GI or combine foods that have a lower GL, it will help you lose weight and get healthier without too much extra effort; put the effort in the front end and reap the benefits throughout your entire body.

References:

1. www.glycemicindex.com
2. Johanna Burani, Practical Use of the GI. 2006

Dr. Chet Zelasko is dedicated to helping men and women get healthy and fit. As a health and fitness consultant with a PhD in Exercise Physiology and Health Education from Michigan State University, he provides health information based on the most recent research and delivers it in a way that's easy to understand. Whether in person during seminars, in audio recordings, or in the written word, he makes sense out of the health news people hear so they can make better health choices and achieve optimal health. He's conducted research and been published in peer-reviewed journals. He is certified by the American College of Sports Medicine as a Health and Fitness Specialist and has taught in ACSM certification workshops throughout the United States; he also belongs to the American Society of Nutrition. Although Grand Rapids, Michigan, is home, he has presented seminars on health to groups all over North America, Mexico, and the Caribbean and has written extensively on the health benefits of a good diet, regular exercise, and targeted supplementation.

The health information in this Basic Health Info is designed for educational purposes only. It's not a substitute for medical advice from your healthcare provider, and you should not use it to diagnose or treat a health problem or disease. It's designed to motivate you to work toward better health, and that includes seeing your healthcare professional regularly. If what you've read raises any questions or concerns about health problems or possible diseases, talk to your healthcare provider today.

Subscribe to Dr. Chet's email Health Memo and learn more about him on his website: www.drchet.com

Food List

Here are a few examples of foods that are high, moderate, and low in GI:

Low-GI Foods		Medium-GI Foods		High-GI Foods	
Cactus	7	Mangoes	56	PepOmint Life Savers	70
Peanut butter	14	Apricots	57	White bread	71
Most fresh veggies	15	Pita bread, white	57	Watermelon	72
Peanuts	15	Pizza with cheese	60	White rolls	73
Agave nectar	19	Sweet corn	60	Chips	74
Cashews	33	Honey	61	Saltines	74
Cherries	22	Ice cream	61	Doughnut	76
Grapefruit	25	Bananas	62	Waffles	76
Diet soda	26	Coca Cola	63	Choc-chip granola bar	78
Whole milk & cheese	27	Brown sugar	64	Water crackers	78
Apricots (dried)	31	Mars Bar	64	Instant oatmeal	79
Fat-free milk	32	Raisins	64	Jelly beans	80
M&Ms (peanut)	32	Rye-flour bread	64	Rice cake	82
Chickpeas	33	Table sugar	64	Pretzels	83
Tomato juice	33	Cantaloupe	65	Potato, instant	83
Soy milk	34	Pineapple	66	Potato, baked	85
Apples	38	Angel food cake	67	Rice milk	86
Pears	38	Croissant	67	Italian white bread	89
Carrots, cooked	39	Pancakes	67	Rice cracker	91
Plums	39	Chocolate ice cream	68	Corn flakes	92
Snickers Bar	40	Shredded wheat	69	Parsnips	97
Apple juice	41	Whole-grain bread	69	Dates	103
Peaches	42			Tofu-based frozen dessert, chocolate with high-fructose corn syrup	115
White rice	43				
Oranges	44				
Carrot juice	45				
Pineapple juice	46				
Grapes	46				
Grapefruit juice	48				
Multi-grain bread	48				
Chocolate bar	49				
Jams & marmalades	49				
Low-fat ice cream	50				
Yam	51				
Orange juice	52				
Sweet corn	52				
Kiwi fruit	53				
Maple syrup	54				
Pound cake	54				
Sweet potato	54				
Fruit cocktail	55				
Popcorn	55				

Glycemic Index (GI): Ranking

Low	0 – 55
Moderate	56 – 69
High	70 or more