Glycemic Index

Emerging research shows that not all calories are processed in the same way. In particular, the quantity and quality of carbohydrates consumed affects insulin release, hunger, and fat storage. Glycemic index (GI) is an objective way of measuring this effect. This Integrative Health tool defines glycemic index and glycemic load and explains how they can be used. Resources for gathering more information are provided below.

What Is Glycemic Index?

The glycemic index of a food refers to the effect the food has on the body's blood sugar levels. Blood sugar levels are raised after a person eats foods containing carbohydrates (sugars and starches). Various carbohydrate-containing foods affect blood sugar levels differently. This is a function of the type and quantity of carbohydrate, as well as the method of preparation and the presence of other substances in the food, such as soluble fiber, fat, and protein. For example, your body absorbs glucose from whole fruit differently from extracted fruit juice due to the fiber content.

The glycemic index compares the rise in blood sugar level after eating a particular food to a reference food, often glucose. Glucose has a GI of 100. The GI of fructose is 25 and sucrose, which is a blend of the previous two, has a GI of 65. Most natural sweeteners are a combination of these three carbohydrates. Figure 1 shows the difference between a low GI and a high GI food in terms of effects on blood glucose levels over time.

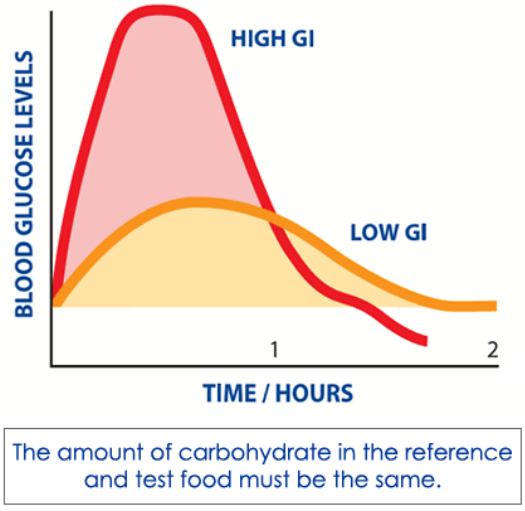

Figure 1 A Comparison of Blood Glucose over Time for High and Low GI Foods

What Is Glycemic Load?

The glycemic load (GL) is a more accurate tool for assessing the impact of eating carbohydrates. It gives a more complete picture than does glycemic index alone, because it accounts for the amount of carbohydrate in a serving. A GI value indicates only how rapidly a particular carbohydrate turns into sugar, whereas GL accounts for how much of that carbohydrate a person would typically eat. The carbohydrate in watermelon, for example, has a high GI. However, there is not a lot of sugar in a serving of watermelon, since most of it is fiber and water. Thus watermelon's glycemic load is relatively low.

Foods that have a low GL almost always have a low GI. In contrast, foods with an intermediate or high GL can have a GI that ranges from very low to very high.

Why Are These Numbers Important?

A low glycemic index diet has been associated with improvements in:

- Obesity[1-3]
- Type 2 Diabetes[3-6]
- Gestational Diabetes[7]
- Metabolic Syndrome[8]
- PCOS[9]
- NAFLD[10]
- Dyslipidemia[11]
- Hypoglycemia[4]

Conversely, diets with high glycemic index or glycemic load are strongly associated with type 2 diabetes incidence.[12] Dietary glycemic index is also positively associated with the prevalence of metabolic syndrome, though according to one review, a significant association between dietary glycemic load and metabolic syndrome has not yet been found.[13]

Examples of GIs for common foods are listed in Table 1.

Table 1. Average Glycemic Index of Common Foods [14]

Food Item	Glycemic Index	Food Item	Glycemic Index
White Bread	75	Pineapple	66
Corn Tortilla	46	Orange	43
Bagel	72	Mango	51
Baked Potato	85	Pear	33
Wheat Bread	74	Apple	36
White Rice	87	Banana	51
Pasta	49	Watermelon	76
Sweet Potato	54	Grapes	46

Food Item	Glycemic Index	Food Item	Glycemic Index
Barley	25	Carrots	39
Brown Rice	55	Corn	52
Oatmeal	61	Peas	51
Couscous	65	Most Vegetables	< 20
Cow's Milk	37	Chickpeas	28
Soy Milk	34	Kidney Beans	24
Rice Milk	86	Black Beans	30
Yogurt	41	Peanuts	7

Resource Links

- Harvard Health Publications: https://www.health.harvard.edu/diseases-and-conditions/glycemic-index-and-glycemic-load-for-100-foods
- The University of Sydney: http://www.glycemicindex.com/

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References

1. Thomas DE, Elliott EJ, Baur L. Low glycaemic index or low glycaemic load diets for overweight and obesity. *Cochrane Database Syst Rev*. 2007;(3):Cd005105. doi:10.1002/14651858.CD005105.pub2
2. Zafar MI, Mills KE, Zheng J, Peng MM, Ye X, Chen LL. Low glycaemic index diets as an intervention for obesity: a systematic review and meta-analysis. *Obes Rev*. Feb 2019;20(2):290-315. doi:10.1111/obr.12791
3. Zafar MI, Mills KE, Zheng J, et al. Low-glycemic index diets as an intervention for diabetes: a systematic review and meta-analysis. *Am J Clin Nutr*. Oct 1 2019;110(4):891-902. doi:10.1093/ajcn/nqz149
4. Thomas D, Elliott EJ. Low glycaemic index, or low glycaemic load, diets for diabetes mellitus. *Cochrane Database Syst Rev*. 2009;1(1)
5. Ojo O, Ojo OO, Adebowale F, Wang X-H. The effect of dietary glycaemic index on glycaemia in patients with type 2 diabetes: a systematic review and meta-analysis of randomized controlled trials. *Nutrients*. 2018;10(3):373. doi:10.3390/nu10030373

6. Wang Q, Xia W, Zhao Z, Zhang H. Effects comparison between low glycemic index diets and high glycemic index diets on HbA1c and fructosamine for patients with diabetes: A systematic review and meta-analysis. *Prim Care Diabetes*. Oct 2015;9(5):362-9. doi:10.1016/j.pcd.2014.10.008
7. Tieu J, Crowther CA, Middleton P. Dietary advice in pregnancy for preventing gestational diabetes mellitus. *Cochrane Database Syst Rev*. 2008;(2):Cd006674. doi:10.1002/14651858.CD006674.pub2
8. Schiltz B, Minich DM, Lerman RH, Lamb JJ, Tripp ML, Bland JS. A science-based, clinically tested dietary approach for the metabolic syndrome. *Metab Syndr Relat Disord*. Jun 2009;7(3):187-92. doi:10.1089/met.2008.0051
9. Moran LJ, Ko H, Misso M, et al. Dietary composition in the treatment of polycystic ovary syndrome: a systematic review to inform evidence-based guidelines. *J Acad Nutr Diet*. Apr 2013;113(4):520-45. doi:10.1016/j.jand.2012.11.018
10. Zivkovic AM, German JB, Sanyal AJ. Comparative review of diets for the metabolic syndrome: implications for nonalcoholic fatty liver disease. *Am J Clin Nutr*. Aug 2007;86(2):285-300.
11. Goff LM, Cowland DE, Hooper L, Frost GS. Low glycaemic index diets and blood lipids: a systematic review and meta-analysis of randomised controlled trials. *Nutr Metab Cardiovasc Dis*. Jan 2013;23(1):1-10. doi:10.1016/j.numecd.2012.06.002
12. Livesey G, Taylor R, Livesey HF, et al. Dietary glycemic index and load and the risk of type 2 diabetes: a systematic review and updated meta-analyses of prospective cohort studies. *Nutrients*. Jun 5 2019;11(6)doi:10.3390/nu11061280
13. Zhang JY, Jiang YT, Liu YS, Chang Q, Zhao YH, Wu QJ. The association between glycemic index, glycemic load, and metabolic syndrome: a systematic review and dose-response meta-analysis of observational studies. *Eur J Nutr*. Mar 2020;59(2):451-463. doi:10.1007/s00394-019-02124-z
14. Atkinson FS, Foster-Powell K, Brand-Miller JC. International tables of glycemic index and glycemic load values: 2008. *Diabetes Care*. Dec 2008;31(12):2281-3. doi:10.2337/dc08-1239