

**Glycemic Index, Glycemic Load and Glycemic Response:
An International Scientific Consensus Summit
Stresa, Italy • June 7th, 2013**

An international panel of experts has formed the “International Carbohydrate Quality Consortium (ICQC)” which met in Stresa on June 6-7, 2013 and discussed the importance of carbohydrate quality and quantity.

Scientific Consensus Statement*

1. Carbohydrates present in different foods have distinct physiological effects, including effects on post-prandial glycemia (PPG), also known as the glycemic response¹, with different implications for health.
2. Reducing PPG is recognized as a beneficial physiological effect (Ceriello and Colagiuri 2008, Levitan et al. 2004, Coutinho et al. 1999, EFSA 2011)
3. Ways to reduce PPG include slowing carbohydrate absorption by consuming low glycemic index (GI)² and low glycemic load (GL)³ foods to reduce the dietary GI and GL (Jenkins et al. 1981, Salmeron et al. 1997).
4. The GI methodology is a sufficiently valid and reproducible method for differentiating foods based on their glycemic response (Wolever, 2013, Brouns et al. 2005).
5. The GI quantifies specific physiological properties of carbohydrate-containing foods as influenced by the food matrix. These characteristics extend beyond their chemical composition of food and include delaying gastric emptying and reducing the rate of digestion and small intestinal absorption.
6. When considering the macronutrient composition, the GL/1000kJ (the product of GI and available⁴ carbohydrate content) is the single best predictor of the glycemic response of foods (Bao et al. 2011).
7. There is convincing evidence from meta-analyses of controlled dietary trials that diets low in GI improve glycemic control in people with type 2 and type 1 diabetes (Giacco et al. 2000, Brand-Miller et al 2003, Livesey et al 2008, Thomas and Elliot 2010, Jenkins et al. 2012).

8. There is convincing evidence from meta-analyses of prospective cohort studies that low GI/GL diets reduce the risk of type 2 diabetes (Barclay et al 2008, Livesey et al 2013).
9. There is convincing evidence from a large body of prospective cohort studies that low GI/GL diets reduce the risk of coronary heart disease (Liu et al. 2000, Mirrahimi et al 2012, Fan et al. 2012).
10. The proof of principle for the concept of slowing carbohydrate absorption is the use of alpha-glucosidase inhibitors (acarbose etc.) to reduce progression to type 2 diabetes and coronary heart disease (Chiasson et al. 2002, Chiasson et al. 2003).
11. The quality of carbohydrate rich foods as defined by GI/GL is particularly important for individuals who are sedentary, overweight and at increased risk of type 2 diabetes (Salmeron et al. 1997, Ludwig et al. 2002).
12. Potential mechanisms for reduction of type 2 diabetes include evidence that low GI/GL diets improve insulin sensitivity and beta-cell function in people with type 2 diabetes and those at risk for type 2 diabetes (Rizkalla et al. 2004, Solomon et al. 2011).
13. Potential mechanisms for reduction of coronary heart disease include evidence that low GI/GL diets improve blood lipids and inflammatory markers including C-reactive protein (CRP) (Frost et al. 1999, Liu et al. 2001, Liu et al. 2002, Wolever et al. 2008, Shikany et al. 2010, Goff et al. 2013).
14. Probable evidence exists for low GI/GL diets in reducing total body fat mass and in weight management (Larsen et al. 2010, Murakami et al. 2013, Bouche' et al. 2002, McMillan-Price et al. 2006, Ebbeling et al. 2005).
15. The GI complements other ways of characterizing carbohydrate-foods, such as fiber and whole grain content (Riccardi et al. 2008, Slavin 2008).
16. Low GI and low GL should be considered in the context of a healthy diet.
17. Given the rapid rise in diabetes and obesity there is a need to communicate information on GI/GL to the general public and health professionals.
18. This should be supported by inclusion of GI/GL in dietary guidelines and in food composition tables.

19. In addition package labels and low GI/GL symbols on healthy foods should be considered.

20. More comprehensive high-quality food composition tables need to be developed for GI/GL at the national level.

Footnotes:

- 1. Glycemic response:** is the simple term for the post-prandial blood glucose concentration (PPG) elicited by a food or a meal.

- 2. Glycemic Index (GI):** Conceptually, GI is the glycemic response elicited by a portion of a carbohydrate-rich food containing 50g (or in some cases 25g) available carbohydrate expressed as a percentage of that elicited by 50g (or 25g) glucose. GI is precisely defined by the ISO (International Organization for Standardization) method 26642:2010
(http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=43633)

- 3. Glycemic load (GL):** is the product of GI and the total available carbohydrate content in a given amount of food ($GL = GI \times \text{available carbohydrate/given amount of food}$). Available carbohydrates can have different modes of expression: g per serving, g per 100g food, g per day intake, and g per 1000 kJ or 1000 calories, dependent on the context in which GL is used. Thus GL has corresponding units of g per serving, g per 100 g food, and g per 1000 kJ or 1000 calories.

- 4. Available carbohydrate:** Is the carbohydrate in foods that is digested, absorbed and metabolised as carbohydrate. Available carbohydrate is sometimes referred to as glycemic carbohydrate.

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This International Scientific Consensus Summit was co-organized by the Nutrition Foundation of Italy and Oldways.