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CONSENSUS

Glycemic index, glycemic load and glycemic response: An International Scientific Consensus Summit from the International Carbohydrate Quality Consortium (ICQC)☆

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Abstract *Background and aims:* The positive and negative health effects of dietary carbohydrates are of interest to both researchers and consumers.
Methods: International experts on carbohydrate research held a scientific summit in Stresa, Italy, in June 2013 to discuss controversies surrounding the utility of the glycemic index (GI), glycemic load (GL) and glycemic response (GR).
Results: The outcome was a scientific consensus statement which recognized the importance of postprandial glycemia in overall health, and the GI as a valid and reproducible method of

☆ Based on the meeting "Glycemic Index, Glycemic Load and Glycemic Response: an International Scientific Consensus Summit" held in Stresa (Italy) on June 6–7th, 2013.

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classifying carbohydrate foods for this purpose. There was consensus that diets low in GI and GL were relevant to the prevention and management of diabetes and coronary heart disease, and probably obesity. Moderate to weak associations were observed for selected cancers. The group affirmed that diets low in GI and GL should always be considered in the context of diets otherwise understood as healthy, complementing additional ways of characterizing carbohydrate foods, such as fiber and whole grain content. Diets of low GI and GL were considered particularly important in individuals with insulin resistance.
Conclusions: Given the high prevalence of diabetes and pre-diabetes worldwide and the consistency of the scientific evidence reviewed, the expert panel confirmed an urgent need to communicate information on GI and GL to the general public and health professionals, through channels such as national dietary guidelines, food composition tables and food labels.

Introduction

Dietary carbohydrates have received negative publicity in the last decade following the popularity of high protein diets for weight loss, and the more recent finds that carbohydrates may be 'worse than saturated fats' for cardiovascular disease (CVD) risk [1,2]. These landscape changes have raised questions about the amount and type of carbohydrate to be recommended in healthy diets. Now the majority of carbohydrate-containing foods consumed in industrialized nations are of poor quality (e.g. higher in GI and GL as well as low in dietary fiber and calorie-dense). Generally foods are now of the kind that are quickly digested, absorbed and give rise to high blood glucose and insulin 'spikes'. As overweight, obesity and insulin resistance have become more prevalent, concerns for the amount and type of carbohydrate consumed has increased because of the changed view that carbohydrate nutrition can increase rather than (as originally perceived) only decrease cardiometabolic risk. Thus evidence has supported that some carbohydrate sources can be beneficial, while others are not, depending on both their glycemic index and fiber content [2–6]. Accordingly a meeting was organized in Stresa (Italy) titled "Glycemic Index (GI), Glycemic Load (GL) and Glycemic Response (GR): an International Scientific Consensus Summit". The purpose of the summit was to bring together international experts in the field of carbohydrates, glycemic index, fiber and health in order to present and discuss the issues related to the role of the dietary GI, GL and GR in the prevention and management of chronic diseases. Discussion points addressed areas of agreement, areas of further investigation, and areas that should be communicated to the public.

Over two days and eight sessions, the expert group discussed the relevance of dietary carbohydrates and postprandial glycemia to health, covering historical perspectives, analytical issues, chronic disease, metabolism, body weight, novel health effects, health claims and future research. Two sessions were devoted to food industry concerns. The program specifically addressed the following issues:

- Postprandial glycemia: should it be lowered?
- If yes, how should it be achieved?
- What does the GI measure?
- GI methodology
- Strengths and weakness of the terms GI, GL and GR
- Testing foods, meals or the overall diet
- Simple sugars, fructose and low GI diets
- Different ways of lowering GI and GL
- GI and GL in diabetes prevention and management
- GI and GL in CHD risk
- GI and GL in cancer risk
- GI and GL and satiety
- GI and GL in overweight and obesity
- GI and GL and chronic inflammation
- GI and GL in childhood and adolescence
- GI and GL in different dietary patterns
- Low GI diets in the context of a healthy Mediterranean diet
- The appropriateness of GI in national/international nutrition guidelines
- Consensus: what can we agree upon?
- Looking to the future and planning new research

The outcome of this first international summit was a consensus statement comprising 20 points of agreement that could be utilized by scientists, industry, health agencies and governmental bodies. In addition, the International Carbohydrate Quality Consortium (ICQC) was officially formed with intention to meet on a bi-annual basis both to bring clarity to the controversy surrounding the health effects of carbohydrates and to increase awareness of healthy carbohydrate choices.

Definitions

Basic definitions are given to clarify terminology used at present: GR is the post-prandial blood glucose response (change in concentration) elicited when a food or meal that contains carbohydrate is ingested. Available carbohydrate is the carbohydrate in foods that is digested, absorbed and metabolized as carbohydrate and it is sometimes referred to as net carbohydrate or glycemic carbohydrate (expressed as the monosaccharide equivalent for optimal comparability between carbohydrates) [7]. The GI is conceptually the GR elicited by a portion of food