

# GLYCAEMIC RESPONSE: CURRENT DEVELOPMENTS



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**Glycaemic response refers to the increase in post-prandial (PP) blood glucose after eating food or drink containing available (glycaemic) carbohydrate. Glycaemic response varies for different carbohydrates: compared with rapidly digestible carbohydrates, slowly digestible carbohydrates show a slower and more prolonged increase in blood glucose rising to a lower peak. The health impacts of altering the blood glucose-raising potential of different foods and diets have been the subject of extensive investigation, as have dietary strategies to improve glycaemic control.**

## MEASURING GLYCAEMIC RESPONSE

Glycaemic response can be assessed by the difference in PP concentrations of blood glucose (e.g. the size and time of peak glucose) and difference in the areas under the blood glucose response curve between test and control foods or meals. The idea of classifying carbohydrates according to their glycaemic response was first published in 1981 (1), with development of the glycaemic index (GI). Historically, GI has been the main focus of research, but more recently glycaemic load (GL) and glycaemic glucose equivalents (GGE) have been proposed as alternative and complementary measures. These each give different information and there is currently much discussion about which is the most appropriate communication tool.

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Within the concept of the glycaemic response, GI is one particular measure linking the glycaemic properties of foods with health status. GI represents a measure of the average concentration of glucose in the blood following ingestion of a test food, ingredient or meal usually containing 50g available carbohydrate and usually over a two-hour period. It is expressed relative to a reference food, usually glucose or white bread and hence, by definition, the reference food has a GI of 100 (2). The accuracy of GI measurements has been tested in an inter-laboratory study (3) comparing the GI measurement of two food products across 28 laboratories in a total of 314 subjects. Consistent with previous studies, ethnicity, gender, age and body mass index (BMI) were not related to intra-individual variation in glycaemic response or to GI values in individual subjects. Factors affecting the precision of measurement were the precise method for glucose analysis and subject preparation, e.g. asking subjects to con-

sume a normal meal and to avoid unusual exercise the night before the test.

Measuring GL incorporates the total available carbohydrate in a (variable) food portion in addition to the glycaemic quality of the carbohydrate - factors that both influence PP blood glucose. GGE is a more complex concept that provides a measure of the glycaemic impact of a food expressed as glucose equivalents.

## HEALTH BENEFITS OF LOW GLYCAEMIC FOODS AND DIETS

A recent meta-analysis (4, 5) has shown that many studies investigating lower GI interventions actually tested lower GL interventions. For some outcomes it is uncertain whether the effects can be attributed to changes in the blood glucose, or to other characteristics of low GI/GL diets (e.g. higher fibre, higher protein and lower energy density). It is suggested that changes in unavailable carbohydrate (e.g. dietary fibre), independent of GI, may have at least as big an effect on health outcomes as changes in GI itself.

Nevertheless, taking the above into account, dietary interventions that intended to lower GI/GL have been demonstrated to:

- improve fasting blood glucose in subjects with poorer blood glucose control;
- reduce blood glycated protein concentration, with greater effects in subjects with poorer glycaemic control;
- improve insulin sensitivity in non-diabetics, overweight subjects, obese subjects and patients with Type 2 diabetes, particularly in association with higher unavailable carbohydrate intake;
- reduce fasting insulin in subjects with hyperinsulinaemia;
- reduce fasting triacylglycerols among those with high baseline concentrations.

Higher intakes of unavailable carbohydrate have an additive effect on reducing fasting blood glucose to that of lower GI/GL, such that a combination of these two dietary manipulations achieves optimum effects. Evidence from prospective randomised controlled trials supports the view that lowering the GI of the diet by 10 points has beneficial effects on total and LDL-cholesterol, with larger decreases in LDL-cholesterol reported for longer studies in well-controlled Type 2 diabetics.

With a PhD in dietary fibre, Michèle has worked at the British Nutrition Foundation and IGD, and has worked as a consultant nutritionist since 2000. Michèle works with the food industry and related organisations on issues such as claims, labelling and communications.

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Some short-term studies (one day or less) have suggested that low glycaemic foods or meals might have a higher satiating effect than high-glycaemic foods or meals and, in some studies, lower GI/GL and lower available carbohydrate have been associated with reductions in body weight, though the data is not entirely consistent.

Health benefits of foods with a low post-meal glycaemic response have been under scrutiny recently as part of the EFSA assessment of health claims in Europe. A number of relevant scientific opinions indicate that, for individuals who wish to reduce their PP glycaemic responses, a reduction of PP blood glucose may be a beneficial physiological effect, as long as PP insulin responses are not disproportionately increased. On this basis, claims relating to beta-glucans, arabinoxylan, fructose, pectin, hydroxymethyl-

cellulose, resistant starch and sugar replacers such as sucralose, polyols, polydextrose and isomaltulose are included in the draft list of general function claims currently being scrutinised in the European Parliament and expected to be in place mid-2012. However, claims for beneficial effects of low GI foods considered together as a general category are not included, on the basis that an overall category of 'low GI foods' is not sufficiently characterised, as it was not accepted to characterise the food on the basis of the claimed effect.

#### DIABETES UK RECOMMENDATIONS

In their 2011 guidelines, Diabetes UK recommends that diets of low-GI and low-GL and higher in dietary fibre and wholegrains are protective for the prevention of Type 2 diabetes in high risk groups, and that high-GI diets increase risk by 40 percent. For people with diabetes, consistency in the quantity of carbohydrate, GI and starch on a day-to-day basis is considered beneficial and positively associated with lower HbA1C level, a marker for longer-term blood glucose control.

A concise monograph summarising the glycaemic concept and the evidence for health relationships has recently been issued by ILSI (6). [www.ils.org/Europe/Documents/Glycaemic%20Response%202011.pdf](http://www.ils.org/Europe/Documents/Glycaemic%20Response%202011.pdf)

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