# Glycaemic Index – helping Malaysian consumers optimise food choice

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Malaysia's high and rising obesity and diabetes prevalence draw national concern. While improved screening in part explains this scenario, intergenerational transmission and environmental amplification are important contributors. Thus, it is with worry we reckon that Malaysia is among the few nations that showed an unhealthy trend of increasing body weight but plateauing height gains among children, over the past four decades.[1] Therefore, prevention and treatment of excessive weight gain and diabetes are of immediate and prime importance. Fortunately, obesity and diabetes have modifiable risks. In this editorial, the rationale for using the Glycaemic Index (GI) to optimise food choice for disease risk reduction and management is discussed.

***Keywords:*** *Carbohydrates, Glycaemic Index, Malaysia, Diet*

## Postprandial glycaemia as a metabolic target

Among the modifiable metabolic risks, hyperglycaemia responds well to dietary intervention, making it a suitable risk management target. Since we spend a major portion of our day in the fed state, postprandial glycaemia is of specific interest. As dietary carbohydrate appears in blood as glucose post digestion and absorption, it is the major determinant of postprandial glycemia. Glucose in the blood is as an energy substrate for all cells and influences satiety, mood and cognitive ability. However, persistent hyperglycaemia leads to excessive body weight gain, diabetes and consequent cardiovascular risks. In those with diabetes, uncontrolled glycaemia expedites systemic complications[2] (Figure 1). This relationship of carbohydrates with metabolic risks is especially pronounced in Asians. Thus, it is intuitive to consider altering carbohydrate intake to alter postprandial glycaemia for better health. So, we have two options: (i) to eliminate/restrict carbohydrate foods (ii) to improve the quality of carbohydrate foods we eat.

## To lower carbohydrate intake or improve its quality?

Avoiding dietary carbohydrate was suggested since the late 1700s to treat diabetes and obesity. However, an umbrella review of systematic reviews evaluating RCTs comparing low-carbohydrate with control (low-fat/energy-restricted) diets in adults with overweight and obesity, concluded that better quality evidence is required to recommend low-carbohydrate diets over other accepted approaches.[3] The current consensus is that both high and low carbohydrate diets increase mortality, with minimal risk observed when carbohydrates provide 50–55% of energy.[4] Thus, it is no surprise that dietary guidelines around the world recommend around 55, 15 and 30% of the calories from carbohydrate, protein and fat respectively. Therefore, low carbohydrate diets (< 45 En%) are currently considered experimental, lacking in evidence for long-term safety, sustainability and affordability.

From a practical standpoint, reducing a single nutrient is challenging, especially when it involves carbohydrate, a macronutrient that contributes to 45-70% of energy in human diets. Such alterations are accompanied by compensatory increases in protein and fat and raise nutritional concerns. However, what one chooses to habitually eat is a function of taste, familiarity, accessibility and affordability. Health considerations are less powerful influencers of food choice decisions made on a day to day basis. Reducing drastically (< 45 En%) or completely cutting out carbohydrate from our diet would mean that our plate has little or no staples and probably costs more. These are "big changes" that many

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individuals may not have the reserve and resource to make. And given the current evidence, unnecessary or dangerous to make (Figure 2: compare Panels A and B).

This leaves us to examine the second option- to improve carbohydrate quality, a reference to altering the type of carbohydrate consumed. Public health efforts to improve carbohydrate quality have been around for decades as messages to increase whole-grain and dietary fibre intakes. In the late 1970s, an increase in diabetes prevalence paralleled by technological advances in metabolic studies led to an interest in better characterising carbohydrates. It came as a surprise that carbohydrate polymer chain length did not predict their glycaemic response as expected. It was frustrating that the glycaemic response of complex carbohydrate in “potatoes” could outbeat simple carbohydrate in “soda drinks”, even when controlled for carbohydrate amount. It was exciting that al dente pasta with a similar amount of carbohydrate could lower postprandial glycaemia by around 25% compared to soda or French fries. Thus, the terms ‘’simple” and “complex” carbohydrates, lost their lustre and a realisation dawned that not all carbohydrates are the same. Consequently, research to categorise carbohydrate foods by their glycaemic response galvanised.[5]

**Glycaemic Index: A measure of carbohydrate quality**

In the 1980s, GI was proposed to evaluate carbohydrate quality. GI is a numerical value that ranks carbohydrate foods from 0-100, in proportion to the postprandial glycaemic response they produce. GI of a food is determined using a standardised *in vivo* process that measures and compares the incremental area under the blood glucose response curve of a test food with a standard glucose drink. The amount of food and glucose served to volunteers in GI testing are standardised to contain 50g available carbohydrate, accounting only for metabolisable carbohydrate. Thus, the GI value of glucose is pegged at 100. White bread, white rice and brown rice, in proportion to the glycaemic response they produce in comparison to glucose, have GI values of 83, 71 and 48 respectively.[6] The higher the GI value of food, the more rapid and higher is the postprandial glycaemic rise it produces (Figure 3). To facilitate interpretation, foods are classified into three GI categories: high (GI >70), intermediate (GI between 55 to 70) and low (GI <55).

Foods differ in their GI owing to the type of carbohydrate they contain, the food matrix and the amount of processing it has undergone. For instance, branched-chain amylopectin starch is more susceptible to hydrolysis by amylase and has higher GI, while linear amylose is more slowly hydrolysed and has a lower GI. Thus, Basmati rice (more amylose) has a lower GI compared to Fragrant Rice (more amylopectin). Physical entrapment of starch in legumes and nuts slows its hydrolysis thereby reducing its GI. High amounts of processing such as milling, and even overcooking breaks down particle size and the ease with which enzymes can hydrolyse nutrients. This can once again increase the GI of the food. Thus, highly processed instant or overcooked oats have higher GI compared to traditional oats. Therefore, GI is both about the food and how it is cooked.

**Glycaemic Index to optimise food choice for Malaysian consumers: Evidence for feasibility and utility**

Since GI values are based on a food’s glycaemic response, it can be used to optimise postprandial glycaemia. Replacing a similar amount of a high-GI carbohydrate-food with a lower GI option lowers post-meal blood glucose. Let's take a cup of brown (lower GI) and white rice (higher GI) for example. They both contain practically the same amount of carbohydrate. But the lower GI of brown rice would mean that even when eating the same amount, you will experience a slower and lower rise in blood glucose versus white rice. Thus, nutritionists and dietitians help plan low-GI menus by referring to the international GI database. Recently, we have published a compendium of GI values of 940 non-Western foods including Malaysian foods.[6] This we believe will assist healthcare professionals and Asian consumers to choose healthier carbohydrate options.

Importantly, low-GI meal plans can be aligned with nationally recommended nutrient intakes (RNI) and communicated to the public through simple strategies. GI of Malaysian diets are typically reduced by choosing wholegrains for breakfast ( wholegrain bread/oats), opting for lower GI staples (replacing fragrant white rice with Basmati, brown rice, noodles or pasta), choosing one low-GI food in every meal (e.g. legumes, nuts or low-fat dairy) and avoiding highly-refined food or over-cooking. Vegetables (except for starchy vegetables like potato) and fruits minimally affect diet GI and therefore can be consumed as per the Malaysian dietary guideline of 3+2 servings per day. Recently, few Malaysian food products have listed GI values facilitating food choice. While changes in taste, affordability and familiarity are still issues one must deal with when choosing to follow a low-GI diet, the magnitude of these changes is potentially smaller and therefore easier to adopt and sustain (Figure 2: Compare Panels A and C).

From a health standpoint, high-GI diets significantly increase the risk for diabetes[7] and adiposity-linked cancers[8]. Additionally, a low-GI diet is more effective in achieving glycaemic control in patients with type 2 diabetes.[9] However, these findings have not been consistent, and the discrepancy is attributed to how the diet was constructed. This underlines the importance of professional guidance in creating low-GI diet plans. For Malaysian consumers, it is encouraging that local evidence exists for low-GI diet in disease risk reduction and management. In a year-long Malaysian trial that aimed to prevent cardiometabolic risks in a high risk group of women with prior gestational diabetes, small decreases in GI of healthy diets led to more women achieving and maintaining clinically significant weight loss with small added improvements in metabolic profile.[10] Trial participants with impaired fasting glucose or glucose intolerance were also twice as likely to become normoglycaemic when following a low-GI diet. Among Malaysian patients with type 2 diabetes, low-GI diet significantly decreased serum fructosamine, plasma glucose and waist circumference over 12 weeks, compared to a conventional dietary prescription.[11] Furthermore, professionally guided low-GI education for Malaysians also improved fibre and calcium intakes. More importantly, no adverse effects of low-GI diets have been recorded. Thus low-GI diet may be well suited for Malaysian individuals with overweight, prediabetes and type 2 diabetes.

**Final Thoughts**

GI is a diet optimisation tool that should be used in conjunction with other dietary principles of moderation, balance and variety. GI is meant to be used only for carbohydrate foods and it should be used to compare only foods within a group. For instance, one could compare the GI of breakfast cereals to choose a suitable option. The GI concept thus helps you optimise your diet with small swaps and while adhering to other dietary recommendations. As with any diet, it is best practised under the guidance of a nutritionist or dietitian. And testing more Malaysian food for their GI will improve the accuracy of low-GI dietary interventions.

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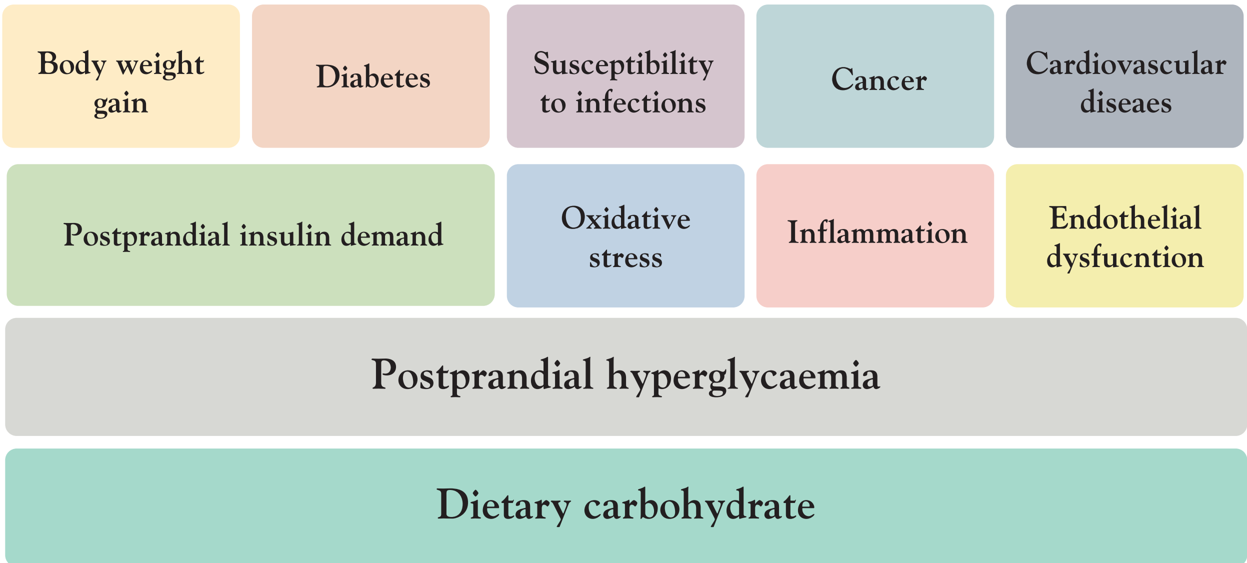


**Figure 1: Consequences of postprandial hyperglycaemia**

**Postprandial hyperglycaemia increases risks for excessive body weight gain, diabetes, cardiovascular diseases and cancer through increases insulin demand, oxidative stress, inflammation and endothelial dysfunction. Dietary carbohydrate is the major determinant of postprandial hyperglycaemia**

| Panel A (Conventional healthy plate) | Vs | Panel B (Low carbohydrate plate) | Panel C Low GI plate |
|---|---|---|---|
|  | |  |   |
| | Cost | $$$ | $$ |
| | Change from usual | +++ | + |
| | Local Evidence for Additional Health Benefits | X | ✓ |
| | Adverse health effects | ! | None reported |

**Figure 2: Comparison of changes needed to adopt a low carbohydrate and low-GI diet from a conventional healthy diet; (Abbreviation: GI - Glycaemic Index)**

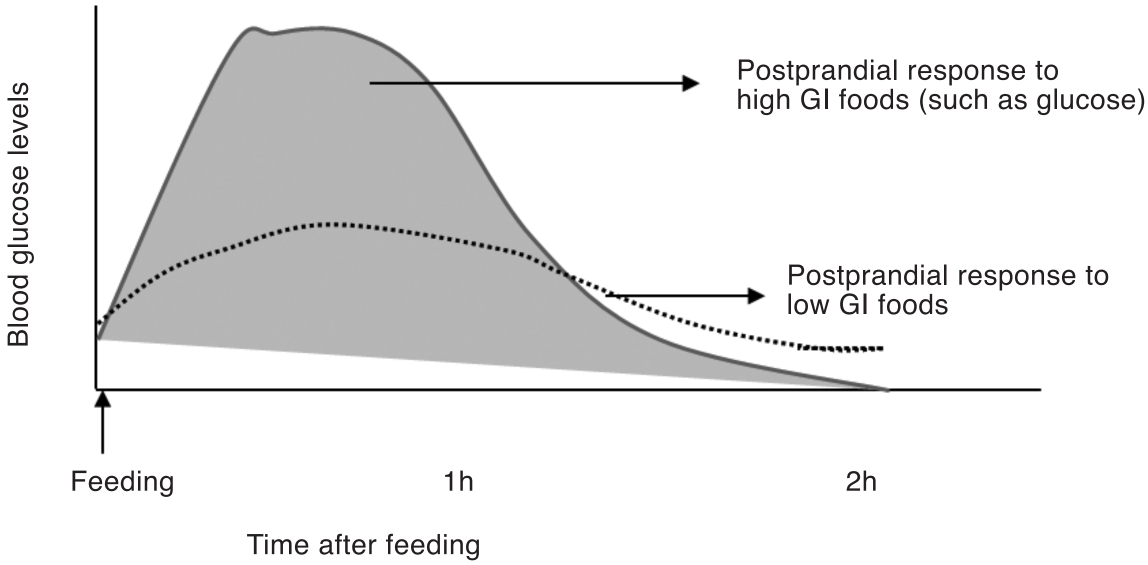


**Figure 3: Comparison of postprandial blood glucose curves after consumption of low and high-GI Foods; (Abbreviation: GI - Glycaemic Index)**