Glycaemic Index for healthy life of Sri Lankans

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Batticaloa Medical Journal 2014; **6:** 3-11

Introduction

Glycaemic index measures the rate at which the carbohydrate in certain foods is digested and absorbed into the blood stream as glucose, i.e. the GI of a food represents its blood-glucose raising potential [1-5]. The Glycaemic Index according to FAO/WHO is defined as the incremental area under the blood glucose response curve of a 75g glucose equivalent carbohydrate portion of a test food expressed as a percent of the response to the same amount of glucose taken by the same subject [1,6].

During digestion, all carbohydrates are broken down glucose, which then enter the blood. As blood glucose level rises, the normal response of the body is to increase the level of insulin in the bloodstream. Insulin maintains the blood glucose level. The blood glucose level is usually maintained, unless a person has diabetes or he is insulin resistant.

Foods with a high glycaemic index raise blood glucose quickly (e.g. glucose), while with low glycaemic index (e.g. legumes) promote a slower release of glucose (and raise blood glucose slowly) and insulin. Diets with high-glycaemic index have been linked to an increased risk for both diabetes and heart diseases [7-8].

What does Glycaemic Index offer?

The Glycemic Index

- reflects the physiological effect of foods,
- helps to keep blood glucose levels even,
- substitutes the old terms of complex and simple carbohydrates [9].

Glycemic Index (GI) ranks foods on a scale from 0 – 100, according to their actual effect on blood glucose levels [9]. On the Glycaemic Index scale, glucose is taken as 100 since it causes rapid rise in blood glucose while all the other foods are rated in comparison with glucose [10]. GI ranks foods based on their actual effect on blood glucose levels. If a food has a glycaemic index of 75, it means that it raises blood glucose by 75% when compared with glucose.

Foods with an index number of 70 or more are considered to be of high GI, with an index between 55-70 as medium GI, and 55 or less as low GI.

It has been proved that it is not the **amount** of carbohydrate, but rather **its rate of absorption and digestion** that determine the physiological response of the body [4]. It was previously thought that if same amount of carbohydrate is eaten (whatever that carbohydrate may be), it would have the same effect on the blood glucose levels. It is now known that the same amounts of different carbohydrate-containing foods have different effects on blood glucose levels. For instance, 30g of bread does not have the same GI as 30g of fruit or noodles.

Factors influencing the Glycaemic Index

The following factors influence the **digestion and absorption** of carbohydrates, and thus on blood-glucose levels, and hence affect the glycaemic index of the food [11]:

The amount and type of sugar

Pure glucose has a maximum effect on blood glucose, i.e. has high GI e.g. glucose syrup (used in cake/ confectionery manufacture), some sports drinks, and as 'dextrose' in many foods. Fructose occurs naturally in many fruits, some vegetables (corn, sweet potato), corn syrup, honey, etc.[12]. Fructose is absorbed as fructose and contributes very little to blood glucose levels because fructose must be converted into glucose by the liver. High fructose foods have a lower GI, and the greater the ratio of fructose (fruit sugar) to glucose in a food, the lower its glycaemic index [13].

Sugar (sucrose) has a lower index than bread or potatoes because sucrose is a disaccharide made up of both glucose and fructose, [14] and after digestion the blood glucose level is increased directly by the glucose and some amount is contributed by the fructose getting converted to glucose in the liver. However fructose can also be metabolized directly. If the glycaemic index of glucose is 100 and that of fructose is 23 then that of sucrose is the average of these two values, i.e.:

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100 (GI glucose) + 23 (GI fructose) / 2 = 61.5 (quoted as 65)

Lactose and sucrose have an intermediate effect on blood glucose levels. Therefore honey has an intermediate GI (58).

Degree of ripeness

Ripe fruits have higher sugar content than those which have not ripened, because during ripening large poly-saccharides are converted into sugars leading to a decrease in the time to digest (with some 40%) and, therefore, has a higher glycaemic index, e.g. the riper the food the higher the GI, e.g. yellow/black bananas vs. greenish bananas.

Type of carbohydrates

It has been noticed for a long time that two carbohydrates (or poly- saccharides) with the same molecular weight but with different structure may be digested differently.

The Chemical composition of the starch

If there is more of the branched starch (amylopectin) and less of the unbranched chains (amylose), digestion will be quicker [15]. Starches, such as rice, can have different types of starch structures, which affect their digestibility. Among the rice available in Sri Lanka BW 400 red varieties showed lowest GI of 27.5 and BW 2726-B (parboiled) showed the highest value of 42.9[16]. Some types of rice such as Basmati have higher amylose content. Other rice, with higher amylopectin content, is much easier to digest and has a higher GI. Beans and pulses have mostly amylose and are digested slowly. The starch in potatoes, for example, is digested and absorbed into the bloodstream relatively quickly.

Fibers

Fibers are "those carbohydrates that are not digested by human enzymes in the small intestine". Fibers shield the carbohydrates in food from immediate digestion, so the sugars in fiber-rich foods tend to be absorbed into the bloodstream more slowly. Soluble fiber slows down the digestion of starches and the absorption of glucose into the bloodstream, e.g. fruit pectin and legume fiber (beans, lentils etc.) [17]. Further the foods containing soluble fiber have a lowering effect on the GI because they delay gastric emptying. Insoluble fiber such as that found in digestive bran has very little effect on the digestibility of the carbohydrate foods it is found in. But, in very large amounts, bran can lower the GI.

The fat and protein content

Stomach is emptied slowly if the food contains high amounts of protein and fat. The higher the fat content of foods the slower its carbohydrates are converted to sugar and absorbed into the bloodstream. As they take longer to digest they have a lower GI. Fat also slows the absorption of a meal. However, it is not advisable to eat too much protein or fat. Protein tends to wear out the body's insulin; and fat has the effect of decreasing the effectiveness of insulin. Protein also overtaxes the kidneys and an over-consumption thereof can lead to osteoporosis, arthritis and gout.

The methods of food preparation and processing

Milling, blending, mixing, mashing and refining foods raise the GI of foods. That is why it is recommended to limit beating, liquidizing or processing in recipes. One of the most important factors in increasing GI is the degree of processing of carbohydrates. In highly processed carbohydrates, the outer bran and inner germ layer are removed from the original kernel of grain, which causes bigger spikes in blood sugar levels than would occur with less-processed grains. Foods, which are more processed, digested quicker and have a higher GI, e.g. instant potato, refined cereals. Processing makes the starch faster to digest. Whole-grain foods tend to have a lower glycaemic index than their more highly processed counterparts.

Degree of starch gelatinisation

Gelatinisation of starch occurs when the starchy food is exposed to water and heat (i.e. cooking in aqueous medium). Water binds with starch (e.g. flour) in the presence of heat and gelatinises the flour. The heat and water expand the hard compact starch granules (which make the raw starch difficult to digest) into swollen granules. Some granules even burst and free the starch molecules. The less a starch is gelatinised, the slower it is digested and absorbed. In other words, it will have a lower GI.

Many confectionery items that contain sugar have a lower GI than those without! If sugar is added, the sugar binds with the liquid, preventing it from binding with the starch and thereby preventing gelatinisation.

Particle Size

Finely ground flour has a higher glycaemic index than more coarsely ground flour. Intact grains such as whole wheat, whole corn and whole rice have a much lower GI value than flours made from the same grains.

Degree of processing

The more processed/refined a food is, the higher the GI. Foods, which are more, textured, chewy, crunchy, fibrous tend to take longer to be digested and release their glucose into the blood stream more slowly than soft, refined or pre-cooked foods. Long grain white rice has a lower GI than quick cooking brown rice and multigrain bread has a lower GI than whole meal bread [16].

Cooking method

Cooking methods such as frying, boiling and baking, all affect GI rating. The method of baking bread appears to influence its GI; traditional slow rising bread dough can have a lower GI than breads made with rapid-rise dough.

Cooking time

Briefly boiled rice, 1 minute, may result in twice the time to digest as compared to 6 minutes boiled rice.

Others

Anti nutrients

Phytates, lectins and polyphenols (tannins) normally slow digestion and thereby decrease the GI.

Acidity

If an acidic food is added to a meal, this will lower the GI, e.g. by adding dressing to a salad, digestion of food by the stomach is made more slow. The higher the acid contents of a food, the slower its carbohydrates are converted to sugar and absorbed into the bloodstream. The more acidic a food, the lower is the GI of that food, e.g. addition of lemon juice to vegetables, vinaigrette dressings on salad, pickled foods, increasing the acidity of bread by using sour dough fermentation. Another example is, a green apple will have a lower GI than a yellow Golden Delicious Apple [18].

Speed of eating

Studies have shown that blood-glucose levels rise less rapidly when eating more slowly. Food that has not been properly chewed also has a lower GI – it may also lead to indigestion.

Salt

Salt and salty foods/condiments tend to speed the rate of digestion of starches and increase the rate of absorption of glucose and increases the GI of the meal.

The Glycaemic Index of a food depends on many factors including harvest time, gene species, age of food, type of processing, nutritional profile, and many other variables. New potatoes have lower GI than desire potatoes and long grain rice lower GI than short grain rice.

Combination of foods in mixed meals

Often the GI of a given food is not what one would expect, e.g, the GI of brown bread is 70 whereas sweetened, low-fat fruit yoghurt is only 33. For this reason, all foods containing carbohydrate need to be tested to determine their GI. Eating proteins rich food in a meal lowers the overall GI of the meal. Rice with meat sauce has a lower GI than rice with tomato sauce [19].

Glycaemic Index versus Glycaemic Load

If foods with low GI are eaten, the blood sugar levels will remain more stable. But when low glycaemic index foods are chosen and eaten too many of them at once, that is, if a meal with a high glycaemic load is eaten, the blood sugar will still rise dramatically and excessive amounts of insulin is required to deal with it. The blood sugar levels will not be nearly stable enough because the insulin index of the meal is too high [20, 21]. The Insulin Index is a relatively new concept, which measures the amount of insulin the body produces in response to a set carbohydrate load of a particular food [22, 23].

Which is more important, is glycaemic index or glycaemic load?

The glycaemic load of a meal has a much greater effect on its insulin index than its glycaemic index, so the total amounts of carbohydrates that are consumed control blood sugar levels [24, 25]. If high glycaemic indexed carbohydrate foods are chosen, and if small amount of them is eaten, the blood sugar will be under control. Thus eating a small amount of carbohydrates with high GI is not unhealthy, while, too much of carbohydrates with low GI are still bad. Carrots have very high GI. But, a small amount of carrot eaten with other foods will not significantly elevate insulin levels. If a meal consisting of half a kilo of carrots is eaten, the insulin levels will be elevated.

Sucrose is a good example of the difference between glycaemic response and insulin response. Sugar (sucrose) is insulinogenic (meaning it elevates insulin), but the insulin-stimulation caused by ingesting sugar is greater than its GI would indicate. When dietary fat is added to sugar, the combination of fat and sucrose

produces a mild glycaemic response, but with a powerful fat-storing insulin response [26].

Though low GI foods do not stimulate fat-storage as efficiently as high GI foods, they still contain calories. If a person continuously eats food with 4,000 kcal per day and with low or high GI and do not exercise, then he will become over weight.

To effectively control the blood sugar levels it is important to eat both suitable types and amounts of carbohydrates. Therefore it is necessary to eat meals with a low GI and a low glycaemic load. Only then the need for insulin can be reduced, and can reap health benefits that we are striving for. Choosing foods with a low GI and low insulin index can improve diabetic management and may possibly reduce the incidence of diabetes complications e.g. heart disease, renal disease [27, 28].

Significance of Glycemic Index

All foods with a GI of 50 or less are slow releasers of carbohydrates and are the best choices for inactive people, the overweight, sportsmen one [29] or two hours before exercise [30], as well as diabetics, hypoglycaemics and persons with high triacylglycerols [31]. Therefore, low-GI foods also prevent the huge drop in blood-glucose, which occurs after the initial rapid rise in blood-glucose levels, which usually happens after eating high-GI foods.

Intermediate GI foods are those with a GI of between 50 and 70. They are the best choice after low-intensity exercise of short duration, in the morning after exercising the previous night and directly after moderate activity in diabetics.

Foods with a GI of 70 and higher are called high-GI foods [32, 33]. High-GI foods are excellent for the prevention of fatigue and hypoglycaemia in regular sportsmen after doing moderate to high-intensity exercise. High-GI foods should, however, be limited by diabetics under normal circumstances, but are completely safe after strenuous exercise lasting two to three hours [32].

High GI foods elicit a huge insulin response, the body's way of coping with the sudden, sharp rise in blood-glucose. Often this insulin response is too much and blood-glucose levels then rapidly fall to below the starting point, a condition known as hypoglycaemia.

- Low GI means a smaller rise in blood sugar and can help to control established diabetes [33, 34].
- Low GI diets can help people to lose weight and lower blood lipids [29, 35, 36]
- Low GI diets can improve the body's sensitivity to insulin
- High GI foods can help to re-fuel carbohydrate stores after exercise [37].

Low GI foods

* best for most people, most of the time because they reduce the risk of disease
* are the most satiating (hunger satisfying), reduce appetite and help reduce overeating [38]
* help people with diabetes to control their blood sugar levels.
* help to reduce blood insulin levels and so reduce the undesirable effects of insulin resistance (e.g. coronary heart disease, obesity and type 2 diabetes.)

The GI tells us which foods make us store fat and which don't. Low-GI diets offer a unique set of benefits. They

* do not stimulate fat storage
* enhance sports performance
* improve energy levels while reducing sugar-related energy and mood swings
* improve muscle to fat ratio
* enhance mental alertness
* may help to lower blood lipids

How to use the Glycaemic Index?

Look at foods that were eaten currently. Then work out ways to replace high GI foods with low GI alternatives, but it should be noted that the amounts (grams) of carbohydrate must be kept the same. The total amount of carbohydrate, the amount and type of fat, and the fiber and salt content of food are also very important. Why? Because foods high in fat often have a low GI. However, a high fat diet is not recommended for overweight people or people with diabetes [39].

Ten simple ways to change to a low GI diet

- The best way is to include one low GI food at each meal.
- Switch to breakfast cereals based on wheat and rice with bran (such as porridge).
- Eat grainy breads made with whole seeds, barley and oats, instead of white or brown bread.
- Eat long-grain rice in place of short-grained rice, but watch serving size.
- Use fat-reduced milk and low-fat yoghurt.
- Eat pulses and legumes (such as beans, lentils and peas).

- Eat legumes and green leafy vegetables in preference to other starchy vegetables.
- Favour apples, grapefruit, grapes, orange, pears, and under-ripe bananas in preference to other fruits.
- Favour less processed foods and foods that aren't over cooked, as processing and cooking makes food easier to digest.
- Eat fibre because it helps slow the digestion and absorption of carbohydrates.

Choose most vegetables without even thinking about their GI. Essentially, low GI eating means high carbohydrate foods that are staples in many parts of the world with an emphasis on whole foods such as the whole grains and legumes or pulses.

Problems in practicing GI

1. GI values of all foods are not known.
2. Foods are not eaten as varied meals.
3. The GI varies for different brands of the same product
4. The GI does not relate to the nutritional value of a food.

Jaffna foods and their Glycaemic Index

Form our recent studies the GI values obtained for the locally available foods were determined [40-47].

Glycemic Index of different varieties of rice [40, 42]

The glycaemic index (GI) values of cooked white rice, brown rice and parboiled rice were 66.61 (±9.86), 60.24 (±8.16) and 55.97 (±6.01) % respectively (Table 1). When fiber contents of the three cooked rice varieties were considered the cooked parboiled rice contained more soluble dietary fibers (0.42%), insoluble dietary fibers (1.88%) and total dietary fibers (2.3%), than the cooked brown rice (0.21, 1.88 and 2.09%) and cooked white rice (trace, 1.21 and 1.21%). The available carbohydrate in the foods for absorption might be made unavailable due to its soluble dietary fibers (SDF), insoluble dietary fibers (IDF) and total dietary fibers (TDF) contents. The monosaccharaides released by the hydrolysis and available for absorption might be made unavailable. This could be due to the tendency of the fibers to absorb sugars and absorbed sugar released slowly. A soluble fiber slows down the digestion of starches and absorption of the glucose in to blood stream. The total dietary fiber content of cooked parboiled rice was higher than that of the other cooked rice. When the insoluble dietary fiber is considered, the cooked parboiled rice contained same amount (1.88%) and the cooked white rice contained lower (1.21%) than other varieties. However the total dietary fiber contents of cooked parboiled rice and brown rice varieties were closer to each other. Thus the parboiled rice variety is a better choice for the diabetics and coronary heart disease patients.

Table 1: Glycemic Index values of different varieties of rice commonly eaten by Jaffna inhabitants.

Rice	Glycemic Index(%)
Parboiled	56.00
Sampa	66.60
Polished (At-402)	60.20

Food items prepared from rice flour [41, 43]

The mean glycemic index values of 'Pittu' and 'string hopper' were 43.74 (±9.09) and 50.01 (±7.06) % respectively (Table 2). When the fiber content of 'pittu' and string hopper were considered 'pittu' contained more soluble dietary fibers than (0.45%), insoluble dietary fiber (1.56%) and total dietary fiber (2.01%) and string hopper contained soluble dietary fibers 0.43%, insoluble dietary fiber 1.45% and total dietary fiber 1.88%. The total dietary fiber of 'pittu' was higher than that of string hopper. 'piitu' and string hoppers are made out of roasted rice flour and steamed wheat flour. When the rice flour is roasted heat might have initiated the Mailard reaction and caramelization. With steaming the starch exposed to moist heat may undergo gelatinization and subsequently they may have retrograded causing a lowering effect on glycemic index. This might be the reason for the lower glycemic index values for 'pittu' and string hoppers when compared with cooked rice.

Table 2: Glycemic Index values of String hopper and 'pittu' prepared from rice flour and wheat flour in1:2 ratio.

Foods	Glycemic Index(%)
String Hoppers	50.00
Pittu	43.70

Effect of side dishes on Glycaemic Index [42]

The mean GI values of parboiled rice (*'Mottaikarupan'*), *'kurakkan pittu'* (*Eleucine coracana*) and *'atta pittu'* (whole wheat grain flour) either with green leaf curry (*Amaranthus*) or gravy (soya meat) or green leaf curry and gravy were determined (Table 3). The GI of parboiled rice or *'kurakkan pittu'* or *'atta pittu'* with green leaf curry differed significantly ($p<0.05$) from other

combined foods. The GI of parboiled rice or *'kurakkan pittu'* or *'atta pittu'* with gravy or green leaf curry and gravy did not differ significantly ($p>0.05$) among them. *'Kurakkan pittu'* is inferior to *'atta pittu'* and parboiled rice. Including curries to basic foods altered the GI. Therefore, when dietary advice is given to diabetic patients, not only the basic foods, but also the curries to be consumed have to be considered. From the findings it could be concluded that among the starch sources 'atta flour' pittu was the best followed by parboiled rice. Even though we have had believed that 'kurakan' and its flour are good starch based diets for diabetics and CVD patients, and obese and overweight persons. The results indicated that the foods made out of 'kurakan flour should not be recommended for diabetics.

Table 3: Glycemic Index values of rice and 'pittu' prepared from rice flour and wheat flour; 'kurakan flour' and 'atta'flour with different side dishes.

	Foods	Glycemic Index(%)
Parboiled rice	Green leafy curry	47.50
	Gravy	56.30
	Green leafy curry and gravy	54.70
	Rice flour and wheat flour-1:2 ratio	43.70
Pittu	Kurakan flour	
	Green leafy curry	57.50
	Gravy	63.30
	Green leafy curry and gravy	59.30
	Atta flour	
	Green leafy curry	44.40
	Gravy	50.80
	Green leafy curry and gravy	46.30

Glycemic Index values of some tubers and legumes [43]

The glycaemic index (GI) values of cassava (*Manihot esculenta*), potato ((*Solanum tuberosum*, Nuwara Elia), boiled green gram (*Vigna radiata*) and chick pea (*Cicer arietinum*) were determined (Table 4).

When boiled potato or cassava, which contained 75g digestible carbohydrate, was administered to the volunteers the peak blood glucose level was obtained at 30 min. The mean glycaemic index values of potato and cassava were 65.2 (±6.56) and 78.7 (±7.3%). When the fiber contents of boiled potato and cassava are considered, the soluble dietary fiber (0.48%, 0.47%), insoluble dietary fiber (1.21%, 2.18) and total dietary fiber (1.69%, 2.65) respectively. the mean glycemic response to boiled potato and boiled cassava were 40.8 (±4.11) and 49.3 (±4.57) mg dl^{-1} respectively. These values could not be due to the effect of soluble dietary fiber or insoluble dietary fiber in these two food items. Because the boiled potato and cassava contained almost same amount of SDF and the boiled cassava contained higher IDF than boiled potato. Hence the fiber content did not affect the glycemic response of boiled potato and boiled cassava. Cooking also has shown to exert a differential effect on GI of a carbohydrate – rich food, particularly one that is high in starch. In the boiled and cooled potato the processing could have formed the resistant starch. Thus the variation in the glycaemic index of boiled potato from boiled cassava could be due to more resistant starch formation in during boiling and cooling of potato and cassava. Thus cassava is a high GI diet.

When boiled green gram or chickpea, which contained 75g digestible carbohydrate, was administered to the volunteers the peak blood glucose level was obtained at 60 min. The mean glycaemic index values of boiled green gram and boiled chickpea were 31.4 (±6.96) and 33.3 (±6.23%). When the fiber contents of boiled green gram and chickpea are considered, the soluble dietary fiber (0.43%, 0.4%), insoluble dietary fiber (8.8%, 7.2%) and total dietary fiber (9.2%, 7.6%) respectively. The mean glycemic response to boiled green gram and boiled chickpea were 19.7 (±4.36) and 20.8 (±3.9) mg dl^{-1} respectively. Boiled green gram contained more soluble dietary fibers, insoluble dietary fiber and total dietary fiber than chickpea. Due to higher fiber content of boiled green gram and chickpea the glycemic response was delayed ad were less. Boiled green gram and chickpea are low GI diets and are good for diabetic and coronary heart disease patients.

Table 4: Glycemic Index values of different foods commonly eaten by Jaffna inhabitants.

Boiled Foods	Glycemic Index(%)
Potato	75.20
Cassava	78.70
Chick pea	33.30
Green gram	31.40

Glycemic Index values of some bakery products [44, 45]

The glycemic index of the bakery products such as bread, normal bun, butter cake, hard bun, and rusk available in Jaffna was determined (Table 5).

When fiber contents of the bread and normal bun were considered, bread contained less soluble dietary fiber (0.5%) and more insoluble dietary (2.73%) and total dietary fibers (3.23%), than the normal bun (0.56, 2.43 and 2.99% respectively). The SDF, IDF and TDF of wheat bread and normal bun did not show much difference. Even though, bread contains higher IDF, the mean glycaemic response to bread is higher (43.0 $\pm$2.32gL^{-1}) than the normal bun (42.2 $\pm$3.15gL^{-1}). It could be due to the less amount of SDF in wheat bread.

When fiber contents of the normal bun and hard bun were considered, hard bun contained more soluble dietary fiber (0.76%), insoluble dietary fiber (2.99%) and total dietary fibers (3.75%), than the normal bun (0.56, 2.43 and 2.99% respectively). The mean glycaemic response to normal bun (42.2 $\pm$3.15gL^{-1}) is higher than the hard bun (33.1$\pm$3.39gL^{-1}). This could be due to the effects of SDF, IDF and TDF in these buns.

The soluble dietary fiber (0.6%), insoluble dietary fiber (2.57%) and total dietary fibers (3.17%), of butter cake were higher than the bread and normal bun. The mean glycaemic response to butter cake was 40.5 ($\pm$4.03gL^{-1}) and this was lower than those of bread and normal bun and this could be due to the higher dietary fiber content while the fat content did not influence.

Table 5: Glycemic Index values of different bakery products.

Bakery Products	Glycemic Index(%)
Wheat Flour bread	68.59
Normal Bun	67.30
Hard bun	52.78
Butter cake	64.72
Rusk	50.30
Malted rice-wheat bread	62.00

Rusk contained more soluble dietary fiber (0.87%), insoluble dietary fiber (3.18%) and total dietary fiber (4.05%) than other bakery products. Among all the bakery products, rusk gave the lowest glycaemic response (31.1 $\pm$3.03mgdL^{-1}). Here the soluble dietary fiber highly influenced the glycaemic response than insoluble dietary fiber.The hard bun and rusk are lower GI diets (GI values < 55%). Bread, normal bun and butter cake are medium GI diets (GI values between 55-70%).

Glycemic index of the wheat flour bread and malted rice-wheat bread [47] were studied [46]. The peak glycemic response of malted rice-wheat bread [38.8 ($\pm$4.8)gL^{-1}] was obtained at 30min and the mean GI value was 62.0 ($\pm$7.67)%. Thus it had lower GI value than the wheat bread. This could be due to the higher SDF, IDF and TDF contents of malted rice-wheat bread.

Glycemic Index values of some fruits [47]

This glycemic index (GI) values of fruits such as 'Kathali' (Yellow plantain), 'Kappal' (Golden plantain), and 'Itharai' (Green plantain) varieties of plantains, jackfruit and papaya were studied. The mean GI values of the 'Kathali', 'Kappal', 'Itharai' varieties of plantains, jack fruit and papaya were 54.45 ($\pm$9.26), 50.43 ($\pm$5.79), 48.47 ($\pm$10.13), 65.36 ($\pm$8.00) and 34.80 ($\pm$12.78) % respectively. The three varieties of plantains and papaya were low GI fruits, and jackfruit was found to be an intermediate GI fruit. The presence of dietary fiber, esp. soluble fiber, reduces the glycemic response and glycemic index of foods. Thus among the different types of plantain varieties, ripped 'ithari' is best followed by kappal. However among the fruits, papya is the best followed by 'Ithari' variety of plantain.

Table 6: Glycemic Index values of different fruits.

Fruits	Glycemic Index(%)
Plantain 'Kappal'	54.5
'Kathali'	50.4
'Itharai'	48.5
Papaya fruit	34.8
Jack fruit	64.4

Acknowledgements

The author would like to thank the co-researcher Dr. S. Balakumar, research students Mr. S. Pirasath, Mr. P. Raguparan, & Ms. Subajini Veluppillai and the technical officer Mr. K. Thayaananthan, Department of Biochemistry, Faculty of Medicine, University of Jaffna.

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