Determination of the Glycaemic Index of selected Malaysian foods

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Abstract

The glycaemic index(GI) is a classification of the blood glucose raising potential of carbohydrate foods. There is evidence to support its application to regular diet in terms of benefits for lipid and glycaemic control. Integrating information about the glycaemic index of foods into the Malaysian diet is limited by lack of data. Therefore we determined the GI of individual foods which are rice(beras kilang, species name : oryza sativa), banana (pisang brangan, species name : musa paradisiaca),sweet potato(ubi keledek, species name: ipomoea batatas), and noodle rice (kuih-teow, rice product species name : oryza sativa). Twelve healthy adults with a mean body mass index of 21.6 ± 1.6 participated in this study. GI was determined using a standard method with white bread and adjusted relative to glucose. The results showed that the mean GI of rice 90±12, kuih teow (noodle rice) 85±15 , sweet potato 77±12 and banana 55±12. Although there was significant difference in incremental area under the curve (IAUC) and GI within the subjects (P= 0.005 , P= 0.001) , there was no significant difference between the foods. However Friedman's ANOVA indicated that there was significant heterogeneity among the means, P=0.015, but that the only individual means which differed from each other were banana vs rice. We conclude that rice, kuih teow and sweet potato as high GI foods, where as banana as a low GI food. This is the first study in determining the GI of individual Malaysian foods. More research has to be done to determine the GI of many individual Malaysian foods so that a database on Malaysian foods can be created.

Key words:glycaemic index, carbohydrate ,blood glucose, foods, Malaysian

Introduction

The glycaemic index (GI) is a classification of the glucose-rising potential of carbohydrate foods relative to glucose (Wolever et al, 1991). Many factors such as food form, particle size, cooking, processing and starch structure affect the GI(Bjorck et al, 1994). There is evidence that low GI foods improve blood glucose control in people with diabetes (Brand et al 1991; Wolever et al , 1992a; Frost et al, 1994; Jarvi et al , 1999; Gilbertson et al , 2001), reduce serum lipids in people with hypertriglyceridaemia (Jenkins et al 1987a), and improves insulin sensitivity (Frost et al , 1998) . these effects prompted a recent FAO/WHO consultation to endorse the usefulness of the GI in diet planning (FAO/WHO, 1998).In Malaysia , diabetes mellitus and coronary heart disease are the leading causes of morbidity and mortality. Rice, cooked in a variety of ways, is the staple food of Malaysians and appears at almost every meal along with a number of accompanying dishes. Kuih Teow, another form of noodles made from rice, is a favourite with the Malaysians . Like other forms of noodles, it can be prepared in a variety of ways. Another important aspect about the Malaysian diet is the desserts , mainly cakes that are served after every meal. One of the major ingredients of these desserts is the sweet potato. Among the fruits banana is one of the favorite and its eaten raw or as a snack.The GI of these important Malaysian foods are not known. An understanding of the GI concept may assist in optimizing healthy food choices in the Malaysian population. Hence in the present study the GI for banana, kuih teow , rice and sweet potato were determined in healthy volunteers.

Materials and Methods

Study design

Study was conducted at the department of dietetics program, School of health sciences , University of science Malaysia using a standard protocol as outlined by FAO/WHO (1998) the respective institutional ethics review committee approved the protocols and informed consent was obtained from all volunteers.

Reference food

White bread (Gardenia Bakeries , KL, Malaysia) portions with 50 grams available carbohydrate was used as a reference food

Test Foods and preparation

These included Test foods Rice(Beras kilang, Species name : Oryza Sativa), Banana (pisang brangan, species name : Musa paradisiaca),Sweet Potato(Ubi Keledek, species name: Ipomoea Batatas), and Noodle Rice (kuih-teow,Rice product species name : Oryza Sativa) . Each of the four test foods was fed as portions providing 50g of available carbohydrate, defined as total carbohydrate by difference minus dietary fibre. Portion sizes of the test foods rice (64g uncooked), Banana (211 g),Sweet Potato (162 g-uncooked), Noodle rice (157 g -uncooked) were based on nutrient composition of Malaysian foods (1997).
50 g available carbohydrate portions of rice (Arnab emas – Thailand rice), noodle rice was cooked using a pressure cooker. For the sweet potato the peel was removed and the edible portions were washed and 50g available carbohydrate portions were steamed using a pressure cooker. For the Banana the peel was removed and 50g available carbohydrate edible portions were given. The degree of ripeness of banana was all yellow , ripe.

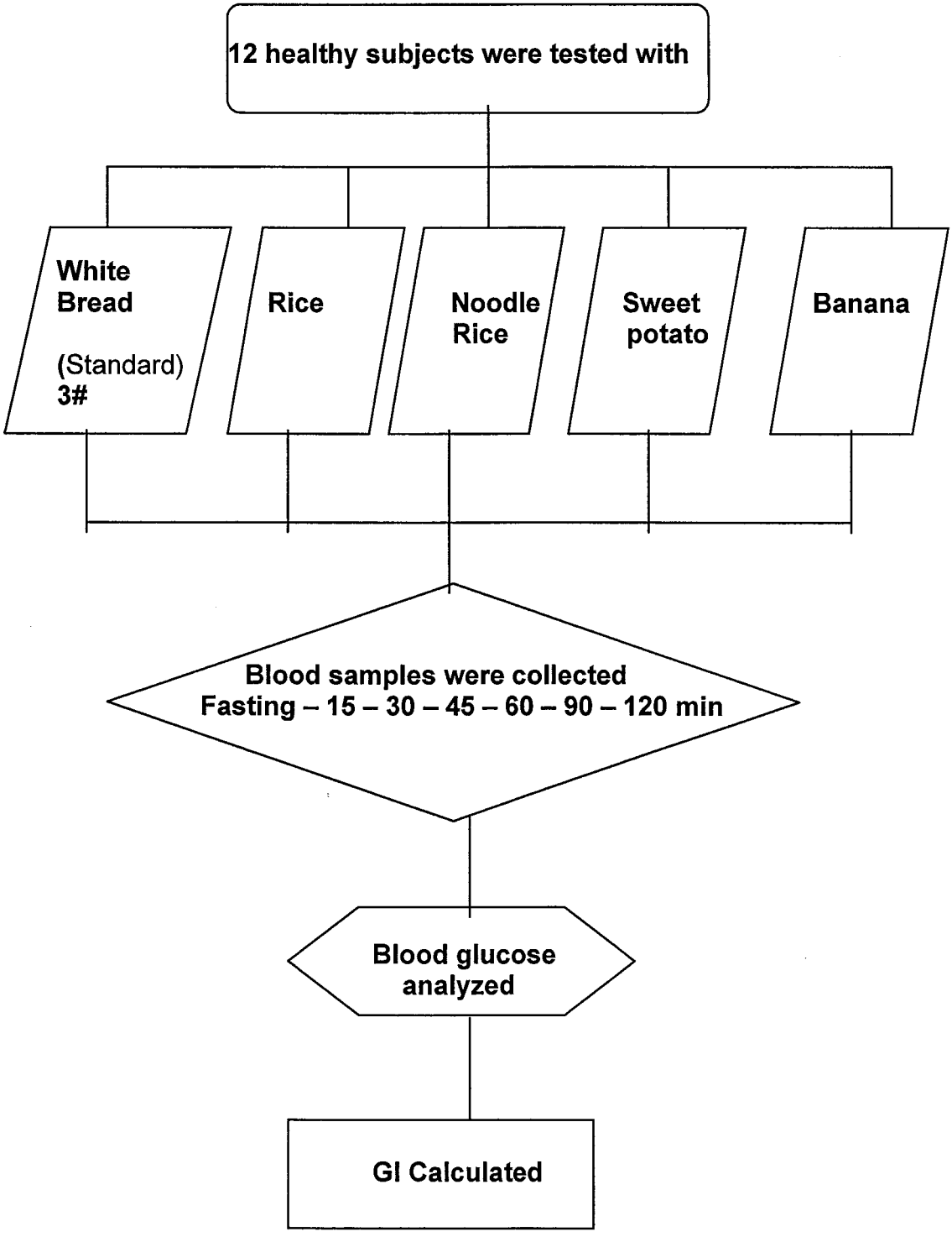
Subjects

12 normal , healthy subjects (six females. six males , mean age 31.9 ± 6.6 , mean body mass index of 21.6 ± 1.6) were recruited to voluntarily participate in the study.

Experimental procedures

Subjects were studied on different occasions in the morning after a 10 – 12 h overnight fast. After a fasting finger prick blood sample, subjects ate a test food at a comfortable pace within 15 min and had further finger prick blood samples at 15, 30, 45, 60, 90 and 120 min after starting to eat. Test foods were served with plain water which remained constant for all the subjects throughout the study. Capillary blood samples were analysed for blood glucose using Advantage glucometer. Incremental area under the curve (IAUC) ignoring area beneath the fasting level were calculated geometrically (Wolever et al. 1991). The IAUC for each food was expressed as a percentage of the mean area for the three white-bread tests and the resulting values averaged to give the food GI based on white bread. As it is preferred to report the GI values using the bread scale , the GI values of the tests foods were multiplied by 0.71, because the GI value of bread is 71 when glucose was used as the reference food with a GI value of 100 ; (Wolever et al 2003). The test food GI for each subject was averaged to give the mean GI for each test food.

Flow chart of the experimental procedure



Results

The Advantage glucometer was tested for accuracy and precision against a Randox glucose GOD/PAP autoanalyser which uses the glucose oxidase method of analysis. The coefficients of variation was 5.9 % for 30 repeated measurements of the blood taken at random in the morning, with a mean concentration of about 5.1 mmol/L.
Table 1 outlines the nutritional composition of banana, rice , kuih teow and sweet potato. The carbohydrate and the protein content of rice is higher than that of the other three foods. The moisture content of noodle rice (kuih teow) , sweet potato and banana is higher than that of rice.

Table 1 Nutritional composition of the test foods (per 100gms)

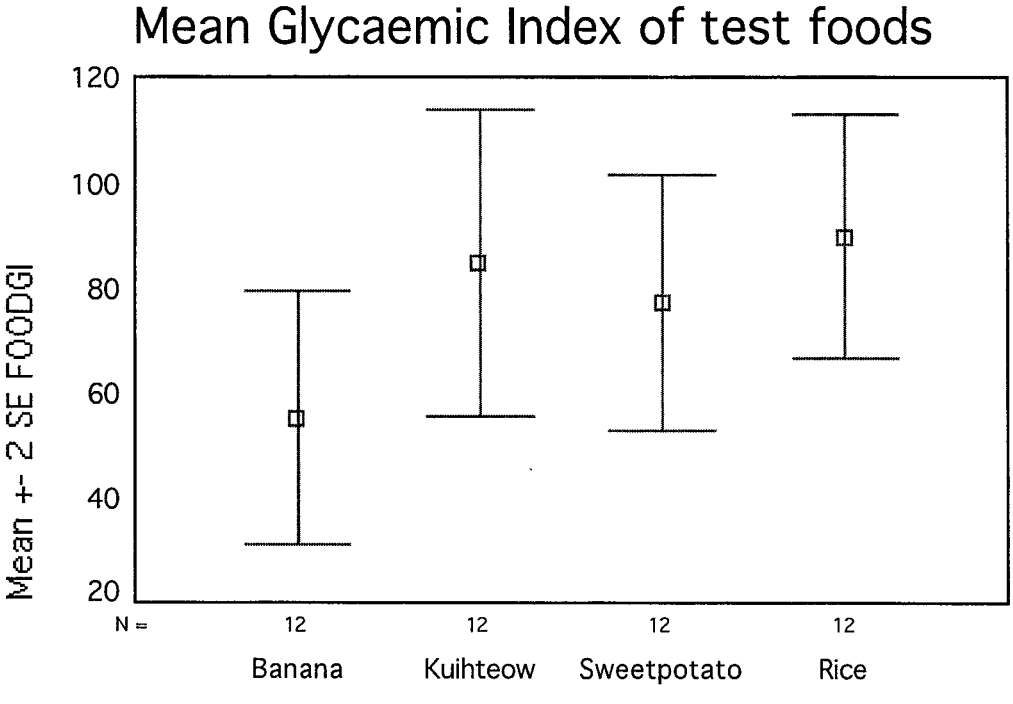
Test foods	carbohydrate grams	fiber grams	fat grams	protein grams	moisture grams
Rice	79.0	0.4	0.5	7.1	12.5
Noodle rice	31.7	0.0	0.0	2.9	64.7
Sweet potato	31.3	0.5	0.5	2 .0	64.3
Banana	24.2	0.5	0.3	1.0	73.1

Values obtained from nutrient composition of Malaysian foods (1997)

Table 2 outlines the GI results for the four test foods .The IAUC and the GI between the subjects were compared using the ANOVA test .Although there was significant difference in IAUC and GI within the subjects (P= 0.005 , P= 0.001) , there was no significant difference between the foods. As the GI values were not normally distributed , statistical analysis was performed by using Friedmans's analysis of variance by ranks (non-parametric test). Friedman's ANOVA indicated that there was significant heterogeneity among the means, p=0.015, but that the only individual means which differed from each other were banana vs rice.
Figure 1 shows that Banana has the lowest GI (55) when compared with rice (90), noodle rice (85) and sweet potato (77).

Table 2 Weights of test foods consumed , mean glycaemic index results and standard error of the mean

Test foods	Weight consumed (g)	Mean GI	Standard Error of the mean
Banana	211	55	12
Kuih Teow	157	85	15
Sweet Potato	162	77	12
Rice	64	90	12



* Standard error of the mean

Figure 1. Mean Glycaemic Index and standard error of the mean calculated for test foods

Discussion

The GI calculated in this study for the test foods places banana among low GI food items. The low GI level (55) is likely to be associated with the high fructose content of the bananas. In contrast Rice, noodle rice and sweet potato has a high GI value (90, 85, 77) which may be due to the high content of the starch , amylopectin. Amylopectin is broken down in the intestine and absorbed more rapidly into the blood than is amylose. The implications of these results are that diabetic patients can consume rice , noodle rice and sweet potato but that they should mix it with vegetables and legumes to slow down the glycemic response. Malaysians normally eat rice during all the three main meals. Banana on the other hand which has a low GI(55) is suitable for patients with diabetes and cardiac problems . Diabetic patients currently think that banana raises the blood glucose , and either refrain from eating banana or eat very rarely. The results from this study support the view that those treating patients with overweight, obesity , diabetes and cardiac diseases should give dietary advice based on the growing evidence of GI values. High GI foods however need not be avoided, but that they can be eaten along with suitable low GI foods.

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