



Assessment of glycaemic index and glycaemic load in selected banana varieties

Kannan Eagappan¹, Minu Mary Mathew², Sasikala Sasikumar³

1- Associate Professor, Department of Clinical Nutrition and Dietetics, PSG College of Arts and Science, Civil Aerodrome Post, Coimbatore, Tamil Nadu 641014. 2- Msc, Department of Clinical Nutrition and Dietetics, PSG College of Arts and Science, Civil Aerodrome Post, Coimbatore, Tamil Nadu 641014. 3- PhD Scholar, Department of Clinical Nutrition and Dietetics, PSG College of Arts and Science, Coimbatore, Tamil Nadu, 641004, India.

Submission Date: 12-01-2015

Acceptance Date: 21-01-2015

How to cite this article:

Vancouver/ICMJE Style

Eagappan K, Mathew MM, Sasikumar S. Assessment of glycaemic index and glycaemic load in selected banana varieties. *Int J Res Health Sci* [Internet]. 2015;3(1):89-93. Available from <http://www.ijrhs.com/issues.php?val=Volume3&iss=Issue1>

Harvard style

Eagappan, K., Mathew, M.M., Sasikumar, S. Assessment of glycaemic index and glycaemic load in selected banana varieties. *Int J Res Health Sci*. [Online] 3(1). p.89-93 Available from: <http://www.ijrhs.com/issues.php?val=Volume3&iss=Issue1>

Corresponding Author:

Dr. Kannan Eagappan, Associate Professor, Department of Clinical Nutrition and Dietetics, PSG College of Arts and Science, Civil Aerodrome Post, Coimbatore, Tamil Nadu 641014. Email: dtkannan@gmail.com

Abstract:

The glycaemic index (GI) is a physiological measure of a food's potential to increase postprandial blood glucose, as compared to the effect produced by food taken as reference, such as glucose or white bread. Currently researchers and consumers are interested in low GI foods, since their consumption is associated with better weight control and reduced risk of incidence of chronic diseases, like diabetes. In the present study, the GI value for "Banana" such as 'Njali poovan', 'nendran', 'poovan', 'robusta' and 'chenkadali' was estimated in the selected healthy volunteers. By convenient sampling 20 female non-diabetic healthy adult volunteers were selected. Standard glucose and selected banana varieties were given on two different days respectively and their blood sugar levels were monitored using glucometer for different time intervals. With the obtained results, GI and GL were found out. Then the data collected were analysed using independent 't' test tool of SPSS 16 version. The highest GI was recorded by 'Njali poovan', followed by 'nendran', 'poovan' and 'chenkadali'. The lowest was recorded for 'Robusta'. 'Poovan' and 'chenkadali' was recorded for the highest GL, followed by 'nendran' and 'Robusta'. 'Njali poovan' was recorded for the least GL.

Key words: Glycaemic index, Glycaemic load, Njali poovan, Nendran, Poovan, Chenkadali, Robusta

Introduction:

Glycemic index is a classification of the blood glucose raising potential of the carbohydrate portion of foods. It is defined as the incremental blood glucose area under the curve following a test food, expressed as the percentage of the corresponding area following a carbohydrate equivalent load of a reference food [1]. The glycemic index concept was developed in human nutrition in an attempt to characterize foods

according to their postprandial glycemic response rather than their chemical composition [2]. The glycemic effect of a food in humans is influenced by the nature of the starch granules, the type of carbohydrates, the physical form of the food and processing [3]. Foods that score higher than 70 are considered to be high glycemic index foods. High glycemic index foods may give acute satiety, give a fast burst of energy, but then lead one to feel hungry and lethargic shortly later. Examples of

high glycemic index foods include; glucose, bread, potato, rice, watermelon etc. Foods with scores 55-70 are regarded as moderate glycemic index foods. Examples include; sucrose, soft drinks, banana, mango etc. Foods with scores below 55 are regarded as low glycemic index foods. Low glycemic index foods raise blood sugar slowly and steadily, giving one a longer feeling of being full and continuous energy. Examples include; pulses, fructose, milk, apple, orange etc [4].

Glycemic index is an important tool used in treating people with diabetes and in weight loss programs. Low glycemic index foods, by virtue of the slow digestion and absorption of their carbohydrates, produce a more gradual rise in blood sugar and insulin levels and are increasingly associated with health benefits. Low glycemic index foods have thus been shown to improve the glucose tolerance in both healthy and diabetic subjects [5]. Glycemic load of a given weight of food is the weight of glucose, which would raise blood glucose by the same amount as that amount of food. Glycemic load is calculated by multiplying the glycemic index of a food by the amount of percent carbohydrates contained in a typical serving of that food [6]. Foods having glycemic load of 20 or more are called high glycemic load foods, those having glycemic load of 11-19 are called medium glycemic load foods and those having glycemic load of 10 or less are called low glycemic load foods. Decreased postprandial glucose concentrations and diets with a low glycemic load are associated with reduced risk for cardiovascular disease, diabetes and some forms of cancer. In addition, generally, low carbohydrate or low glycemic load diets result in greater weight loss than high carbohydrate diets over periods of 3-6 months and have a favorable effect on Triglyceride, HDL and Cholesterol [7]. Hence, from diabetes per se, low glycemic index foods and low glycemic load foods are more favourable and need of the day. As some foods naturally have more of simple sugars and as if they are consumed by diabetics may shoot up their blood sugar instantly. Particularly some of the fruits are regarded as such food items which can easily increase the blood sugar.

Generally as all the Diabetics are fond of some fruits but reluctant to have some, especially Banana. Hence, in the present study an effort has been taken to explore the Glycemic Index and load of the selected varieties of Banana which are widely consumed by Non-diabetics in Kerala.

Though the selected varieties of Banana have been used widely yet there is no affirming data to recommend these varieties of Banana to the diabetics. The present study was undertaken to assess the glycaemic index, glycaemic load and glycaemic response to glucose of selected varieties of bananas.

Materials and Methods

By convenient sampling 20 non-diabetic healthy adult volunteers were selected and the importance of the study was explained to them. They were asked to assemble on a fixed day with empty stomach in the early morning. The fasting blood glucose levels of the volunteers were determined using glucometer and test strips. Fifty grams of glucose was diluted in 150 ml of water and given to them for drinking. The blood glucose levels at fasting state and there after followed by administration of glucose, at 30, 60, 90 and 120 minutes were determined and recorded. With the same volunteers, the study was carried out on the following day. The fasting blood glucose levels were recorded. Instead of glucose, the previously fixed portion of selected banana variety containing 50 grams of carbohydrate was fed. The blood glucose levels were also determined as given above and recorded.

Using these values, the Glycemic index of the recipe was determined using the standard formula given by Jennie Brand Miller, 2004 [8].

$$\text{Glycemic Index} = \frac{\text{Incremental area under the 2 hours blood glucose curve after eating of carbohydrate from test food.}}{\text{Incremental area under the 2 hours blood glucose curve after taking of reference food (glucose in water)}} \times 100$$

The Glycemic index values were used to calculate the Glycemic load. The GL is calculated using the formula:

$$\text{Glycemic Load} = \frac{\text{GI} \times \text{Available carbohydrate content per serve size}}{100}$$

The Glycemic load was calculated using the value of Glycemic index and the available carbohydrate content in one serving of the food. Then the data collected were analysed using independent 't' test tool of SPSS 16 version.

Results and Discussion

The collected data were consolidated systematically, tabulated methodically and analyzed statistically to arrive at concrete results. The ultimate results obtained are presented coherently and discussed under the following headings:

- **Glycemic Index of selected food items**
- **Glycemic Load of selected banana varieties**

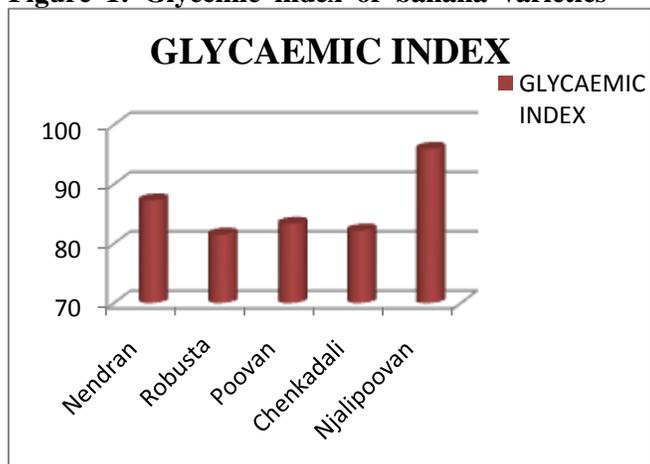
Glycemic index of selected food items

Glycaemic index is a numerical system of measuring how much of a rise in circulating blood sugar that the carbohydrate triggers. The higher the number, the greater the blood glucose response. David Mendosa(2003) [9], gave a special classification of foods based on their respective GI Values as follows:

Table 1: Classification of glycaemic index

Range of GI	Category
1 -55	Low GI
56 – 69	Medium GI
70 – 100	High GI

Figure 1: Glycemic index of banana varieties



The above figure represents the glycaemic index of the selected banana varieties. All of the varieties come under the ‘high GI’ category. Among those varieties, ‘njalipoovan’ was recorded for the highest GI value (95.98). followed by ‘nendran’ and then ‘poovan’. ‘Robusta’ had the lowest GI value when compared with other varieties of banana.

Glycemic load of selected banana varieties

The concept of Glycemic load (GL) is defined as the product of the GI and available

carbohydrate content divided by 100 and was introduced to derive a global estimate of post prandial glycemia and insulin demand [10]. David Mendosa (2003) gave a special classification of foods based on their Glycemic loads as follows [9].

Table 2: Classification of glycaemic load

Range of GL	Category
1 – 10	Low GL
11 – 20	Medium GL
20 and more	High GL

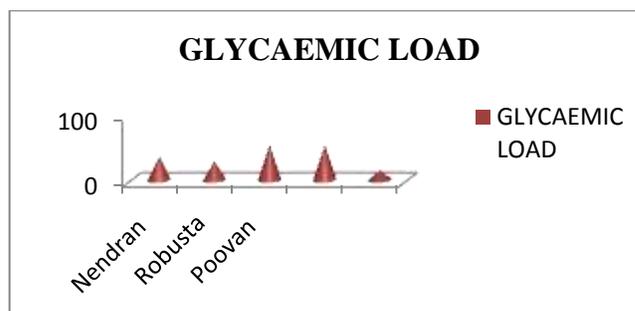
Source: www.mendosa.com

Table 3: Glycemic load of selected banana varieties

S.No.	Name of the food item	Glycemic Index (GI)	Nominal serving size (gm)	Available Carbohydrate (gm)	Glycemic Load (GL)
1	Nendran	87.29	173.3	40.8	35.6
2	Robusta	81.55	135	34.6	28.2
3	Poovan	83.36	128.3	28.4	53.4
4	Chenkadali	82.23	223.3	64.98	53.4
5	Njalipoovan	95.98	48.3	15.2	14.6

Out of the total 5 banana varieties studied, Njalipoovan had Medium GL, whereas, 4 other varieties namely, Nendran, Robusta, Poovan and Chenkadali had high GL of 35.6, 28.2, 53.4 and 53.4 respectively.

Figure 2: Glycemic load of selected banana varieties



Discussion

The glycemic index (GI) was introduced by Jenkins et al (1981) [2] to assess the rise in plasma glucose after consuming a particular food. Actually the GI was conceptualized in order to help diabetes choose foods with a low GI [11]. Generally fruits have a lower GI even though they are sweet to taste [2, 4]. Jenkins et al (2011), have also stated that fruits in general have a glycemic index (GI) that ranges from 56 to 103 GI units (on the bread Scale) [12]. The present study has focussed on GI and GL of few selected variety of Indian banana. However, all the banana varieties fell under only high glycemic index range and correspondingly their glycemic load too. In contrary to high glycemic index of njali poovan its glycemic load was comparatively low. This may be attributed to their low carbohydrate content of the given nominal serving size and plausibly due to their stage of ripening. Though the glycemic index and load of these banana varieties have been studied, yet there was no assessment on their stages of ripening was taken into account. Conversely the state of ripening may also make the complex sugar to an easily digestible simple sugar and thereby increase the glycemic index. Hence, this concern on degree of ripening was not considered which stands to be a draw back in the present study. Only the fruits were procured as it is available and for further clarity on glycemic index, age matched or degree of ripening matched varieties of banana may yield even more valid results. Similarly in the present study, the fruits were not administered for 50g carbohydrates content rather it was measured as actual weight of one fruit which otherwise would become tedious to cut the fruit for exactly 50g of carbohydrate. Hence, an average size was considered to be the nominal serving size and accordingly the fruits were trimmed for the even size and administered. This may be yet another drawback in arriving at the right result. May be this procedure could have also let to a high glycemic index. However, in the present study, it is very well understood that none of the banana varieties namely 'Njali poovan', 'nendran', 'poovan', 'robusta' and 'chenkadali' were found to be suitable for consuming any diabetics as all varieties fell under high glycemic index categories.

Conclusion

As India ranks first with high prevalence of diabetes, which paves way for other dreadful complications, "Prevention and Control of diabetes" in the present scenario is very crucial to protect and improve the health status of our population. For a perfect Glycemic control in diabetics, persons with impaired glucose tolerance and those who are health conscious, right choice of foods with low Glycemic Index (GI) and low Glycemic Load (GL) is mandatory.

From the study it can be concluded that 'njali poovan' had a highest GI and the least GL. Those who are diabetic, they should reduce the frequency of consuming 'njali poovan' and they can include the variety, 'robusta' in their day-to-day life, as it has a low GI compared to other varieties. However, diabetics have to be self conscious though 'robusta' variety is far better yet it also falls under high glycemic index category. Further, other varieties of bananas may also be explored for their GI and found whether they are suitable for diabetics.

Source of Funding: Nil

Source of Conflict: None

Acknowledgement

Authors acknowledge the immense help received from the scholars whose articles are cited and included in references of this manuscript. The authors are also grateful to authors/ editors/ publishers of all those articles, journals and books from where the literature for this article has been reviewed and discussed.

References

1. Bjorck, I.M.E., H.G.M. Liljeberg and E.M. Ostman, 2000. Low glycemic-index foods. *Br. J. Nutr.*, 83: 149-155.
2. Jenkins, D.J., T.M. Wolever, R.H. Taylor, H. Barker, H. Fielden and J.M. Baldwin, 1981. Glycemic index of foods: A physiological basis for carbohydrate exchange. *Am. J. Clin. Nutr.*, 34: 362-366.
3. Wolever, T.M., 1990. The glycemic index. *World Rev. Nutr. Diet.*, 62: 120-185.
- Foster-Powell, K., S.H. Holt and J.C. Brand-Miller, 2002. International table of glycemic index and glycemic load values. *Am. J. Clin. Nutr.*, 76: 5-56.

4. Foster-Powell K, Holt SHA, Brand-Miller JC. International table of glycemic index and glycemic load values: 2002. *Am J Clin Nutr.* 2002;76:5–56.
5. Jenkins, D.J.A., T.M.S. Wolever, G. Buckley, K.Y. Lam, S.Giudici and J. Kalmusky, 1988. Low-glycemic-index starchy foods in the diabetic diet. *Am. J. Clin. Nutr.*, 48: 248-254.
6. Salmeron, J., J.E. Manson, M.J. Stampfer, G.A. Colditz, A.L. Wing and W.C. Willett, 1997. Dietary fiber, glycemic load and risk of non-insulin-dependent diabetes mellitus in women. *JAMA.*, 277: 472-477.
7. Stern, L., N. Iqbal, P. Seshadri, K.L. Chicano, D.A. Daily, J. McGrory, M. Williams, E.J. Gracely and F.F. Samaha, 2004. The Effects of Low-Carbohydrate versus Conventional Weight Loss Diets in Severely Obese Adults: One-Year Follow-up of a Randomized Trial. *Ann. Int. Med.*, 140: 778-785.
8. Jennie Brand Miller, Kaye Foster Powell and Stephen Colaguri (2004) “The GI solution for millennium for health, the new glucose revolution” :P278 – 290 Kaveri, N., Madanmohan, A.A., and Veena, N. (2004) “Cardiovascular autonomic dysfunction in type 2 diabetics diagnosed within 6 months”. *Postgraduate Med*, 50 (3):233.
9. David Mendosa. *Insulin Index*. July 13, 2003. *Mendosa.com*. Retrieved 2012-08-01.
10. Higginbotham S, Zhang ZF, Lee IM, Cook NR, Buring JE, Liu S. Dietary glycemic load and breast cancer risk in the Women's Health Study. *Cancer Epidemiol Biomarkers Prev.* 2004;13(1):65-70.
11. Jenkins DJ, Wolever TM, Jenkins AL, Thorne MJ, Lee R, Kalmusky J, et al. The glycaemic index of foods tested in diabetic patients: a new basis for carbohydrate exchange favouring the use of legumes. *Diabetologia.* 1983;24:257–64.
12. D.J.A.Jenkins, K.Srichaikul, C.W.C. Kendall, J.L.Sievenpiper, S.Abdulnour, A. Mirrahimi, et al. The relation of low glycaemic index fruit consumption to glycaemic control and risk factors for coronary heart disease in type 2 diabetes, 2011 Feb;54(2):271-9.