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Glycemic Index and Glycemic Load of Traditional Rice Flakes (Salem District) of Tamil Nadu

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ABSTRACT: Now a days traditional rice varieties are gaining important because of its therapeutic value. The traditional rice varieties have low glycemic index. This study aimed to analyse the glycaemic index and glycaemic load of rice flakes from traditional rice variety of Salem District, Tamil Nadu. The traditional varieties of Salem District, mapillai samba and kavuni rice were selected and converted in to flakes and compared with milled rice flakes. The Glycemic Index (GI) and Glycemic Load (GL) were determined in all rice flakes. For the study, 15 non diabetic subjects were selected. Rice flakes were given as a test food and compared with control (glucose). The IAUC method was applied for blood glucose level method for every 30 minutes interval up to 1 ½ hour. For statistical analysis of the glycaemic index and glycaemic load data paired T-test were used. The results showed that milled, mapillai samba and Kavuni rice flakes had glycaemic indexes of 75, 71.2 and 63.3 and glycaemic loads of 44, 33 and 32 respectively. The study conclude that the traditional rice varieties have low GI and GL and slowly increase the blood sugar level compared to milled rice flakes. Both flakes prepared from Mapillai samba and Kavuni rice flakes can be recommended as snacks for the type 2 diabetic patients.

Keywords: Glycemic Index, Glycemic Load, Traditional Rice Flakes, Diabetes mellitus,

INTRODUCTION

Diabetes mellitus (DM) is a disease characterized by hyperglycaemia that occurs due to abnormal insulin secretion, abnormal insulin action, or both. Type 2 DM is progressive; thus, blood glucose control is needed as an effort to prevent the risk of complications (Franz, 2012). Besides pharmacological therapy, non-pharmacological therapy through dietary adjustment is effective to control blood glucose levels, lipid profile, and blood pressure in people with type 2 DM. The dietary adjustments using a small portion size and frequent eating are needed to maintain blood glucose stability (Riccardi, 2008). Foods with a low glycaemic index (GI) will maintain blood glucose. Glucose level in the blood is reduced and sensitivity of insulin by the cells increased when intake of high-fiber, high-amylose, and low-GI foods and it is useful for blood glucose control; thereby, reducing the risk of complications in people with type 2 DM (Arif *et al.,* 2013). Low Glycemic Index and glycemic load (GL) were good control over to obesity, also for degenerative diseases like diabetes and coronary heart disease (Augustin *et al.,* 2015). Insulin resistance by the cells occurred by consumption of high carbohydrate foods over a long run Schulze, (2004) study revealed that there is direct proportional to consumption of low glycaemic index foods and lower chance of Non-Insulin Diabetes Mellitus (NIDM), Similarly, there is less chance of insulin insufficiency, which leads the metabolic syndrome (McKeown, 2004).

Rice (*Oryza sativa* L.) is highly consumed in India especially south India. Rice is a major cereal food crop and staple food in most of the developing countries. India ranks second in the production of rice. There are 40,000 varieties of rice are said to exist, at present, only a few varieties are cultivated. The Indian people especially south Indian are rice eaters and 75% of the energy comes from rice-based foods (Raghuvanshi *et al.,* 2017). Study conducted by Sun *et al.,* (2010) rice plays an important role in the dietary pattern of South Indians. During digestion of food, the carbohydrates are converted in to simple sugars and easily increase the sugar level in the blood (Robert and Ismail 2012; Septianingrum *et al.,* 2016). Due to the type of rice varieties, processing steps involved and its other constituents (Foster-Powell *et al.,*1992; Saragih *et al.,* 2013). In addition to starch other chemical constituents like fibre and resistant starch may have an effect on glucose level (Widowati *et al.,* 2006; Alsaffar, 2011;

Syahariza *et al.,* 2013; Mir *et al.,* 2013; Umar *et al.,* 2018). Traditional rice varieties such as red kavuni rice release the glucose slowly and has low glycaemic load (Anitha *et al.,* 2017). Rice can be eaten as such or it can be converted in to value added products. One of such products is flakes. Flakes are also converted in to upma (savoury) and consumed for breakfast.

MATERIALS AND METHODS

The study was done at Salem District. Traditional rice varieties like Mapillai samba, kavuni and milled rice were selected and converted in to rice flakes. The rice flakes were taken for the test.

A. Blood sampling and analysis

The IAUC procedure was used for Glycaemic Index. The test was carried out in fifteen non diabetic subjects (panamarathupatti block, Salem District), who were previously asked to fast (except plain water) for 10-12 hours before the test. So, the tests were carried out in the morning as the subjects were in empty stomach. The fasting blood glucose (FBG) was then measured. The subjects were then asked to consume the test foods (flakes made of milled rice, Mapillai samba rice and red Kavuni rice) equivalent to 50 g of carbohydrate and control food (glucose). The gap between each treatment were fifteen days to avoid bias-based error. The subjects' blood samples (1-2 µL) were taken every 30 minutes (at 30, 60, 90, and 120 minutes) using a blood glucose test device AccuChekBlood Glucose Monitoring System. The time interim was plotted X-axis and blood glucose levels plotted in Y axis in a graph sheet. The Glycaemic Index was calculated by comparing the three types of rice flakes to a standard (pure glucose), and the results were then averaged.

The Glycaemic Index (GI) using the given formula:

$$\text{GI food} = \frac{\text{IAUC in response to relevant test food portion}}{\text{IAUC in response to equal weight of Reference food (glucose)}} \times 100$$

Glycaemic load: Glycaemic load is obtained by multiplying the glycaemic index by total carbohydrate of one serving of the test food divided by 100.

B. Statistical analysis

ANOVA was used for statistics. Significance was referred as 0.05% based on blood glucose level.

RESULTS AND DISCUSSION

The Glycaemic Index is a ranking system It does not related to the chemical constituents present in the food item but it links with nutrients and showed the response in blood.The blood glucose level of fifteen volunteers are systemized in the Table 1. The results showed that the highest levels of glucose occurred inreference (pure glucose) followed by milled rice flakes, mapillai samba and red kavuni rice flakes respectively. Statistical data revealed that Glycaemic index number was calculated depending on blood glucose level of test food with reference. The results depicted that any food item showed the raised blood glucose, it has high GI and vice versa also takes place in low GI foods. The low GI food has effect on Non-Insulin Dependent Diabetes Mellitus (NIDDM) and can control it too by slow release of glucose in blood. Similar findings were observed by Gilbertson *et al.,* (2001) in diabetic patients. This study also revealed that rice-based foods have broad scale of Glycaemic Index, from low to high based on the variety, chemical constituents and processing methods (Miller *et al.,* 1992; Foster Powell *et al.,* 2002), especially milled rice showed a vast range of GI from 54 to 121 mg/dL (Miller *et al.,* 1992).

Table 1: Blood Glucose level (mg/dl) after consumption of three traditional varieties of Salem District.

Sample	Time of taking blood (minutes)				
	0	30	60	90	120
Glucose	84.5±2.4[a]	157.6±4.2[a]	152.6±2.0[a]	121.9±2.6[a]	86.1±2.6[a]
Milled rice flakes	86.1±2.6[a]	108.3±4.2[c]	99.2±4.8[c]	92.5±2.8[c]	89.2±2.6[a]
Mapillai samba flakes	82.4±4.2[a]	109.3±2.4[c]	95.2±1.8[c]	89.3±2.2[c]	86.3±2.8a
Red kavuni rice flakes	84.0±2.0[a]	100.5±6.4[c]	87.4±2.2[d]	88.1±4.2[c]	85.6±4.4[a]

Values are mean ± standard deviation. Value represents the average of three replicates.

A. Glycaemic index and glycaemic load

The glycaemic index and glycaemic load profile of flakes from three different rice of Salem District are given in the Table 2. Milled rice flakes (75) had the highest of glycaemic index followed by Mapillai samba flakes (71.2) and red kavuni rice flakes (63.3) and glycaemic load at 44, 33 and 32 respectively. The lowest of glycaemic index and the glycaemic load was observed in red kavuni rice flakes. Similar results were observed in black rice by Paiva *et al.,* (2014) and Rohman *et al.,* (2014). Glycaemic index (GI) and glycaemic load are affected by factors processing (Astawan *et al.,* 2011; Saragih *et al.,* 2017), and starch content (Miller *et al.,* 1992; Gilbertson *et al.,* 2001; Yogyakarta Hu *et al.,* 2004; Robert *et al.,* 2012). A study conducted by Srinivasan Bharath Kumar and

Pichan Prabhasankar (2005) exhibited that the noodles had a low GI which were added with rajma, whole guar and guar seed powder at different proportions compared to control noodles. The results were on par with this study.

Table 2: Glycaemic Index and Glycaemic Load (GL) of three rice samples.

Sample	Glycaemic Index (GI)	Glycaemic Load (GL)
Glucose	100	50
Milled rice flakes	75	44
Mapillai samba flakes	71.2	33
Red kavuni rice flakes	63.3	32

CONCLUSION

This present study conveyed that the rice flakes prepared from traditional rice varieties especially red kavuni rice flakes released the blood sugar level slowly compared to milled rice flakes. All three rice flakes had less GI than control. So, this may very useful for an individual who are obesity and onset of diabetes. It is also increasing the ability of the cells to take up insulin. Based on this study other traditional rice varieties may be determined for its glycaemic index and glycaemic load.

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