Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

J P P Journal of Pharmacognosy and Phytochemistry

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(2): 694-696
Received: 17-01-2018
Accepted: 19-02-2018

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Assessment of glycemic index and correlation with *In-vitro* digestibility of "Instant wheat rice pulav mix" developed by bambino industries

Sujatha Vicharapu and Supraja Thomati

Abstract
Glycemic Index GI has recently gained attention as a possible tool for controlling appetite and managing weight and blood glucose levels. The current study was undertaken to determine the GI value of pulav mix that is commercially available in India.
Glycemic index was calculated using glucose as the reference. The instant wheat rice pulav mix was fed to 20 selected subjects and their blood sugar responses are measured using standard blood glucose meter (One Touch Horizon) to see the effect of the test food on release of glucose. The blood sugar response to pulav mix is then compared with their response to eating pure glucose.
There was a significant elevation in the post-prandial blood glucose levels upon the consumption of standard glucose and Pulav mix (t value: 4.109; $p<0.001$), but the elevation was more pronounced with the administration of standard glucose when compared to Pulav mix. Further the post-prandial blood glucose levels were lower in different time intervals with the administration of Pulav mix ($p<0.05$). Thus the mean iAUC of Pulav mix (20.90) was found to be lower when compared to standard food (37.20). The in-vitro digestibility of the test meal was conducted by using enzymatic method. The in-vitro digestibility of the test meal was found to be 68 which was within the range of medium GI.
Thus the test meal which can be classified as medium glycemic food is suitable breakfast item for diabetic patients, patients with coronary heart disorders and a good breakfast for reducing weight.

Keywords: glycemic index, glucose, pulav mix, post-prandial blood glucose levels, *in-vitro* digestibility

1. Introduction
The GI ranks carbohydrate foods based on the increases in blood glucose levels they produce when eaten. An understanding of the GI values of food or beverage can help dieticians to create and direct consumers to choose sensible, low GI foods that are believed to "reduce the risk of developing type 2 diabetes, CHD and obesity".
The glycemic index was developed by researchers from the University of Toronto approximately thirty years ago, and was primarily used as a tool for diabetics looking to control their blood glucose (blood sugar) levels (DJ Jenkins *et al*., 1981) [1]. Today, many other non diabetic individuals are also using this index as a way to choose foods to eat for health, weight loss and performance. Glycemic index is a numerical ranking of carbohydrate-containing foods based on their potential to raise blood sugar levels. Carbohydrates that are high on the glycemic index (>70) are quickly digested and absorbed. These carbohydrates tend to cause a rapid rise in blood glucose and in most cases a quick rise in insulin. Conversely, carbohydrates that are low on the glycemic index (~55 and below) are more slowly absorbed and subsequently cause a relatively small increase in blood sugar and insulin. The data on the GI values of different varieties of commercially available snacks/ foods within India is very limited. In view of this background, the current study was undertaken to determine the GI value of pulav mix that is commercially available in India.

2. Materials and Methods
Subjects: Twenty healthy subjects (10 male and 10 female) were selected for the study. Subjects were moderately active, non-smoking and non-alcoholics. Exclusion criteria were as follows:
Age - <18 or >55 years;
BMI <18 or >25 kg/m2;
Fasting blood glucose value <80>120 mg%

(Mean age of the subjects was 37.3 (±5.5) years and mean BMI was 21·3 (±3·6) kg/m2). The selected subjects had no past history of any illness, cold, cough, allergy, inflammation and

were not on any medication. Subjects were given full details of the study protocol and had opportunity to ask any doubts / questions on the protocol.

A written informed consent was obtained from each of the participant prior to participation in the study.

The protocol used was in line with the procedures recommended by the Food and Agriculture Organization/ World Health Organization (FAO/ WHO, 1998) [2] To determine the GI of a food, tests should be repeated in six or more subjects, thus in the present study twenty subjects were selected to determine the GI of the Pulav mix. On the day prior to the test, subjects were asked to restrict their activities and not to eat or drink after 21.00 hours the night before the test, although water was allowed.

Test food pulav mix containing 66 grams of carbohydrate (a total of 100 grams of Pulav mix was taken so that the total carbohydrate is reached to 66 g). The standard food consisted of 66 g of glucose. Glucose tolerance test (GTT) was performed as follows. After an overnight fasting (8-12 hrs), the fasting blood sample was collected and the subjects were asked to consume 66g of glucose which served as standard food. A fasting capillary blood sample was taken at 0 min and the standard food/ or test food was consumed immediately after this. Further blood samples were taken at 15, 30, 45, 60, 90 and 120 min for estimation of the blood glucose by using a standard blood glucose meter (One Touch Horizon) which served as Glucose Tolerance Test (GTT). The subjects were instructed to consume normal diet for the next three days and the test food was given to the subjects to see the effect of the test food on release of glucose. Further blood samples were taken at 15, 30, 45, 60, 90 and 120 min for estimation of the blood glucose by using a standard blood glucose meter (One Touch Horizon). The area under curve for the test food was estimated.

2.1 *In-vitro* digestibility of test meal

The in-vitro digestibility of the test meal was conducted by using enzymatic method [4]. The test sample was dissolved in maleate buffer (pH 7.0). Pancreatin from porcine pancreas (Sigma-Aldrich, Ref. P 7545) was added. The blend was incubated for 30 min at 37^0C. After this time, an intestinal acetone powder from rat intestine (Sigma-Aldrich, Ref. I 1630) was added and the incubation continued for another 3 hrs 30min. Samples were taken at different times. The free glucose content was measured by colorimetry. The digestion process was evaluated by calculation and expressed as percentage of released glucose, related on the dry substance of the test material. Maltose served as a standard for comparison and water as control.

2.2 Calculation of GI

The incremental Area Under the Curve (iAUC), ignoring the area beneath the baseline, was calculated geometrically for the standard and test food. The iAUC for each subject was expressed as a percentage of the mean iAUC for the standard food taken by the same subject. The mean Glycemic Index (GI) of Pulav mix was calculated for the whole group. Statistical analysis was performed using SPSS. Statistical significance was set at $p< 0{\cdot}05$.

3. Results and Discussions

The mean blood glucose values upon the consumption of test and standard food are given in Table 1 and Fig. 1.

Table 1: Mean blood glucose concentration in subjects after oral administration of glucose (GTT) and Test meal (TM)

	Blood glucose concentrations (mg%)							Mean AUC	GI
Time interval	0	15	30	45	60	90	120		
Glucose (66g)	90	128	160	144	129	115	94	20.90	56
Pulav Mix (66g CHO)	81	101	115	108	103	99	92	37.20	

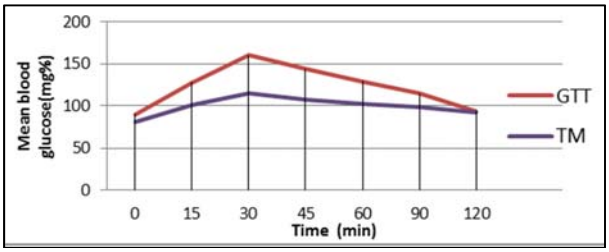

Fig 1: Mean blood glucose concentration in healthy human subjects after oral administration of glucose (GTT) and Test meal (TM).

There was a significant elevation in the post-prandial blood glucose levels upon the consumption of standard glucose and Pulav mix (t value: 4.109; $p<0.001$), but the elevation was more pronounced with the administration of standard glucose when compared to Pulav mix. Further the post-prandial blood glucose levels were lower in different time intervals with the administration of Pulav mix ($p<0.05$). Thus the mean iAUC of Pulav mix (20.90) was found to be lower when compared to standard food (37.20). The mean GI value of the Pulav mix was found to be 56 with a range of 40- 77. The changes in blood glucose levels were lower upon the administration of Pulav mix when compared to standard glucose. For practical measures, GI values are often grouped into categories as producing either a low, medium or high glycemic response. The cut off values are as follows: low <55; medium 56–69 inclusive; high >70.7. Thus the Pulav mix can be grouped under medium glycemic food. The in-vitro digestibility of the test meal was found to be 68. The carbohydrate content of the sample was 66g.

Pulav mix contained 66 g of carbohydrates per 100 g of serving size. International table of glycemic index and glycemic load values, mentioned wide variety of foods with different GI values and have classified foods into low, medium and high GI foods (Foster –Powell, *et al*.,2002)[3]. With reference to these values the present test meal was classified as medium GI food with value of 56.with a range of 40-77. The *in-vitro* digestibility of the test meal was found to be 68 which was within the range of GI.A comparison of the test product with a standard carbohydrate indicates that the Pulav mix exhibits medium-glycemic response. Therefore it is clear that the glycemic index of the test meal is classified as medium and can be a suitable breakfast item for diabetic patients, patients with coronary heart disorders and a good breakfast for reducing weight.

4. Conclusion

The results presented in the current report provide the scientific basis of the glycemic response of Pulav mix. Considering the widespread consumption of snacks in India, it is useful to have information regarding the glycemic response

of Pulav mix. Identification of Pulav mix and other foods with lower glycemic responses will have practical applications because such information will be useful for diabetic patients. The availability of low GI foods / snacks in the Indian market is anticipated to benefit many diabetic patients and also in better management/prevention of chronic diseases like obesity and CHD.

5. References

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