

Glycemic Index of Different Rajasthani Diets in Diabetic Patients and Healthy Controls and Effect of Psyllium Supplementation on Glycemic Response

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Abstract

Disease like diabetes is continuously spreading in the population. There has been substantial evidence regarding the health promoting impacts of different Rajasthani diets. The beneficial effect of these diets in the management of type II diabetes has not been totally demonstrated. The purpose of this study was to determine glycemic index (GI) of various Rajasthani diets and to evaluate effect of psyllium husk on their glycemic response. Ninety six, non-diabetic volunteers and ninety seven, diabetic patients consumed reference (glucose) and test foods missi roti (diet -1), missi roti with psyllium husk (diet- 2), bajra roti (diet -3) and bajra roti with psyllium husk (diet -4) providing 50 g of available carbohydrate. Finger pricked capillary blood samples from the fasting subjects were collected at 0, 30, 60, 90 and 120 min from the start of each food. For test foods, the incremental area under the curve was calculated and GI values were determined. It was found that in diabetic patients missi roti with GI 43.1 ± 7.1 , and missi roti with psyllium husk with GI 35.7 ± 8.0 fell under the category of foods with low GI with $p < 0.0001$ (HS). In diabetic patients bajra roti has GI 56.0 ± 5.0 and bajra roti with psyllium husk with GI 47.5 ± 5.5 low or medium GI with $p < 0.0001$ (HS). Similarly in healthy subjects missi roti has GI 35.2 ± 3.5 and missi roti with psyllium husk has GI 30.1 ± 4.2 fell under the category of foods with low GI with $p < 0.0001$ (HS). In healthy controls bajra roti has GI 56.7 ± 5.2 and bajra roti with psyllium husk with GI 49.0 ± 5.6 , low or medium GI with $p < 0.0001$ (HS). Our results demonstrate values of glycemic indices for Rajasthani diets and evaluate effect of psyllium husk on glycemic response, addition of 5 gm of psyllium husk to test diets significantly decrease the value of glycemic index in both the groups.

Keywords: Glycemic index, Missi roti, Bajra Roti.

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Introduction

Nutritional management of diabetes is the improvement of glycemic control by balancing food intake. Several attempts have been made to control the glycemic response of food, particularly to food rich

in carbohydrates. Jenkins et al described the concept of glycemic index which classifies the glycemic response to various carbohydrate containing diets [1]. The low glycemic index foods are known to produce

less postprandial hyperglycemia and hyperinsulinemia than high glycemic index foods [2].

Effect of Missi Roti on Glycemic Response

Missi roti flour (wheat flour + chick pea flour), Partial replacement of wheat flour by chickpea flour due to their amino acid composition and fibre content enhance the nutritional value of food and palatability, and lower down the glycemic response [3]. Glycemic index of chickpea flour bread containing barley flour was significantly less than control flat bread made without any addition of chickpea flour [4]. Pasta added with chickpea flour might be a dietetic alternative for people with low-calorie requirements [5,6].

Pearl Millet in Management of Diabetes

Pearl Millet (*Pennisetum glaucum*) is receiving increasing spotlight in combating diabetes as a dietary option [7]. Indeed, there are evidences to support that millet have many properties making it a good dietary option for diabetics. Millet protein can increase insulin sensitivities, and reduce blood glucose level as well as triglyceride level [8]. These play a substantial role in prevention of many human illnesses such as NIDDM, cancer, cardiovascular, and neurodegenerative diseases [9]. Patients with NIDDM fed with foxtail millet for 90 days showed improved glycaemic control as well as other improvements [10].

Health Benefits of Psyllium Husk

Psyllium seeds from the *Plantago ovata* belong to the plantaginaceae family; contain 10–30% mucilage. Psyllium is a common ingredient in over-the-counter bulk laxative products and has been used traditionally for constipation, diarrhoea, haemorrhoids, irritable bowel syndrome, weight loss, obesity, high cholesterol and diabetes [11]. Fiber improves the control

of blood glucose and delays glucose absorption and hyperinsulinaemia [12,13].

Effect of Psyllium on Glycemic Response

Studies on the effect of *P. ovata* husk in patients with NIDDM found that it can reduce the postprandial rise of glucose and insulin levels significantly [14]. It delayed gastric emptying and reduced colon transit time in man [15]. Supplementation of the diet with soluble fibre or consumption of a high-fibre diet has been shown to lower total serum cholesterol and triacylglycerol in type 2 diabetic patients [16]. Psyllium as soluble fibre has also improved blood sugar levels in some people with diabetes [17]. Supplementation with psyllium can lower total cholesterol (TC), and LDL-C, Levels of HDL-C were shown to increase by psyllium supplementation [18]. The soluble fiber component of psyllium is believed to account for this effect, In Iranian folk medicine, there is a report on anti-diabetic effect of psyllium. Studies support that psyllium is an effective co-therapy for improving glycemic control in patients being treated for NIDDM [19].

Materials and Methods

Study Design

The study is divided into two phases In Phase 1 Glycemic Indices of diets were determined, In Phase 2 effect of Psyllium Husk on Glycemic response of diets evaluated.

Participants

The study was conducted on 193 subjects of 21 - 50 year of age of either sex; out of which 96 were healthy subjects and 97 were the patient of controlled type II diabetes. Patients were excluded from the study if they were receiving insulin, corticosteroids, other soluble fiber treatment, patients with clinically significant renal, hepatic, gastrointestinal disorder, and cancer patients. Subjects with more than 13% HbA_{1c}, Subjects with a history of allergy to psyllium seed, were

also excluded. The study was approved by the Institutional Ethics Committee (IEC) of Jhalawar medical college, Jhalawar, Rajasthan.

Foods Involved in the Study

The reference food taken in the study was glucose (Glucon-D^R). Test diet -1 missi roti and test diet -2 missi roti with Psyllium husk, test diet -3 is bajra roti and test diet -4 is bajra roti with psyllium husk. Deer brand sat isabgol is used for psyllium husk.

For reference food 50 gm glucose dissolved in 250 ml of water and asked to drink within 15 minutes. For phase I, test diets Dough were prepared with appropriately weighed flours and chapattis were prepared. These chappatties were served with kainth chutney to enhance palatability. For phase II study the same diets were given with 5 gm of psyllium husk.

Interventions

In this case control study glycemic response of missi roti and bajra chapatti for healthy person and diabetic patients measured with and without psyllium husk. All participants completed a consent form, and all of them had been given diet counselling, all participants were evaluated for blood sugar level for consecutive three days. Day first, 50 gm of glucose in 250

ml water was given to the volunteers, Day second, The test food missi roti /bajara roti were given to the same volunteers after they have been in fasting mode for at least 10-12 hours, Day third, The test foods with 5 gm psyllium husk was given to the same volunteers. A capillary blood sample was taken daily in the fasting state (00 min) and at 30 min, 60 min, 90 min and 120 min. after consuming each sample was analyzed using glucometer "On Call Plus" and strips to produce a graph of glucose levels over time.. Incremental area under curve (IAUC) for a given time-period can be calculated in accordance with the method recommended by (Wolver et al. 2004). Glycemic index calculated as per the formula.

Glycemic index = $\frac{\text{IAUC of 50g test carbohydrates}}{\text{IAUC of 50g reference carbohydrate}} \times 100$

Statistical Analysis

Analysis of data was done by using SPSS software (version 23.0), unpaired – t test, ANOVA, post hoc test were used in data analysis. The data in the study was expressed as mean \pm SD, and p value < 0.05 was considered as statistically significant. To compare the change in glycemic response in consecutive 3 days, unpaired Student's t-tests, was used.

Results

Table 1: Comparison of GI of Rajasthani diets in case and control group

Deits	GI case	GI control	Statistical significance
Missi Roti	43.1 \pm 7.1	35.2 \pm 3.5	p< 0.0001 (HS)*
Missi Roti with psyllium husk	35.7 \pm 8.0	30.1 \pm 4.2	p< 0.0001 (HS)*
Bajra Roti	56.0 \pm 5.0	56.7 \pm 5.2	p = 0.485 (NS)**
Bajra Roti with psyllium husk	47.5 \pm 5.5	49.0 \pm 5.6	p = 0.183 (NS)**

* Highly significant ** Not significant

Comparison of Glycemic Indices in cases and controls were statistically analyzed using unpaired – t test. The mean Glycemic Index in Diabetic patients after

missi roti was found to be (43.1 \pm 7.1) low GI. The mean Glycemic Index in healthy controls after missi roti was found to be (35.2 \pm 3.5) low GI. Statistical analysis

showed that $p < 0.0001$ (HS) therefore the difference in Glycemic index after both groups were statistically significant. The glycemic indices in cases and controls was statistically analyzed using unpaired – t test. The mean Glycemic Index in Diabetic patients after missi roti with Psyllium Husk was found to be (35.7 ± 8.0) low GI. The mean Glycemic Index in healthy controls after missi roti with Psyllium Husk was found to be (30.1 ± 4.2) Low GI. Statistical analysis showed that $p < 0.0001$ (HS) therefore the difference in Glycemic after Kuttu Chapatti with Psyllium Husk both groups were statistically significant.

Glycemic Indices in cases and controls were compared statistically. it was found that the mean Glycemic Index in Diabetic patients after bajra roti was found to be (56.0 ± 5.0) medium GI. The mean

Glycemic Index in healthy controls after bajra roti was found to be (56.7 ± 5.2) medium GI. Statistical analysis showed that $p = 0.485$ (NS) therefore the difference in Glycemic index after both groups were statistically insignificant. The mean Glycemic Index in Diabetic patients after bajra roti with Psyllium Husk was found to be (47.5 ± 5.5) low GI. The mean Glycemic Index in healthy controls after bajra roti with Psyllium Husk was found to be (49.0 ± 5.6) low GI. Statistical analysis showed that $p = 0.183$ (NS) therefore the difference in Glycemic after Kuttu Chapatti with Psyllium Husk both groups were statistically not significant. It is evident that addition of psyllium husk lower down the glycemic indices of diets studied.

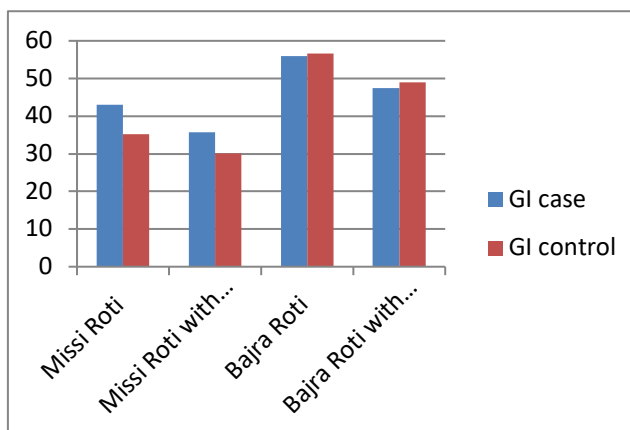


Figure 1: Comparison of GI of different Rajasthani diets in case and control group

Table 2: Effect of psyllium husk on glycemic index of test diets,

Group studied	GI missi roti	GI missi roti with psyllium husk	p value	GI bajra roti	GI bajra roti with psyllium husk	p value
Case	43.1 ± 7.1	35.7 ± 8.0	$p < 0.0001$ (HS)*	56.0 ± 5.0	47.5 ± 5.5	$p < 0.0001$ (HS)*
Control	35.2 ± 3.5	30.1 ± 4.2	$p < 0.0001$ (HS)*	56.7 ± 5.2	49.0 ± 5.6	$p < 0.0001$ (HS)*

* Highly significant

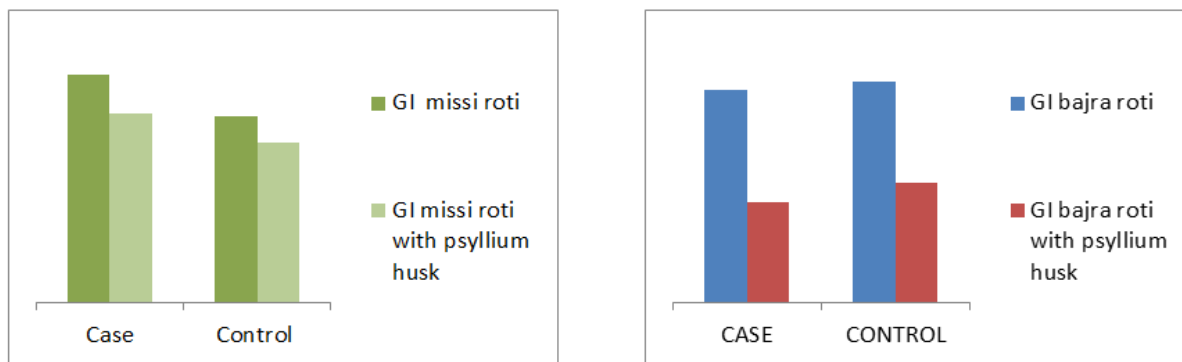


Figure 2: Comparison of effect of psyllium husk on different Rajasthani diets in case and control groups

Glycemic indices of missi chapattis was statistically highly significant with missi chapattis with psyllium husk for healthy subjects ($P < 0.0001$) and for diabetic patients ($P < 0.0001$). Similar results were obtained when glycemic indices of bajra chapatti and bajra chapatti with psyllium husk are compared for healthy subject ($P < 0.0001$) and diabetic patients ($P < 0.0001$).

Discussion:

Table -1 show comparison of GI of missi roti and bajra roti in case and control group similar results were obtained in studies revealed that Glycemic index of chickpea flour-based flat bread (CFB) containing barley flour was significantly less than control flat bread [4,20]. legume proteins are rich in lysine and deficient in sulphur containing amino acids, whereas cereal proteins are deficient in lysine, but have adequate amounts of sulphur amino acids Therefore, the combination of grain with legume proteins would provide better overall essential amino acid balance, helping to overcome the protein calorie malnutrition problem [21]. Comparison of GI of bajra roti in different groups demonstrated in table -1our findings are very close to the studies conducted by Shukla et al (1991) [22]. Since Bajra chapatti has a low glycemic index, bajra becomes a choice of food for diabetic patients [23].

highly significant results were obtained (Table- 2) for both control and diabetic patients for the test foods when compare glycemic responses to assess the effect of psyllium husk, this is indicative that the addition of psyllium to a traditional diet is safe, well tolerated and improves glycemic control in both healthy controls and in patients of diabetes mellitus. effect of psyllium husk on glycemic index of test diets, Psyllium husk when mixed with the food have the effect of reducing blood glucose responses, and that the mechanism of action relates to a reduced rate of digestion rather than carbohydrate malabsorption [24]. The combination of a high glycemic index and a low cereal fiber intake further increased the risk of diabetes when compared with a low glycemic load and high cereal fiber intake [25]. Psyllium husk with meal reduces postprandial glucose and insulin concentrations in NIDDM [26]. Plantago psyllium and acarbose, both significantly reduce glycemic index of carbohydrate food [27, 28].

Conclusion:

Our study reveals that safety and effectiveness of psyllium used adjunctively to traditional diabetes diet in patients with type 2 diabetes. Significant differences between glycemic index missi roti and bajra roti with and without psyllium were seen in both control group and diabetic patients with the psyllium

group showing improved glycemic control compared with the without psyllium diets. Present study obtained use of psyllium husk important for medical management of not only diabetes but also for prediabetics and to maintain glycemic response in healthy subjects.

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