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Original Research Article

# The Effect of *Plantagoovata* Husk on Glycemic Index and Glycemic Response of Kuttu Chapatti in Diabetic Patients and Healthy Controls

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**Abstract**

Psyllium is a form of fiber made from the husks of the *Plantagoovata* plant's seeds. Psyllium is a bulk-forming laxative and is high in both soluble fiber (70%) and insoluble fiber (30%). The beneficial effect of psyllium in the management of type II diabetes has not been totally demonstrated. The purpose of this study was to determine glycemic index of kuttu chapatti and to evaluate effect of psyllium husk on glycemic response of kuttu chapatti. Subjects were randomly selected from Jhalawar Medical College, Jhalawar to participate in a case-controlled study ninety-seven subjects were included in the study that were given diet counseling before the study. Kuttu chapattis were given in 50 grams of digestible available carbohydrates as test diet 1. Same Kuttu chapattis were given along with 5 gm of psyllium husk as test diet 2. The reference food was a solution in water (250 ml) containing 50 g glucose. In the morning, 5 times the blood was collected - on an empty stomach and 30, 60, 90 and 120 minutes after eating for both test diets and reference food for three consecutive days in healthy controls and in patients with type II diabetes. The glycemic indices of kuttu chapatti were found to be 53.1 $\pm$ 6.1 and 54.1 $\pm$5.2 for healthy subjects and diabetic patients respectively, with P = 0.399 therefore the difference in Glycemic indices after Kuttu Chapatti in both groups was statistically insignificant. Glycemic indices of kuttu chapatti with psyllium husk found 47.0 $\pm$ 6.2 and 48.2 $\pm$6.2 for healthy subjects and diabetic patients respectively with p – value was 0.317 therefore the difference in Glycemic indices after Kuttu Chapattiwith Psyllium Husk in both groups was also statistically insignificant. Difference in Glycemic indices of kuttu chapattis is statistically highly significant with kuttu chapattis with psyllium husk for healthy subjects (P < 0.0001) and for diabetic patients (P < 0.0001). our results demonstrate values of glycemic indices for kuttu chapatti 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.



## Introduction

### Buck Wheat a Rich Nutrient Seed

Buckwheat (kuttu/ **Fagopyrum esculentum**) is a pseudo cereal recognized as a good food source which is nutritionally valuable due to the content of protein, lipid, dietary fiber, and minerals, and in combination with other health-promoting components. Therefore, it has

received increasing attention as a potential functional food. The amino acid composition and nutritional value of buckwheat are superior from other grains, also one of the protein sources having high biological value. At the same time, buckwheat contains minerals such as zinc, copper, manganese, selenium, potassium, sodium, calcium and magnesium, also it contains vitamins such as B1, B2, B3 and B6; flavonoids, polyphenols, inositol, organic acid, and high dietary fiber [1].

## Buckwheat in Management of Diabetes

Buckwheat digestion in the body is more difficult than wheat and legumes due to certain antinutritional factors such as polyphenols and enzyme inhibitors. The delay in digestion helps in regulating blood glucose level. Buckwheat consumption with a healthy diet positively affects insulin level and blood lipids [2]. In some countries such as Taiwan, buckwheat is used as a nutritional support in the treatment of type 2 diabetes. Rutin and quercetin in buckwheat, reduce insulin resistance through their ability to increase the activity of hepatic antioxidant enzymes [3]. In addition, it is suggested that the chemically synthesized D-chiro-inositol, an insulin regulatory component known to be antihyperglycemic agents, is used to lower serum glucose concentrations in diabetic patients and it is available relatively in high amount in buckwheat [4]. Buckwheat contains resistant starch Foods with resistant starch generally have low glycemic index buck wheat diets regulate blood glucose, prevent obesity and reduce heart disease risk [5]. In addition, it was observed that blood glucose levels of buckwheat-fed mice were significantly lower after 30th minutes of sucrose consumption [6]. Buckwheat consumption resulted in a decrease in fasting blood glucose, serum insulin levels and body weight and improvement in glucose intolerance. In addition, a decrease in total cholesterol, triglyceride, LDL levels and increase in HDL levels were observed [7].

## Health Benefits of Psyllium Husk

Psyllium seeds from the Plantagoovata 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 [8]. Fiber improves the control of blood glucose and delays glucose absorption and hyperinsulinaemia[9,10].

## 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 [11]. It delayed gastric emptying and reduced colon transit time in man [12]. 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 [13]. Psyllium as soluble fibre has also improved blood sugar levels in some people with diabetes [14]. Supplementation with psyllium can lower total cholesterol (TC), and LDL-C , Levels of HDL-C were shown to increase by psyllium supplementation [15]. 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 [16].

## Materials and Methods

### Study Design

**The study is divided into two phases In** Phase 1 Glycemic Index of kuttu chapatti were determined, In Phase 2 effect of Psyllium Husk on Glycemic response of kuttu chapatti evaluated.

## Participants

The study was conducted on 97 subjects of 21 - 50 year of age of either sex; out of which 50 were healthy subjects and 47 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% Hba1c, 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 Kuttu chapattis and test diet -2 kuttu chapattis with Psyllium husk. PatanjaliKuttu flour used for test diets, and for psyllium husk Deer brand sat isabgol$^{R}$ is used.

For reference food 50 gm glucose dissolved in 250 ml of water and asked to drink within 15 minutes. For test diet- 1, Kuttu Dough was prepared with appropriately weighed kuttu flours and chapattis were prepared. These chappatties were served with kainth chutney to enhance palatability. The same chapattis were given with 5 gm of psyllium husk as test diet -2.

## interventions

In this case control study glycemic response of kuttu 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 kuttu chapatti were given to the same volunteers after they have been in fasting mode for at least 10-12 hours, **Day third,** the test food with psyllium husk was given to the same volunteers. A **capillary blood** sample was taken daily in the fasting state and at 30 min, 1 hr, 1 hr 30 min and 2 hours 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 as described below in accordance with the method recommended by (Wolver et al. 2004). Glycemic index calculated as per the formula.

Glycemic index = IAUC of 50g test carbohydrates / IAUC of 50g reference carbohydrate X 100.

## Statistical Analysis

Analysis of data was done by using SPSS software (version 20.0), unpaired – t test, ANOVA, post hoc test was used in data analysis. The data in the study was expressed as mean ± 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 diets in case and control group**

| Diets | GI Case | GI Control | statistical significance |
|---|---|---|---|
| Kuttu chapatti | 54.13 ± 5.26 | 53.15 ± 6.17 | P= 0.399 (NS) |
| Kuttu chapati with psyllium husk | 48.28 ± 6.27 | 47.02 ± 6.24 | P= 0.317 (NS) |

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

afterKuttu Chapatti was found to be (54.13 ± 5.26). The mean Glycemic Index in healthy controls after Kuttu Chapatti was found to be (53.15 ± 6.17). Statistical analysis showed that p – value was 0.399 therefore the difference in Glycemic after Kuttu Chapatti both groups were statistically insignificant.

The glycemic indices in cases and controls were statistically analyzed using unpaired – t test. The mean Glycemic Index in Diabetic patients after Kuttu Chapatti with Psyllium Husk was found to be (48.28 ± 6.27). The mean Glycemic Index in healthy controls after Kuttu Chapatti with Psyllium Husk was found to be (47.02 ± 6.24). Statistical analysis showed that p – value was 0.317 therefore the difference in Glycemic after Kuttu Chapatti with Psyllium Husk both groups were statistically insignificant.

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

| Group studied | GI kuttu chapatti | GI kuttu chapatti with psyllium husk | p value |
|---|---|---|---|
| Case | 54.13 ± 5.26 | 48.28 ± 6.27 | p< 0.0001 (HS) |
| Control | 53.15 ± 6.17 | 47.02 ± 6.24 | p< 0.0001 (HS) |

Glycemic indices of kuttu chapattis was statistically highly significant with kuttu chapattis with psyllium husk for healthy subjects($P < 0.0001$) and for diabetic patients ($P < 0.0001$).

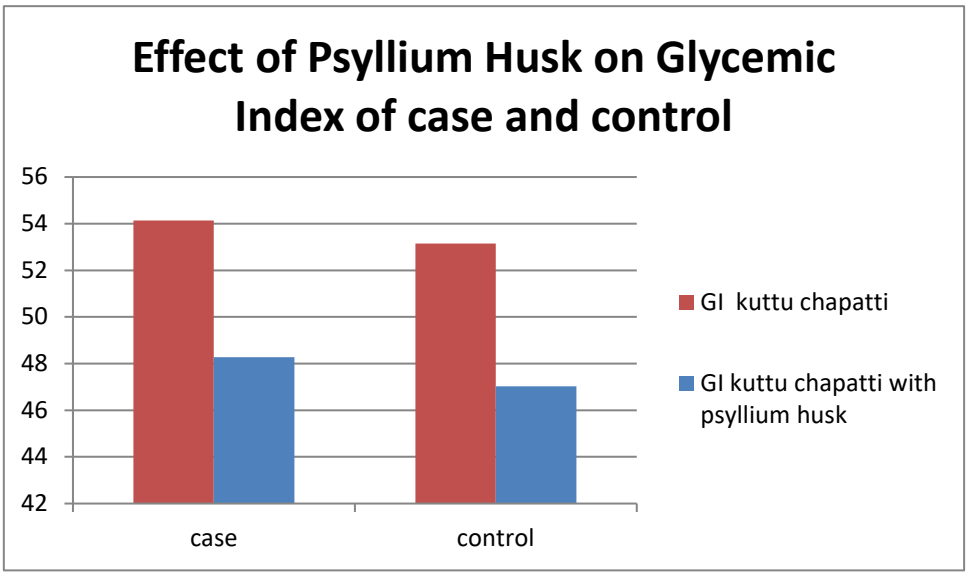


**Figure 1: Effect of psyllium husk on glycemic index of kuttuchappati in healthy subjects and diabetic patients.**

## Discussion

table – 1 shows comparison of GI of diets in case and control group similar results were obtained in study that demonstrate that a buckwheat concentrate is an effective source of D-chiro-inositol for lowering serum glucose concentrations in rats and therefore may be useful in the treatment of diabetes [17]. Another study show significant differences in blood glucose or glycated hemoglobin levels between the buckwheat and control groups. In addition, subgroup analyses based on daily buckwheat intake showed a reduction in insulin, total cholesterol, and low-density lipoprotein cholesterol [2]. Components of buckwheat extract other than rutin have inhibitory activity against sucrase in vivo. They suggest that buckwheat could have beneficial effects on

diabetes [18]. Ethanol extract of buckwheat inhibit increases in blood glucose and insulin levels [3].

Table- 2 shows effect of psyllium husk on glycemic index of test diets, A significant inverse association found between dietary fiber intake and risk of type 2 diabetes. 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 [19]. 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 [20]. Psylliumhusk with meal reduces postprandial glucose and insulin concentrations in NIDDM [21]. Plantagopsyllium and acarbose, both significantly reduce glycemic index of carbohydrate food [22,23].

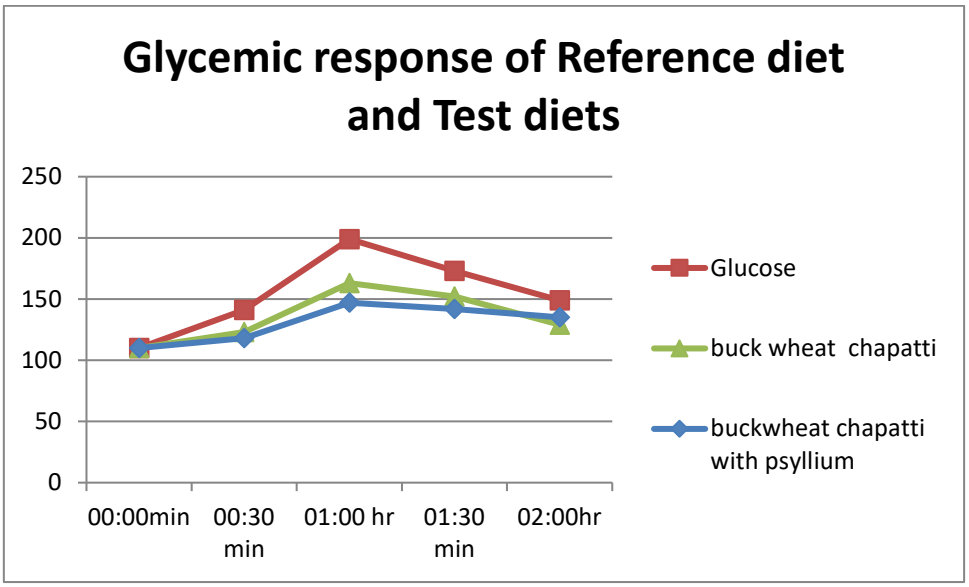


**Figure 2: Glycemic response of reference food and test diets.**

**Conclusion: the findings of** our study reveal that safety and effectiveness of psyllium used adjunctively to a traditional diabetes diet in patients with type 2 diabetes. Significant differences between glycemic index of kuttu chapatti 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 psylliumhusk important for medical management of not only diabetes but also for prediabetics and control of glycemic response in healthy subjects.

## References

1. Wronkowska M, Soral-Smietana M, Krupa-Kozak U. Buckwheat, as food component of a high nutritional value, used in the prophylaxis of gastrointestinal diseases. Eur J Plant Sci Biotechnol 2010; 4: 1-7.
2. Qiu J, Liu Y, Yue Y, Qin Y, Li Z. Dietary tartary buckwheat intake attenuates insulin resistance and improves lipid profiles in patients with type 2 diabetes: a randomized controlled trial. Nutr Res 2016; 36(12): 1392-401.
3. Lee CC, Hsu WH, Shen SR, Cheng YH, Wu SC. Fagopyrumtataricum (buckwheat) improved high-glucose-induced insulin resistance in mouse hepatocytes and diabetes in fructose-rich diet-induced mice. Exp Diabetes Res 2012; 2012375673.

4. Kawa JM, Taylor CG, Przybylski R. Buckwheat concentrate reduces serum glucose in streptozotocin-diabetic rats. J Agric Food Chem 2003; 51(25): 7287-91.
5. Bonafaccia G, Fabjan N. Nutritional comparison of tartary buckwheat with common buckwheat and minor cereals. Zb Bioteh Fak Univ Ljubl Kmet 2017; 81: 349-55.
6. Hosaka T, Nii Y, Tomotake H, et al. Extracts of common buckwheat bran prevent sucrose digestion. J Nutr Sci Vitaminol (Tokyo) 2011; 57(6): 441-5.
7. Li J, Gong F, Li F. Hypoglycemic and hypolipidemic effects of flavonoids from tatary buckwheat in type 2 diabetic rats. Biomed Res 2016; 27: 132-7.
8. Mehta KG, Modi R & Gupta R Psyllium. Indian J Agron 1976:21, 509 –510
9. Chandalia M, Garg A, Lutjohann D, Bergmann K, Grundy SM & Brinkle LJ. Beneficial effects of high dietary fiber intake in patients with type 2 diabetes mellitus. N Engl J Med 2000:342, 1392 –1398.
10. Abraham ZD & Mehta T (1988) Three-week psyllium husk supplementation: effect on plasma cholesterol concentrations, fecal steroid excretion, and carbohydrate absorption in men. Am J ClinNutr 47, 67– 74.
11. Wolever TM, Vuksan V, Eshuis H, Spadafora P, Peterson RD, Chao ES, Storey ML & Jenkins DJ. Effect of method of administration of psyllium on glycemic response and carbohydrate digestibility. J Am Coll Nutr 1991:10, 364 – 371.
12. Washington N, Harris M, Mussellwhite A & Spiller RC. Moderation of lactulose-induced diarrhea by psyllium: effects on motility and fermentation. Am J Clin Nutr 1998:67, 317 –321.
13. Vinik AL & Jenkins DJA (1988) Dietary fibre in management of diabetes. Diabetes Care 1988:11, 160 – 173.
14. Florholmen, J., Arvidsson-Lenner, R., Jorde, R., Burhol, P.G. The effect of metamucil on postprandial blood glucose and plasma gastric inhibitory peptide in insulin-dependent diabetics. ActaMedica Scandinavia 1982:212, 237–239.
15. Oson, B.H., Anderson, S.M., Becker, M.P. Psyllium-enriched cereals lower blood total cholesterol and LDL cholesterol, but not HDL cholesterol, in hypercholesterolemic adults: results of a meta-analysis. Journal of Nutrition 1997:127, 1973–1980
16. Mark N. Feinglos, Roger D. Gibb, David L. Ramsey, Richard S. Surwit, Johnson W. McRorie, Psyllium improves glycemic control in patients with type-2 diabetes mellitus, Bioactive Carbohydrates and Dietary Fibre, Volume 1, Issue 2, 2013, Pages 156-161,
17. Kawa JM, Taylor CG, Przybylski R. Buckwheat concentrate reduces serum glucose in streptozotocin-diabetic rats. J Agric Food Chem 2003; 51(25):7287-91.
18. Hosaka T, Nii Y, Tomotake H, et al. Extracts of common buckwheat bran prevent sucrose digestion. J NutrSciVitaminol (Tokyo) 2011; 57(6): 441-5.
19. Wolever TM, Vuksan V, Eshuis H, Spadafora P, Peterson RD, Chao ES, Storey ML & Jenkins DJ. Effect of method of administration of psyllium on glycemic response and carbohydrate digestibility. J Am CollNutr 1991:10, 364 – 371.
20. Salmeron J., Ascherio A., Rimm E., et al. Dietary fiber, glycemic load, and risk of NIDDM in men. Diabetes Care. 1997; 20: 545-550.
21. Pastors, J.G., Blaisdell, P.W., Balm, T.K., Asplin, C.M., Pohl, S.L., 1991.

Psyllium fiber reduces rise in postprandial glucose and insulin con- S.A. Ziai et al. / Journal of Ethnopharmacology 102 (2005) 202–207 207 centrations in patients with non-insulin-dependent diabetes. American Journal of Clinical Nutrition 53, 1431–1435.

22. Frati Munari, A.C., Benitez Pinto, W., Raul ArizaAndraca, C., Casarrubias, M., 1998. Lowering glycemic index of food by acarbose and plantagopsyllium mucilage. Archives of Medical Research 29, 137–141.
23. MokbelKhalefa, K. M. Ten years incidence of intracranial complications of chronic suppurative otitis media. Journal of Medical Research and Health Sciences, 2020:3(6), 996–1000.