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Glycemic Index of Ficus religiosa Based Bakery Products for Healthy Normal Subjects

KEYWORDS: Ficus religiosa, Incremental Area Under Curve, Glycemic Index, Glycemic Load

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ABSTRACT *The present study was undertaken with the aim of preparing bakery products based on Ficus religiosa with sensory quality and their glycemic Index. The bakery products (Biscuits, Dal samose and Bati) were supplemented with 5%, 10% leaves and bark and its equiproportioned blends of Ficus religiosa. For religiosa based bakery products, the glycemic index was calculated by incremental area under the blood glucose curve (IAUC). The result showed that 10% leaves Dal samose and 5% bark Bati were insignificant at P≤0.05 level which was comparable with standard.Glycemic Index and Glycemic Load values were found to be lowest for 10% leaves incorporated Dal samose (35 and 13) when compared to 5% bark incorporated Bati (53 and 20). Therefore, Bati and Dal samose classified under low glycemic index food. Considering the wide-ranging consumption of bakery products, this information is valuable for people who prefer to use low glycemic food which offer many beneficial therapeutic effects.*

Introduction

The concept of glycemic index (GI) was developed to help diabetic patients with blood glucose control when it was marked that high GI food consumption was allied with an increased risk of metabolic disorders such as type II diabetes mellitus (Jenkins 2002 and Feskens et al. 2006). Epidemiological and dietary intervention studies suggest that a low-GI diet is beneficial for blood glucose control and consumption of foods with a high GI is hypothesized to contribute to insulin resistance, which is associated with an increased risk of diabetes, obesity, cardiovascular disease, and various cancers (Brand et al. 1990 and Neuhouser et al. 2006). Both dietary GI and GL were independently associated with several metabolic risk factors in subjects whose dietary GI and GL were primarily determined on the basis of the GI of predominantly carbohydrate foods such as white rice (Murakami et al. 2006). It is thus apparent that GI is an aspect of diet of potential importance in the treatment and prevention of chronic diseases. This is primarily of importance to the understand the dietary control of diabetes, particularly in a developing countries, where carbohydrate food sources form the bulk of diet available to the majority of the population.

Ficus religiosa belongs to moracae family, commonly known as Peepal, ethno medicinal tree used in Ayurveda (Hassan et al. 2009). Various parts such as stem bark, aerial roots, vegetative buds, leaves, fruits, latex are used in diabetes, diarrhea, skin disease, ulcers, inflammation, asthma and nervous disorders (Charde et al. 2010). It can be a good nutritional supplement because its leaves and fruits contain carbohydrates, protein, lipids, calcium, sodium, potassium and phosphorous (Wangkheirakpam and Laitonjam. 2012). New research findings in this area indicate the potential value of religiosa has good nutritional and nutraceutical profile but its potential role as low GI food has remained unrealized and unexploited in prevention of such disorders. Thus, the present study was taken up to investigate the effect of low GI products based on religiosa plant powder on blood glucose in normal healthy subjects.

METHODOLOGY

- **Sample Collection**

Leaves and barks of Ficus religiosa were collected in around August- September month and identified and authenticated by Dravyaguna department, National Institute of Ayurveda, Jaipur. The plant parts were sun dried and reduce to coarse powder

Product Development and Sensory Evaluation

In the present study, Biscuit, Dal samose and Bati were developed with variations (5 , 10% and their equiproportioned powder) in each food products. The sensory evaluation was carried out for overall acceptability of the religiosa powder based products which were compared with control product. These test products were evaluated by 15 semi-trained panels for different sensory quality characteristics by structured hedonic scale (1; dislike extremely to 9; extremely liked)

- **Study Subjects**

Eighteen normal healthy subjects of the age 24-32y, height 157-162cm, weight 52-556 kg and BMI 22-25 kg/$m^{2)}$ were randomly selected from Banasthali University campus.The subjects were given general instructions to avoid any physical exertion, medication, fast and feasts during the experimental period. The present study was approved by the Banasthali University research Ethics Board.

- **Assessment of Post Prandial Glycemic Response and Glycemic Index**

On the first day of the study, glucose tolerance test (GTT) was conducted on overnight fasted subjects. A 50 g glucose dissolved in 200 ml water was given to the subjects. The blood glucose level was measured at 0, 30, 60, 90 and 120 min with the help of a glucometer using glucostix which is based on the action of glucose oxidase. The food products Dal samose (10% FRL) and Bati (5% FRB), based on their respective powder were evaluated in two consecutive days. The incremental area under the blood glucose curve is calculated for each blood glucose response curve geometrically by the trapezoid rule described by Wolever and others (2003). The GI and GL of each food was determined by the following formula:

GI = IAUC of food / IAUC of glucose 100
GL=Available Carbohydrate (g)×(Glycemic Index)/100

- **Statistical analysis**

All data were triplicate and expressed as mean ± standard deviation. The results of the study were statistically analyzed

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to ascertain its significance by paired t-test at ($p \leq 0.05$ level) was estimated.

Results and Discussion

Table 1: Overall acceptability of Biscuits, Dal Samose and Bati based F. religiosa leaves, Bark and its equiproportioned mixture

Food Products	Standard	Leaves		Bark		Equiproportioned mixture	
		Variant A	Variant B	Variant C	Variant D	Variant E	Variant F
Biscuits	8.66±0.83	8.00±0.48[b]	7.80±0.84[a]	7.60±0.84[a]	7.86±0.74[a]	7.93±0.96[b]	6.2±0.75[a]
Dal Samose	8.73±0.79	8.23±0.74[b]	8.46±0.70[b]	8.2±0.84[b]	7.9±0.74[a]	8.06±0.79[a]	6.9±0.79[a]
Bati	8.77±0.83	7.53±0.83[a]	8.3±0.81[b]	8.2±0.48[b]	6.73±0.59[a]	7.20±1.01[a]	6.20±0.86[a]

Data is reported as MEAN±SD group of 15 panels each. All test recipes groups (A, B, C, D, E, F) compared to standard recipe. [a]significance and [b] insignificance $P \leq 0.05$ level 9 point hedonic scale- 6(Like Slightly), 7(Like Moderately, 8(Like very much), 5(Neither like nor dislike).

Variant S: 100% refined wheat flour
Variant A, C &E: 5% incorporation FRL, FRB and their equiproportioned powder.

Variant B, D & F: 10% incorporation FRL, FRB and their equiproportioned powder.

All fifteen panels completed sensory assessment of test products (Biscuits, Dal samose and Bati) of Ficus religiosa leaves and bark powder. Although food products scored higher than 7 (slightly liked) for all the products except for FRB(10%) based Bati (6.73±0.59) and 10% equiproportioned mixture based products for Biscuit (6.2±0.75), Dal samose (6.9±0.79) and Bati (6.20±0.86). Sensory analysis revealed that all products with FRL (5 and 10%) and FRB (5%) powder based products were comparable to corresponding standard product(Table 1).Among all the products, 10% FRL based Dal samosa (8.46±0.70) and Bati 5% FRB (8.2±0.84) was most acceptable and had no significant difference ($P \leq 0.05$).

Table 2: Incremental Area Under Curve (IAUC), Glycemic Index (GI) and Glycemic Load (GL) For Food Products.

IAUC(mmol/L) Glucose (Control)	IAUC(mmol/L) Dal samose (10% religiosa leaves)	GI	GL	IAUC(mmol/L) Bati (5% religiosa bark)	GI	GL
242.25±0.20	85.74±0.30[a] (64.60%↓)	35	13	129.89±0.20[ns] (46.42%↓)	53	20

Units for IAUC values are mmol.min/L. Values are mean±SD, n= 5, Percentage ↓ in parenthesis.
[a] values are significantly different at $P \leq 0.05$ when test products compared with the control (Glucose).

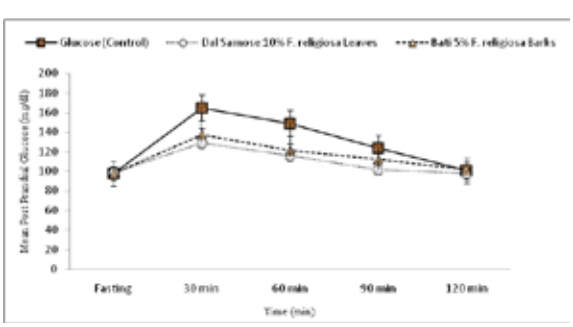

Figure 1: Mean post prandial glucose response curve in healthy normal subjects after oral administration for Glucose (Control), Dal samose (10% religiosa leaves) and Bati 5% religiosa bark).

Comparisons of postprandial glucose responses for test recipes i.e. Dal Samose10% FRL and Bati 5% FRB with control (50g glucose powder dissolve in 250ml water) on normal subjects are summarized in Figure 1. Result showed IAUC values for product Dal Samose (10% FRL) and Bati (5% FRB) were 85.74±0.30 (64.60%) and 129.89±0.20 (46.42%) mmol/L respectively which was lower when compared to IAUC value for control (glucose)242.25±0.20mmol/L.The GI and GL values were found to be lowest in Dal Samose (35 and 13) compared to Bati as shown in table 2.

The present investigation provides supportive scientific evidence in favor of the view that Ficus religiosa (leaves and bark) powder based food products posses significant lowering effect in glucose level and therefore shows low glycemic index and glycemic load. This may be due to religiosa contain good amount of amino acids, super oxide dimutase,vitamins and minerals especially those involved in defense mechanism. Thus it can be speculated that addition 10% leaves incorporated recipe may rise insulin which affects digestion of carbohydrates thereby bringing hypoglycemic effects (Gannon et al. 1988), and differences in the rates of digestion and absorption influenced by the presence of dietary fibre, fat, anti-nutrients, and starch structure (Wursch et al. 2002). The following cut-off limits of GI have been proposed: <55 % (low), 55-69 % (medium), > 70 % (high) (Brand Miller et al. 2003) and similarly Low≤10, medium 11-19 and ≥20 for GL (Foster Powell et al. 2002). Thus acceptable bakery products prepared from F. religiosa exhibits low glycemic response and used as effective therapy for diabetes mellitus.

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Conclusion

Considering the extensive consumption of bakery products, the current report provides the scientific information regarding the glycemic response of plant based bakery products. The availability of low GI bakery foods in the Indian market is projected to better management/prevention of chronic diseases like diabetes, obesity and coronary heart disease.

REFERENCE

• Brand, J.C., Snow, B.J., Nahban, G.P., Truswell, A.S. (1990). Plasma glucose and insulin responses to Pima Indian beans. The American Journal of Clinical Nutrition, 51, 416-420. | • Brand-Miller, J., Petocz, P., Hayne, S., Colagiuri, S. (2003). Low glycemic index diet in the management of diabetes. Diabetes Care, 26, 2261-2267. | • Charde, R.M., Dhongade, M.J., Charde, M.S., Kasture, A.V. (2010). Evaluation of antioxidant, wound healing and anti-inflammatory activity of ethanolic extract of leaves of Ficus religiosa. Indian Journal of Pharmaceutical Sciences, 1, 73-82. | • Foster-Powell, K., Holt, S.H.A., Miller, J.C. (2002). International table of glycemic index and glycemic load values. The American Journal of Clinical Nutrition, 76, 5-56. | . | • Gannon, M.C., Nuttsll, F.Q., Saeed, A., Jordan, K.,Heidi, H., (2003). An Increase in dietary protein in improves the blood glucose response in persons with type2 diabetes. The American Journal of Clinical Nutrition, 78, 734-741. | • Hassan, A.K.M., Afroz, F., Jahan, M., Khatun, R. (2009). In vitro regeneration through apical and axillary shoot proliferation of Ficus religiosa L.- a multipurpose woody medicinal plant. Plant Tissue Culture & Biotechnology, 19, 71-78. | • Jenkins, D.J., Axelsen, M, Kendall, C.W., Augustin, L.S., Vuksan, V., Smith U. (2000). Dietary fibre, lente carbohydrates and the insulin-resistant diseases.British Journal of Nutrition, 83, 157–63. | • Murakami, K,, Sasaki, S., Takahashi, Y., Okubo, H., Hosoi, Y., Horiguchi, H., Etsuko Oguma, E., Fujio Kayama, F. (2006). Dietary glycemic index and load in relation to metabolic risk factors in Japanese female farmers with traditional dietary habits. The American Journal of Clinical Nutrition, 83, 1161-1169. | • Neuhouser, M.L., Tinker, L.F., Thompson, C., Caan, B., Van, H. L., Snetselaar, L., Parker, LM., Patterson, R.E., Robinson-O'Brien, R., Beresford, S.A.A., Shikany, J.M. (2006) Development of a glycemic index database for food frequency questionnaires used in epidemiologic studies. Journal of Nutrition, 136, 1604-1609. | • Wangkheirakpam, S.D., Laitonjam, W.S., (2012): Comparative study of leaves of Ficus pomifera, Ficus hispida and Ficus religiosa for biochemical contents, minerals and trace elements. Indian Journal of Natural Products and Resources, 3:184-188. | . | • Wolever, T.M.S., Vorster, H.H., Bjo¨rck, I., Brand-Miller, J., Brighenti, F., Mann, J.I., Ramdath, D.D., Granfeldt, Y., Holt, S., Perry, T.L., Venter, C., Xiaomei Wu. (2003): Determination of the glycaemic index of foods: inter laboratory study. European Journal of Clinical Nutrition, 57:475–482. | • Wursch, P., Pi-Sunyer, F.X. (2002). The role of viscous soluble fiber in the metabolic control of diabetes: a review with special emphasis on cereals rich in beta-glucan. Diabetes Care, 20, 1774–1780. |