Glycaemic Index of Fenugreek Recipes and Its Relation to Dietary Fiber*

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ABSTRACT

Background: Fenugreek seeds, a commonly used condiment, are a rich source of dietary fiber and have been shown to be beneficial in the management of diabetes. However, bitterness has limited its long-term use.

Methods: Common recipes, containing fenugreek seeds in which the bitterness could be masked with other ingredients were formulated. Organoleptic evaluation revealed that 12 preparations were found to be acceptable to diabetic patients. Glycaemic index of these preparations, each containing 75g carbohydrate and 12.5g fenugreek seeds, was determined in comparison with equivalent amounts of glucose. Glycaemic index of six preparations without fenugreek were also evaluated. Glycaemic index was correlated to nutrient and fiber components of the preparations.

Results: All the preparations with fenugreek seeds had a glycaemic index of less than 50% and it was lower than that of preparations without fenugreek. Stepwise multiple regression analysis indicated that 73% of the variation in glycaemic index was explained by soluble fibre, insoluble fibre and cellulose.

Conclusions: Fenugreek seeds significantly reduced the glycaemic index. Inclusions of any of the two formulated preparations in the diabetic diet would provide the minimum required effective dose of fenugreek in the management of diabetes.

INTRODUCTION

In recent years, several studies have shown the beneficial effects of fenugreek seeds in the management of diabetes (1, 2). However, the bitter taste of fenugreek seeds to a certain extent limited its long-term use. Therefore, several common recipes containing fenugreek seeds have been formulated in which bitter taste of seeds could be masked by the taste of other ingredients of the preparations.

Data on glycaemic index of foods in planning and formulating diets for diabetes has been well recognised (3, 4). In addition to several other factors, dietary fiber has considerable influence on glycaemic index of foods (5). It is known that both quantity and quality of dietary fiber alter the glycaemic response of food (6). Fenugreek seeds are a rich source of fiber (7). If significant association existed between various components of dietary fibre and glycaemic index, the advantages are obvious – the glycaemic response could be predicted from the amount and type of dietary fibre.

In the present study, an attempt has been made to determine the glycaemic index of some recipes with and without fenugreek seeds and also to correlate the values of glycaemic index to various components of dietary fibre and other nutrients in the preparations.

MATERIALS AND METHODS

Fourteen common recipes each containing 75g carbohydrate and 12.5g fenugreek seeds, were formulated. Organoleptic evaluation was conducted on all the 14 recipes in 10 volunteers (8) and 12 recipes, in which the bitterness of fenugreek seeds could be masked, were selected.

The nutritive value of each preparation was calculated using Nutritive Value of Indian Foods (9). The amount of total fibre and its various components, present in 75g of available carbohydrate of the preparation, was calculated from the reported values of Kamath and Belavady (10).

Glycaemic Index:

Thirty male volunteers, aged between 25-40 years, participated in the study. Oral glucose tolerance test with 75g glucose was carried out in each individual after an overnight fast. On separate days, each recipe was given randomly after overnight fasting to 5 persons and blood samples were collected at half-hour intervals for next two hours and analysed for glucose(11). Areas under the glucose curve and glycaemic index of each preparation were calculated as suggested by

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wolever and Jenkins (12). The glyacaemic index of the first 6 preparations listed in Table 1 without fenugreek seeds were also determined to evaluate the effect of fenugreek seeds on glycaemic index.

Table 1
Fibre Components of Fenugreek Recipes*

Recipes	Soluble fibre (g)	Insoluble fibre (g)	Cellulose (g)	Ligni (g)	Total fibre (g)
Chapati	4.91	10.65	6.51	1.34	23.50
Idli	3.94	6.70	3.73	1.65	13.38
Ragi Roti	3.57	7.10	5.36	7.60	23.62
Pongal	3.89	6.55	3.67	1.63	15.76
Besan Paratha	3.52	8.95	6.93	1.20	20.70
Dalia	5.01	10.08	6.04	1.41	22.56
Dosai	3.63	5.72	3.57	1.64	14.56
Rava Dosai	4.20	8.34	5.08	1.33	18.96
Pesarattu	3.79	8.92	5.43	2.43	20.57
Dhokla	3.32	6.29	6.89	0.92	16.69
Addai	3.67	6.25	4.08	1.34	15.33
Ragi Idli	3.57	7.07	5.36	7.60	23.62

* Fibre components (g) / 75g carbohydrates

Statistical analysis:

Zero order co-relations were calculated by Karl Pearson product moment method to determine inter-relations between the nutrients of recipes and glycaemic index. Taking glycaemic index as dependent variable and nutrients of recipes as independent variables, stepwise multiple linear regression analysis and analysis of variance were performed to determine the set of variables significantly related to the glycaemic index (13).

RESULTS

Nutrient composition of preparations is given in Table 1. The weight of the cooked preparations ranged from 150-450 g. Nutrient composition of recipes, all containing 75g carbohydrate, markedly differed from one to another (Table 2).

Fibre components of various fenugreek recipes and their glycaemic index are presented in Table 2 and Figure 1. There was almost two-fold variation in various components of fibre from one preparation to another. Similarly, all recipes, although containing similar amounts of carbohydrate and fenugreek seeds, showed considerable variation in glycaemic index (Fig. 1). The glycaemic index of all recipes containing fenugreek seeds, was less than 50. On the other hand, the mean glycaemic index of first 6 recipes (Table 1) which was also determined without fenugreek (66.2 ± 3.9) was significantly higher ($p < 0.001$) than that of the same preparations with 12.5g of fenugreek (43.3 ± 1.9).

Table 2
Nutrient composition of fenugreek recipes*

Recipes	Main Ingredients	Weight of cooked preparation (g)	Protein (g)	Fat (g)	Calories (Kcal)
Chapati	Wheat flour	170	15.1	2.2	380
Idli	Rice, blackgram dhal	218	15.4	1.5	377
Ragi Roti	Ragi	192	11.8	7.3	417
Pongal	Rice, Lentil	448	15.7	6.4	421
Besan Paratha	Wheat flour, Besan	150	19.0	13.9	501
Pesarattu	Green gram whole, rice	292	23.7	11.9	504
Dalia	Broken wheat, Green gram dhal	450	19.9	7.5	444
Dosai	Rice, Black gram dhal	250	11.6	16.3	495
Rava Dosai	Rava, Rice	280	16.5	20.9	564
Dhokla	Besan, Curd	265	30.4	17.8	579
Addai	Rice, Bengal gram dhal Green gram dhal	305	19.3	17.1	543
Ragi Idli	Ragi, blackgram dhal	412	16.1	2.1	283

* Nutrient composition / 75g carbohydrate

The inter-relationships between various nutrients and fibre components to glycaemic index of recipes are presented in Table 3. From the co-relation matrix, it was observed that glycaemic index of preparations was negatively correlated to total dietary fibre, water soluble and insoluble fibre. In other words, these three components of fibre in the preparations have reducing effect on glycaemic index. On the other hand, protein, fat, calories, lignin and cellulose content were not related to glycaemic index.

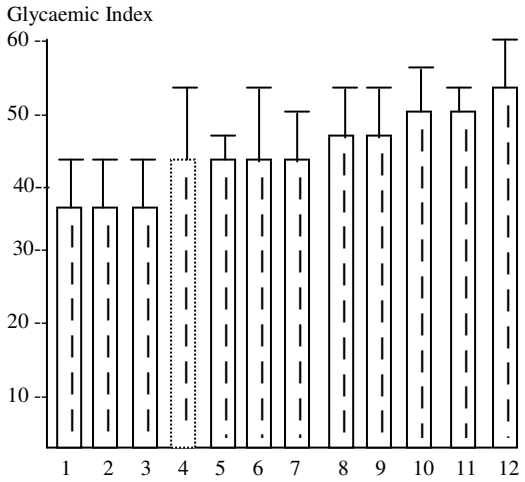

Fig. 1
Glycaemic Index of Fenugreek Recipes

Table 3
Inter-relationship between nutrient and fibre components and Glycaemic Index of recipes

	Corelation coefficient with Glycaemic index
Nutrients	
Protein	-0.482
Fat	-0.138
Calories	-0.263
Fibre	
Total fibre	-0.591*
Soluble fibre	-0.804***
Insoluble fibre	-0.547*
Cellulose	-0.264
Lignin	-0.116

Correlation between glycaemic index and fibre content was found to be significant
* $p < 0.05$; ***$p < 0.001$

Stepwise multiple regression analysis revealed that 73% of the variation in glycaemic index was explained by water soluble fibre, insoluble fibre and cellulose content in the preparations. From the stepwise regression analysis, the following multiple regression was derived:

Glycaemic Index = 0.646* insoluble fibre – 1.252*** soluble fibre – 0.474* cellulose
R = 0.854

The regression coefficients were significantly different: *** $p < 0.001$; * $p < 0.05$.

DISCUSSION

Several studies, both short term and long term metabolic studies have demonstrated hypoglycaemic effect of fenugreek seeds in normal (7) and diabetic patients (1, 2, 14). In recent years, glycaemic index of foods received considerable attention because of its usefulness in formulating diets for diabetics (4). In the present study, glycaemic index of some common fenugreek recipes which were found to be acceptable to the diabetic patients was determined and also an attempt was made to assess the role of various nutrients, particularly dietary fibre components, on glycaemic index of these preparations.

In our earlier study, we reported glycaemic index of 10 common preparations (15). Incorporation of fenugreek seeds significantly reduced the glycaemic index of all the recipes. All fenugreek recipes had glycaemic index of less than 50.

Several factors such as physical form of the preparation (16), nature of cooking (17), presence of anti-nutrients (18), fat (19), protein (20), dietary fibre, (5) have been shown to influence the glycaemic index. But the role of some of these factors is doubtful. Lack of correlation between glycaemic index and nutrient-protein and fat content of preparations indicates that these nutrients did not influence glycaemic index. Recently, it has been suggested that effects of protein and fat on glycaemic index are not observed unless they are present in amounts of 25g/50g of carbohydrate (4). All the preparations selected in the study, except dhokla, contained less than 25g protein or fat per 75g of carbohydrate content of preparation and therefore, lack of co-relation between glycaemic index and protein and fat content of the preparations is not surprising.

Among dietary fibre components, correlation matrix indicated that total fibre, soluble and insoluble fibre, cellulose influenced the glycaemic index. It is however known that all dietary fibre components have no uniform physiological effect (6). Several studies have shown hypoglycaemic effects of soluble fibre (21). Stepwise multiple regression analysis also indicated 63% variation, in glycaemic index could be explained by the soluble fibre alone. Though purified cellulose and insoluble fibre have no significant effect on post-prandial glycaemic response (22), the results of

present study indicate significant influence of these components on glycaemic index. These observations are in line with Wolever (6) who has also recently observed significant correlation between glycaemic response of 25 foods and their cellulose content and uronic acid in insoluble fibre. He suggested that such an association indicates that foods with low glycaemic index have strong cell walls and thus inhibit starch digestion.

The results of the present study demonstrate that fenugreek seeds significantly reduced the glycaemic index of the recipes, and the reduction is mainly due to contribution of soluble fibre from fenugreek seeds. Inclusion of any of the two recipes in the daily menu, would provide the minimum required effective dose (25g) of fenugreek seeds and thus it can form a dietary supportive therapy in the management of diabetes.

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