International Journal of
Life Sciences
International Peer Reviewed Open Access Refereed Journal

Int. J. of Life Sciences, 2021; 9 (4):437-442
ISSN:2320-7817(p) | 2320-964X(o)

Research Article Open Access

Hypoglycemic Effect of Breakfast Preparation by Incorporating Low Glycemic Kitchen Herbs Mixes in Type 2 Diabetics

Sharma Shilpi [1] and Sharma Pushpanjali [2]

[1]Associate Professor, School of Allied Health Sciences, Jaipur National University, Jaipur-302021, Rajasthan, India
[2]Research Scholar, Department of Foods and Nutrition, Mahatma Jyoti Rao Phoole University, Jaipur-302004, Rajasthan, India
*Corresponding author Email: sharma.shilpi79@gmail.com

Manuscript details:
Received: 02.07.2021
Revised: 06.09.2021
Accepted: 06.10.2021
Published: 30.12.2021

Cite this article as:
Sharma Shilpi and Sharma Pushpanjali (2021) Hypoglycemic Effect of Breakfast Preparation by Incorporating Low Glycemic Kitchen Herbs Mixes in Type 2 Diabetics, *Int. J. of Life Sciences*, 9 (4): 437-442.

Available online on http://www.ijlsci.in
ISSN: 2320-964X (Online)
ISSN: 2320-7817 (Print)

ABSTRACT

Diabetes is one of the largest global health emergencies of the 21st century. Complication of diabetes can be prevented or delayed by effective dietary approach. Currently, the challenge is to identify hypoglycemic diet supplements to control blood glucose levels. More than 450 plants worldwide have been documented as beneficial in the treatment of diabetes. The present study was therefore undertaken to assess the impact of Fenugreek (Trigonella foenum- graecum), Cinnamon (Cinnamoum zeylanicum), Gurmar (Gymnema sylvestre) and Bengal gram flour incorporated breakfast preparation on glycemic index. One hundred subjects of type 2 diabetes were selected by using the purposive sampling technique from outdoor subjects of National Institute of Ayurveda (NIA), Jaipur. Blends of the herb powders and cereals used in the formation of three hypoglycemic mixes and glycemic index were analysed. For fenugreek seed, Cinnamon and Gurmar based hypoglycemic mix product GI was 68, 63 and 65 respectively. Therefore, results revealed that in present study cinnamon was found most effective in controlling blood glucose level in selected diabetic.

Keywords: Diabetes mellitus, Glycemic index, Hypoglycemic diet,

INTRODUCTION

Diabetes is a chronic condition that occurs when the body cannot produce enough insulin or cannot use insulin (Evans *et al*, 2000), and is diagnosed by observing raised levels of glucose in the blood. Type 2 diabetes is the most common type of diabetes. It usually occurs in adults, but is increasingly seen in children and adolescents. In type 2 diabetes, the body is able to produce insulin but becomes resistant so that the insulin is ineffective. Over time, insulin levels may subsequently become insufficient. Both the insulin resistance and deficiency lead to high blood glucose levels.

The prevalence of diabetes is increasing rapidly in the worldwide. The toll of diabetes on health and the economy is enormous and will continue to rise. Diabetes is one of the largest global health emergencies of the 21st century. Each year more and more people live with this condition, which can result in life-changing complications. In addition to the 415 million adults who are estimated to currently have diabetes, there are 318 million adults with impaired glucose tolerance, which puts them at high risk of developing the disease in the future (IDF Diabetes Atlas, 2020). The global prevalence of diabetes mellitus for all age groups was estimated to be 2.8% in 2000 and is projected to rise to 4.4% in 2030 (Wild *et al*, 2004).

People with diabetes are at higher risk of developing a number of disabling and life-threatening health problems than people without diabetes. Consistently high blood glucose levels can lead to serious diseases affecting the heart and blood vessels, eyes, kidneys and nerves. People with diabetes are also at increased risk of developing infections. In almost all high-income countries, diabetes is a leading cause of cardiovascular disease, blindness, kidney failure and lower-limb amputation. The growth in prevalence of type 2 diabetes in low-and middle income countries means that without effective strategies to support better management of diabetes, it is likely that there will be large increases in the rates of these complications. Diabetes complications can be prevented or delayed by maintaining blood glucose, blood pressure and cholesterol levels as close to normal as possible. Many complications can be picked up in their early stages by screening programmes that allow treatment to prevent them becoming more serious.

Dietary modification, weight control and regular exercise are the main approaches in the management of diabetes, diet being the principal factor. Further complication of diabetes can be prevented or delayed by effective dietary approach. Currently, the challenge is to identify hypoglycaemic diet supplements to control blood glucose levels.

More than 450 plants worldwide have been documented as beneficial in the treatment of diabetes. Studies with most effective plants, demonstrated that the anti-hyperglycaemic activities were in part explained by the ability of water-soluble plant components it increases glucose transport and metabolism in muscle and / or stimulate insulin secretion (Gallagher *et al*, 2003).

The present study was therefore undertaken to assess the impact of Fenugreek (*Trigonella foenum- graecum*), Cinnamon (*Cinnamoum zeylanicum*), Gurmar (*Gymnema sylvestre*) and Bengal gram (*Cicer arietinum*) flour incorporated breakfast preparation on glycemic index.

MATERIAL AND METHOD

Selection of Subjects: One hundred subjects of type 2 diabetes were selected by using the purposive sampling technique from outdoor subjects of National Institute of Ayurveda (NIA), Jaipur. The ages of subject were 40-60 years with fasting plasma glucose levels between 120-150 mg/ dl. Non pregnant women and subjects with no apparent complications were selected for the study. Whole procedure and motive of the study was explained to the subjects and informed consent was taken.

Tools Used for the Study: An interview schedule was developed to collect information regarding their socio-economic back states, life style and dietary pattern etc. Fasting and post prandial plasma glucose were estimated by using Accu-Chek active glucometer, which gives the test results in 30 seconds.

Formation of Hypoglycemic Mixes: The blends of the herb powders and cereals used in the formation of hypoglycemic mixes are given in Table 1.

Table 1: Composition of Hypoglycemic Mixes (HGM)

Mixes	Ingredients (in powder form)			
	Bengal gram Flour	**Fenugreek** (Trigonella foenum-graecum)	**Cinnamom** (ccinnamoum) zeylanicum	**Gurmar** (Gymnema sylvestre)
Test mix I (TMI)	**50%**	**50%**	**-**	**-**
Test mix II (TMII)	**50%**	**-**	**50%**	**-**
Test mix III (TMII)	**50%**	**-**	**-**	**50%**

Preparation of Breakfast Item Incorporated with Hypoglycemic Mix: In order to select recipes for the study a list of daily-consumed food items was prepared and khaman was commonly consumed among the breakfast items by the selected type 2 diabetic subjects. Therefore, khaman was selected for incorporation of the developed hypoglycemic mixes. TM-I, II and III were separately incorporated in Bengal gram flour in different proportion and sensory evaluation was done by using 9-point rating scale. The best accepted proportion was the five percent incorporation of hypoglycemic mixes.

Estimation of Glycemic Index (GI) of the Products: Initially the selected subjects were subjected to Oral Glucose Tolerance Test (OGIT) using 50 g glucose load. Blood samples were withdrawn at zero minutes i.e. fasting and post prandial blood glucose at 60 minutes and 120 minutes.

The total of 80 subjects selected for the study were allocated for group I, II, III and IV randomly. After a 10 days interval of conducting OGIT, subjects were fed equal carbohydrate test products A, B, C, and D respectively. The feeding was done in random order on separate occasions after an overnight fast.

Group A - Khaman + TM I
Group B - Khaman + TM II
Group C- Control (Normal khaman)
Group D - Khaman + TM III

The subjects were made to consume the test products; blood samples withdrawn were similar to that of glucose load at zero minutes and post prandial blood glucose level at 60 minutes and 120 minutes. Blood glucose response at different time intervals were used to calculate AUC, and GI value was calculated using the following equation (Wolever and Jenkins, 1986).

$$GI = \frac{\text{Area under blood glucose response curve for 50 g test carbohydrate food}}{\text{Area Under blood glucose response curve for 50 g glucose}} X100$$

Statistical Analysis

Standard statistical software package of social science (SPSS) version 20.0 was used for statistical analysis and all data were expressed as mean± standard deviation. Data of sensory evaluation and AUC were analyzed by one-way ANOVA. Paired t test was used for comparison of the GI of standard food and test food.

RESULTS

Background Information:

Among the eighty selected subjects sixty eight subjects were found to come under normal BMI and 12 subjects were overweight. Seventy four of them were involved in sedentary activity while six were moderate workers. The duration of the diabetes among the subjects ranged from one to five years. The mean chronological age of the study group was 50.54 years. Thirty five subject's parents had diabetes and ten subjects had positive history of diabetes within their kinship. Polyuria, polydipsia, loss of weight, fatigue, tiredness and irritability were said to be the predominant symptoms by over 63 subjects. At the time of the study 67 of subjects were performing physical exercise. With regard to exercise pattern, 48 of them were in the practice of doing exercise regularly in the form of walking and 20 subjects were doing yoga at studied. Sixty of the selected diabetics underwent blood sugar check-up once in a month and 20 subjects were checked in every 15 days.

Dietary Habits:

Fifty seven diabetes subjects were vegetarian in their dietary habits. However six were reported them as eggetarian and seventeen subjects were non-vegetarian. The mean calorie intake was found to be less compared to recommended allowances and it was found to be 2133 Kcal and 2220 Kcal respectively for sedentary and moderate working men. Wheat was the staple food of all the selected subjects while jowar and ragi were included by only 10 subjects frequently. Among the selected subjects 64 consumed three meals a day and 8 of them had four meals a day. However only eight subjects were having only 2 meals in a day. All of the selected subjects were consumed vegetables, green leafy vegetables and milk & milk products every day.

Estimation of Glycemic Index (GI): The mean blood glucose response responses for reference food (glucose) and test foods are presented in Table 2.

The mean fasting blood glucose responses in the selected subjects were in the range of 128.4 to 135.8 mg/dl. A continues rise in blood glucose level was seen after ingestion of reference food, the peak being reached at60 minutes after ingestion. The result of the meal tolerance test is presented in Table 2.

Table 2: Blood Glucose Values in selected subjects

Sources of carbohydrate	Fasting (mg/100ml-1)	60 minutes after ingestion (mg/100ml-1)	120 minutes after ingestion (mg/100-1)
Glucose	130.4±12.72	213.3±11.78	172.5±11.48
Control Khaman (c)	128.4±12.21	195.0±11.13	169.0±11.28
Glucose	135.3±10.67	235.3±14.82	170.9±11.11
Khaman +TM I (A)	135.8±10.12	190.3±14.02	161.0±14.70
Glucose	131.3±11.01	222.7±12.14	172.0±12.65
Khaman + TM II (B)	128.6±13.24	192.0±12.31	160.7±12.84
Glucose	131.2±10.38	224.8±14.46	176.0±14.41
Khaman + TM III (D)	132.2±10.18	193.0±11.23	163.2±11.45

Table 3: Mean Glycemic Index of Reference and Test products

Source of carbohydrate	Glycemic index
Glucose	109.2
Khaman Control (group C)	80.0
Glucose	109.7
Khaman + TM I (group A)	68.2
Glucose	109.6
Khaman + TM II (group B)	63.0
Glucose	110.7
Khaman + TM III (group D)	65.0

A steady rise in blood glucose level was seen after the ingestion of test products, the peak being reached at 60 minutes similar to reference food. In general, peak values for all the test foods were lower than the reference food.

The mean GI of four products is given in Table 3. The mean GI of the test products and control ranged from 63.0 to 80.0 in selected subjects. Glycemic index of khaman (control) was 80.0 higher than group A (TMI) 68.2 having significant difference (P<0.05).

Group B i.e., khaman incorporated with TM II showed the lowest GI 63.08. Group B was highly significant when it compares with control group (P<0.01). In group D (TMIII), GI value was 65 where control was 80.0 shows significant difference (P<0.05).

In the past, diabetic subjects were advised to avoid carbohydrates, but it is now accepted and recommended by diabetic associations that 60-70%of the calories in a diabetic diet should be provided by carbohydrate and that the carbohydrate should be in the form of complex polysaccharides (starch) and non-starch polysaccharide (dietary fiber) (Anderson *et al*, 2004; DiPiro *et al*, 1993). Both the amount and the type of carbohydrate induce distinct plasma glucose and insulin responses which is quantified by the glycemic index (GI) (Bove *et al*, 2006; Raghuram, 1996; Sheard *et al*, 2004; Wolever and Jenkins, 1986). Clinical and preclinical experiments suggest that foods with a low GI improve glycemic control and reduce hypoglycemic episodes, both in animal models and in diabetic subjects.

DISCUSSION

In the present study Fenugreek, Cinnamom and Gurmar were assessed for their low GI and improve glycemic control in diabetic subjects. In group A fenugreek was assessed and result shows effective controlling blood glucose level. Preliminary animal and human trials suggest possible hypoglycemic properties of fenugreek seed powder taken orally. Fenugreek seeds contain 50% fiber (30% soluble fiber and 20% insoluble fiber) that can slow the rate of post-parandial glucose absorption. This may be a secondary mechanism for the hypoglycemic effect.

Its hypoglycemic activity is described to the presence of saponin fraction, and 4-hydroxyisoleucine, a free amino acid (Gopalan and Balasubramanian, 1998). The hypoglycemic activity of fenugreek seed is also due to glucose-dependent insulin secretion from pancreatic beta cells and soluble dietary fiber (50%) that can slow the rate of glucose (Ali *et al*, 1995). In humans, fenugreek seeds exert hypoglycaemic effect by stimulating glucose-dependent insulin secretion from pancreatic beta cells, as well as by inhibiting the activities of α-amylase and sucrose (Amin, 1987).

In another study fenugreek significant attenuation of the glucose tolerance curve and improvement in the glucose induced insulin response, suggesting that the hypoglycemic effect may be mediated through stimulating insulin producing beta-cells of the Islets of Langerhans (Baquer *et al*, 2009).

In group B Cinnamon was most efficiently controlling blood glucose level. Cinnamon has been shown to increase in vitro glucose uptake and glycogen synthesis to increase phosphorylation of the insulin receptor. Furthermore, when cinnamon compared with herbs, spices and medicinal extracts for insulin-like or insulin-potentiating activity in an in vitro model, aqueous cinnamon extracts potentiated insulin activity more than twenty-fold, higher than any other compound tested at comparable dilutions (Broadhurst *et al*, 2000). The effects of adding more of the aqueous extract of cinnamon appear similar to adding more insulin. This is important from a human health standpoint because it results in increased insulin sensitivity and less insulin is required to have larger insulin effects (Natural Standard Database, 2020). People with metabolic syndrome have adequate amounts of insulin but the insulin is not efficient. Components of cinnamon make insulin more efficient (Anderson *et al*, 1978).

In group D, Gurmar was used as a hypoglycemic agent. As can be seen from the data above, the use of Gymnema sylvestre in group D with diabetes has a positive result. The active components are present in the leaves of the plant. The main constituent of *Gymnema* is believed to be gymnemic acid, consisting of different spooning. Gurmar constituents that contribute to the hypoglycemic effect of the plant include polypeptides (gurmarin) alkaloids (conduritol, gymnamine, gypenoside), and other spooning **(**Jarvill *et al*, 2001)**.** Laboratory studies also suggest that *Gymnema* may decrease the uptake of glucose from the small intestine and improve glycogen synthesis and hepatic and muscle glucose uptake.

CONCLUSION:

In present study cinnamon was found most effective in controlling blood glucose level in selected diabetic. As the support of other studies and in the light of present study cinnamon could be used as a supplemented food for diabetics. It provides a healthy and easily digested carbohydrate diet that can help to maintain blood glucose normal range in diabetic subjects.

Conflicts of Interest: The authors declare no conflict of interest.

REFERENCES

Ali L, Azad Khan AK, Hassan Z, Mosihuzzaman M, Nahar N, Nur-e-Alam M, *et al.* Characterization of the hypoglycemic effects of trigonella foenum graecum seed. Planta med.1995;61:358-60.

Amin R, Abdul-Ghani AS and Suleiman MS intestinal absorption. Proceedings of the 47th Annual Meeting of the American Diabetes Association (Indianapolis U.S.A.). Diabetes.1987;36, 211.

Anderson JW, Randles KM, Kendall CW, Jenkins DJ. Carbohydrates and Fiber recommendations for individuals with diabetes: A quantitative assessment and meta Analysis of the evidence. J Am Coll Nutr. 2004;23:5-17.

Anderson RA, Brantner JH, Polansky MM. An improved assay for biologically active chromium. J Agric Food Chem. 1978;26:1219-21.

Baquer NZ, Taha A, Kumar P, McLean P, Cowsik SM, Kale RK, Singh R and Sharma D. A metabolic and functional overview of brain aging linked to neurological disorders. Biogerontology.2009;10:377–413.

Bove A, Hebreo J, Wylie-Rosett J, Isasi CR. Burger King, Subway. Key nutrients, glycemic index and glycemic load of nutritionally promoted items. Diabetes Educ 2006;32(5):675-690.

Broadhurst CL, Polansky MM, Anderson RA. Insulin like biological activity of culinary and medicinal plant aqueous extracts in vitro. J Agric Food Chem.2000;48:3;849–52.

DiPiro JT, Talbert RL, Yee GC, Matzke GR, Wells BG, Michael PL. Pharmacotherapy: A pathophysiological approach. 2nd ed. Appleton and Lange Publishers,1993,1124-6.

Evans JM, Newton RW, Ruta DA, MacDonald TM, Morris AD. Socio-economic status, obesity and prevalence of type 1 and type 2 diabetes mellitus. Diabet Med J Br Diabet Assoc. 2000;17:478–80.

Gallagher, AM, Flatt, PR, Duffy, G, Abdel- Wahab,YHA. The effect of traditional antidiabetic plants on in vitro glucose diffusion. Nutr. Res. 2003;23:413-424.

Gopalan C, Ramasastri BV, Balasubramanian SC. Nutritive Value of Indian Food. Hyderabad: National institute of nutrition, Indian council of medical research, 1998,47-91.

Jarvill-Taylor KJ, Anderson RA, Graves DJ. A hydroxychalcone derived from cinnamon functions as a mimetic for insulin in 3T3-L1 adipocytes. J Am Coll Nutr. 2001;20:327-36.

Natural Standard Database Monograph Retrived on June,22, 2020 from http://www.naturalstandard.com/monographs/herbs supplements/

Prevalence of Diabetes Retrived on January,12, 2020 from www.diabetes **HYPERLINK "http://www.diabetesatlas.org/" HYPERLINK "http://www.diabetesatlas.org/"**

Raghuram TC. Diet and diabetes mellitus. In: Bamji MB, Rao PN, Reddy V, editors. Textbook of human nutrition. Oxford and IBH publishing Co. Pvt. Ltd: New Delhi 1996,333-45.

Sheard NF, Clark NG, Brand-Miller JC, Franz MJ, Pi-Sunyer FX, Mayer-Davis E, *et al.* Dietary carbohydrate (amount and type) in the prevention and management of diabetes. Diabetes Care. 2004;27:2266-71.

Wild S, Roglic G, Green A, Sicree R, King H " Global prevalence of Diabetes - Estimates for the year 2000 and projections for 2030" Diabetes Care. 2004;27:1047-1053.

Wolever TM, Jenkins DJ. The use of the glycemic index in predicting the blood glucose response to mixed meals. Am J ClinNutr.1986;43:167-72.