

Probing the Therapeutic Effects of Bamboo Shoots Supplementation on Diabetic Male and Female Patients

Laraib Imdad, M Adeel Alam Shah, Javaid Hassan, Farhat Humayun, Ayesha Sadiq, Mavish Javed

ABSTRACT

Objective: To check whether bamboo shoots help to lower blood glucose level in type II diabetic patients.

Methodology: Prospective experimental study was conducted in district Faisalabad from January to march 2016 after approval from ethical committee and advance study & research board University of Agriculture Faisalabad (UAF). All Samples were collected from Allied Hospital Faisalabad and Family Polyclinic Faisalabad. Both male and female with type II diabetes mellitus with different age groups (ranging from 40 to 60+ years) were included in the study and exclusion criteria were applied. Fine grinded bamboo-shoot powder prepared in UAF Lab was supplemented in cookies at different doses and was given to them. Blood sugar level was monitored at different intervals from 0 to 120 minutes. Data was recorded.

Results: Study was comprised of 20 male and 20 female diabetic subjects with mean and SD age 51 ± 0.78 years. Current result revealed that blood glucose level was decreased gradually in 120 minutes of period after eating bamboo shoots supplemented cookies as compared to control group. It was noted that increased dose of bamboo shoots lowers the blood glucose concentration with significant difference. Lowest blood glucose concentration was observed after taking highest dose of bamboo shoots of 20 gram (T10 dose) (p value 0.00). The results showed highest score for G.I for T0 (79.19 ± 2.74) and the lowest for T10 (64.68 ± 1.78), representing the consumption bamboo shoot significantly reduces glycemic index (p value = 0.00).

Conclusion: Glycemic control was improving with increasing the dose of bambooshoot in cookies.

KEYWORDS: Bamboshoots, Glycemic Index, Diabetes

INTRODUCTION

Type II diabetes mellitus is a worldwide most

Laraib Imdad BS (Hon), MPhil

University of Agriculture, FSD

Dr. M Adeel Alam Shah MBBS, MPhil

Assistant Professor

Independent Medical College, FSD

Dr. Javaid Hassan MBBS, MPhil

Assistant Professor

Muhammad College of Medicine, PEW

Dr. Farhat Humayun MBBS, MPhil

Assistant Professor

Abwa Medical College, FSD

Dr. Ayesha Sadiq MBBS, MME

Woman Medical Officer

Govt. General Hospital G.M abad, FSD

Dr. Mavish Javed MBBS, MPhil

Assistant Professor

Khyber Girls Medical College, PEW

Correspondence:

Dr. M Adeel Alam Shah

Email: dr.adeelalam@gmail.com

common problem. It is a major health issue of both genders above 40 years, which is likely to be increase in number over next ten years.¹

Dietary habits and life style plays a major role in persons health, as in modern era people are more prone to eat extra processed food and high sugar drinks which is one of the leading cause in weight gain and causing insulin resistant diabetes.² Lack of exercise, over stressed environment and lack of social activities are in correlation of having diabetes in later age.³ All over the World, Bamboo shoots are used for various purposes like medicine and food from earlier times.^{4,5} These are also used in different foods especially in East Asian countries. Few portions of young bamboo plants are used as an herbal medicine by human beings but there is a lack of scientific study on its medical significance. Bamboshoots contain multiple nutritive materials such as protein, starches, fats, minerals, enzymes, vitamins, reducing & nonreducing sugars, lactic and citric acids. They contain little fats and calories.⁶ Studies shows that they are also rich in nutrients and prebiotic properties which reduce blood cholesterol and LDL, moreover also help in weight loss and relieve constipation.^{7,8} In type 2 diabetes due insulin resistance, dietary fibers help to maintain blood glucose levels, gut motility, enhancement of bowel health and reduce in weight as an adjunct therapy, this has been studied in 2020.⁸ Another study published in 2018 revealed the therapeutic role of dietary fibers in the disease of

diverticulosis via reduction of pressure in large intestine.⁹

Also in 2018 Study, it was assessed that the incidence of Americans citizens diagnosed with diabetes mellitus (DM) have been raised thrice in number which is approximately from 5.8-20.9 million, thus leads to diabetic complications associated with high mortality rate.¹⁰ Nowadays the dietary habits are changed; there is a significant increase intake of fat and total cholesterol and decreased intake of dietary fiber contents, which resulted in obesity and cardiovascular diseases.¹¹ So it was a need of the day to conduct a study on therapeutic role of bamboo shoots as a dietary fiber in reducing blood sugar levels. The aim this study was to check whether bamboo shoots help to lower blood glucose level in type II diabetic patients.

METHODOLOGY

After approval from graduate committee and ethical research board of institute of home science, university of agriculture Faisalabad, a prospective experimental study was conducted on male and female patients previously diagnosed with type II diabetes mellitus in year 2016 from January to march with letter number CE/2641. After informed consent samples were taken from medical outdoor Allied Hospital Faisalabad and Family Polyclinic Faisalabad. All samples from age 40 to 60 years old were included with no prior history of any other chronic illnesses other than diabetes or on insulin therapy. A questionnaire was made in order to record their medical history, tests profile, medical treatment and exclusion criteria were applied. In our study, fine flour was supplemented with bamboo shoots to prepare cookies. Bamboo shoots were collected from Gutwala Park Faisalabad. *Dendrocalamus hamiltonii* specie of bamboos was used. The fine flour was arranged from laboratory of university. Other material such as oil, sugar, salt and baking powder was bought from local market of Faisalabad. Bamboo shoots were thoroughly washed, chopped into small pieces with cutting knife and then boiled for 3-4 hours at 100 °C. They were dried in oven at 72°C for 24-hours. After this, bamboshoots were finely grinded to powder. By mixing of bamboo shoots powder from 1% to 10% in fine flour, composite flour was prepared. According to criteria of AACC (2000) fortified flour was used to prepare cookies. Then all ingredients were added in Hobart Mixer following a specific sequence. The contents were mixed until they converted to a homogeneous mass. The batter was rolled. Cookies were formed by 50- mm cookie cutter. These cookies were baked at temperature of 210 °C for 18-20 minutes

and set to be cooled at ambient room temperature. Then these cookies were kept at room temperature in separate containers.

All of these cookies were made from different doses of bamboo shoots and labeled them with English alphabet "T" and numerical number "N" such as T2, T4, T6, T8 and T10 with dosage 2, 5, 10, 15 & 20 grams respectively. The control group was labeled as T0, due to zero concentration of bamboo shoot powder. After applying exclusion criteria all selected patients were asked not to take their anti-diabetic medicine on that day, and eat three cookies according to treatment number assigned to them. Their blood sugar levels were monitored by "Accu-check" glucometer with intervals of 15 minutes starting from 0 minute to 120 minutes. Data were recorded against each patient's profile and type of treatment given to them according to above dosage.

Statistical Analysis: Data analysis was performed by using spss v22, continues variables are presented as mean and standard deviations. Means are compared by ANOVA. P value ≤ 0.05 was taken as significant

RESULTS

Twenty males and twenty females with type II diabetes were enrolled for the experiment from Allied hospital, Faisalabad and Family Polyclinic, Faisalabad. Mean age and weight was 51 ± 0.78 and 87 ± 5.10 respectively. The average B.M.I for subjects was 29 ± 1 . Blood glucose conc. after consumption of control cookies showed that increased initially and was maximum at 45 min time interval and after that gradually there was decline till 120min time interval. For T1 and T2 cookies same trend was observed, 45 min after that there was decrease till 120 min. On the other hand, T3, T4 and T5 following the same trend and higher at 60 min then gradually decreased till 120 min (Table 1).

Table 1: Blood glucose concentration are taken in mmol/dl

Food Type	Time Interval (min)						
	0	15	30	45	60	90	120
Glucose	5.02±0.02	8.17±0.39	11.21±0.42	12.62±0.41	14.18±0.52	8.35±0.25	6.7±0.23
T0	4.91±0.13	7.01±0.36	9.73±0.39	11.5±0.38	12.35±0.48	7.67±0.18	5.25±0.19
T2	5.01±0.16	6.60±0.32	9.43±0.34	10.53±0.37	12.28±0.46	7.53±0.21	5.06±0.16
T4	4.91±0.08	6.37±0.21	9.26±0.37	10.39±0.34	12.11±0.43	7.30±0.20	5.27±0.12
T6	4.91±0.06	6.41±0.19	9.14±0.29	10.12±0.31	12.06±0.39	7.14±0.19	5.15±0.14
T8	5.07±0.12	6.40±0.27	9.11±0.27	9.99±0.24	11.79±0.40	6.96±0.28	5.02±0.09
T10	4.99±0.04	6.32±0.23	9.09±0.31	9.79±0.37	11.68±0.37	6.73±0.23	5.03±0.10

Same trend for changes in glucose levels were observed for T8 and T10 doses, however the greatest reduction

Table 2: Analysis of Variance (ANOVA) for Blood Glucose Concentrations for Two Hours After Food Consumption Relation to Types of Cookies and Time Interval

SOV	SS	df	MS	F	Sig.
Model	3601.497	13	277.038	2293	0.00**
Treatment	16.07	6	2.678	22.168	0.00**
Time	326.322	6	54.387	450.163	0.00**
Error	4.349	36	0.121		
Total	3605.846	49			

at 120 min were observed at these doses of bamboo shoot. Significant difference in blood glucose levels was noted among the various doses of bamboo shoot doses (p value 0.00) (Table 2).

Table 3: Mean, SD and SE for glycemic index of various types of cookies

Treatments	Mean	SD	SE
Glucose	100	0	0
T0	79.198	2.742	0.867
T2	75.716	2.325	0.735
T4	72.565	2.278	0.720
T6	69.974	1.781	0.563
T8	67.152	1.785	0.565
T10	64.689	1.378	0.436

Table 4: Analysis of Variance for Glycemic Index with Respect to Types of Cookies

Glycemic Index					
SOV	SS	df	MS	F	Sig.
Between Groups	8395.995	6	1399.333	371.464	0.00**
Within Groups	237.326	63	3.767		
Total	8633.321	69			

p-Value \leq 0.05 taken significant

The results showed in Table 3 highest score for G.I for T0 (79.19 \pm 2.74) and the lowest for T10 (64.68 \pm 1.78). For T2 (75.71 \pm 2.32) for T4 the values are (72.56 \pm 2.27). The results for analysis of variance in Table 4. pertaining to the glycemic index of different treatments of cookies indicated that the glycemic index of cookies significantly different with each other.

DISCUSSION

The concept of taking high fiber diet in correlation with food for lowering the blood sugar levels, reduction in plasma concentration of bad cholesterol along with enhanced gut motility and prebiotic activity should be

appreciated and adopt to prevent pre-diabetic condition and providing good blood sugar control in diabetics. This practice should be adopted in our daily lives to avoid risk of metabolic syndromes. Our food is a source of essential nutrients, minerals and vitamins, which is a life line for human in growth and development, which also plays a vital role in immunological defense and healing. The concept of taking high fiber diet for good health is a topic of interest among public and researchers. Therefore, sometimes it becomes difficult to define whether these fibers or low G.I and or both brings progressive changes in-correlation to a state of healthy or disease conditions. Dietary fibers are capable to decrease the digestion of carbohydrates only if it is existing in an insoluble form and stay unaffected while going through gastrointestinal tract. The Glycemic load along with glycemic index among various bakery products are different which usually cause different metabolic syndromes including diabetes, so choosing baked food with high fiber content could be beneficial in preventing these metabolic diseases. It is predominantly significant that the slight difference in glycemic index of commonly consumed food and minor variation in reducing plasma glucose levels have been related with a prevention of getting heart diseases, these findings are in correlation with our study.^{12, 13} A study done on pre-meal consumption of protein fortified dietary fiber and its effects on lowering post prandial glucose level on type II diabetic patients, their result was similar to our study.¹⁴ From this study, it was determined that food supplemented with resistance starch (R.S) has the potential to regulate insulin-sensitivity. Ingestion of (R.S) aids the postprandial blood sugar levels & regulate secretions of insulin in women after consumed with β glucan. It was apparent drop in incremental area under the curve, consuming food having high β glucan 34% and peak R.S 60%. This shows decreased I.A.U.C for insulin and glucose respectively. These findings are in correlation with our results of bamboo shoots. It was revealed by authors that the soluble-fibers have better effects on decreasing in post-prandial insulin response than the R.S from high amylase cornstarch alone. Mixture of R.S and soluble-fiber indicated that the drop in glycemic response was enhanced.¹⁵ Foods which possessed with high glycemic index are ingested and absorbed quickly. This could bring toxic impact on plasma glucose balance. Plasma glucose levels (mmol/L) become twofold at least for 2 hours after eating meals with high glycemic than that of low caloric diet containing a smaller amount of added sugars. Low caloric food stuff have slow and persistent absorption. Thus resulted in slight increase and gradual decrease in post prandial blood sugar levels

without creating harsh peaks and falls, which is usually associated with high glycemic index food.¹⁶ These findings are relevant to our study. It was observed that gradual decrease in blood sugar levels after consuming high fiber diet also resulted in decrease LDL levels.¹⁷ This also influence blood sugar levels for long term, which tends to lower the curve of insulin resistance in diabetics. These findings favor the results of our study. More dietary fiber intake produce bulk in our gut, control un necessary appetite, lower blood glucose levels and also considered as prebiotics.¹⁸ Although prebiotic activity was not the parameter of our study but it could open a new pathway to conduct a research on bamboo shoot as a prebiotic.

Limitation: Hence a detailed through study is also advised on molecular levels of bamboo shoots component in lowering post prandial sugar levels.

CONCLUSION

Bamboo shoots are helpful in reducing the random blood glucose levels in diabetic subjects. glycemic control was improving with increasing the dose of bambooshoot in cookies.

Recommendation: G.I foods is not only a step to reduce the risk of diseases but helps the dietary experts for the formulation of diet plans.

Conflict of Interest: None

Funding Source: None

REFERENCES

- Izzo A, Massimino E, Riccardi G, Della Pepa G. A Narrative Review on Sarcopenia in Type 2 Diabetes Mellitus: Prevalence and Associated Factors. *Nutrients*. 2021;13(1):183. DOI: 10.1002/2327-6924.12447
- Levy RB, Rauber F, Chang K, Louzada MLdC, Monteiro CA, Millett C, et al. Ultra-processed food consumption and type 2 diabetes incidence: A prospective cohort study. *Clinical Nutrition*. 2021;40(5):3608-14. DOI:10.1002 /2327 - 6924.12447
- Jenkins DW, Jenks A. Exercise and diabetes: a narrative review. *The Journal of Foot and Ankle Surgery*. 2017;56(5):968-74. DOI: 10.1002/2327-6924.12447
- Nirmala C, Bisht MS, Bajwa HK, Santosh O. Bamboo: A rich source of natural antioxidants and its applications in the food and pharmaceutical industry. *Trends in Food Science & Technology*.2018;77:91-9. http://DOI: 10.1002 /2327-6924.12447
- Santosha O, Bajwaa HK, Bishtb MS, Nirmalaa C. Bamboo shoot fortified cookies as a healthy snack. ID; 2018. DOI: 10.1002/2327-6924.12447
- Wang Y, Chen J, Wang D, Ye F, He Y, Hu Z, et al. A systematic review on the composition, storage, processing of bamboo shoots: Focusing the nutritional and functional benefits. *Journal of Functional Foods*. 2020;71:104015. DOI: 10.1002/2327-6924.12447
- Li Q, Fang X, Chen H, Han Y, Liu R, Wu W, et al. Retarding effect of dietary fibers from bamboo shoot (*Phyllostachys edulis*) in hyperlipidemic rats induced by a high-fat diet. *Food & Function*.2021;12(10):4696-706.DOI:101039/D0FO024 07D
- Wu W, Hu J, Gao H, Chen H, Fang X, Mu H, et al. The potential cholesterol-lowering and prebiotic effects of bamboo shoot dietary fibers and their structural characteristics. *Food Chemistry*. 2020;332:127372.
- Rezapour M, Ali S, Stollman N. Diverticular disease: an update on pathogenesis and management. *Gut and liver*. 2018;12(2):125.
- Gregg EW, Cheng YJ, Srinivasan M, Lin J, Geiss LS, Albright AL, et al. Trends in cause-specific mortality among adults with and without diagnosed diabetes in the USA: an epidemiological analysis of linked national survey and vital statistics data. *The Lancet*. 2018;391 (10138) :2430-40.
- Herrera MCA, Subhan FB, Chan CB. Dietary patterns and cardiovascular disease risk in people with type 2 diabetes. *Current obesity reports*. 2017;6(4):405-13.
- Kasprzak K, Wojtunik-Kulesza K, Oniszczuk T, Kuboń M, Oniszczuk A. Secondary metabolites, dietary fiber and conjugated fatty acids as functional food ingredients against overweight and obesity. *Natural Product Communications*. 2018;13(8):1934578X1801300836. DOI: https://doi.org/10.1177/1934578X1801300836
- Singh J, Metrani R, Shivanagoudra SR, Jayaprakasha GK, Patil BS. Review on bile acids: Effects of the gut microbiome, interactions with dietary fiber, and alterations in the bioaccessibility of bioactive compounds. *Journal of agricultural and food chemistry*. 2019;67(33):9124-38.
- Bae JH, Kim LK, Min SH, Ahn CH, Cho YM. Postprandial glucose-lowering effect of premeal consumption of protein-enriched, dietary fiber-fortified bar in individuals with type 2 diabetes mellitus or normal glucose tolerance. *Journal of diabetes investigation*. 2018;9(5):1110-8.
- Higa M, Fuse Y, Miyashita N, Fujitani A, Yamashita K, Ichijo T, et al. Effect of high β -glucan barley on postprandial blood glucose levels in subjects with normal glucose tolerance: assessment by meal tolerance test and continuous glucose monitoring system. *Clinical nutrition research*. 2019;8(1):55-63. DOI: 10.7762/cnr.2019.8.1.55
- Ahuja A, Gupta J, Gupta R. Diabetes silent killer: Medical focus on food replacement and dietary plans. *Adv Biores*. 2020;11(5):128-35.
- Rivera-Piza A, Choi L, Seo J, Lee HG, Park J, Han SI, et al. Effects of high-fiber rice *Dodamssal* (*Oryza sativa* L.) on glucose and lipid metabolism in mice fed a high-fat diet. *Journal of food biochemistry*. 2020;44(6):e13231.
- Lambeau KV, McRorie Jr JW. Fiber supplements and clinically proven health benefits: How to recognize and recommend an effective fiber therapy. *Journal of the American Association of Nurse Practitioners*. 2017;29(4):216-2 DOI: 10.1002/2327-6924.12447

Author's Contribution:

Laraib Imdad	Study design, approval from advance study and research board, data collection, data analysis, and interpretation and write up for results. Manuscript writing, critically revised important intellectual content.
Dr. M Adeel Alam Shah	Study design, data analysis. Manuscript writing, critically revised important intellectual content. Revised and approved the articles.
Dr. Javaid Hassan	Data collection, data analysis, Manuscript writing, critically revised important intellectual content. Revised and approved the articles
Dr. Farhat Humayun	data collection, data analysis, Manuscript writing, critically revised important intellectual content. Revised and approved the articles.
Dr. Ayesha Sadiq	Study design, data analysis and interpretation, revising manuscript critically for important intellectual content.
Dr. Mavish Javed	data collection, data analysis, Manuscript writing, critically revised important intellectual content. Revised and approved the articles.
	All authors are equally responsible for the validity of the data

Date of Submission: 19-08-2021
Revised received: 01-01-2022
Accepted: 25-01-2022