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Short Communication

Effect of momordica charantia (bitter gourd) tablets in diabetes mellitus: Type 1 and Type 2

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Bitter melon (Momordica charantia) or bitter gourd commonly known as karella, (family: Cucurbitaceae), has been proved for hypoglycemic effects. Momordica Charantia is one of the many plants considered to have a hypoglycemic effect and many diabetic subjects consume it because of its hypoglycemic effect. Bitter gourd is well known for its insulin-like protein, called p-insulin, v-insulin, or polypeptide-p, that decreases fasting blood sugar levels in type 1 and type 2 diabetic patients. Cucurbitantype triterpenoids in fruits, including momordicine and momordicosides, and conjugated linolenic acid, a fatty acid found in high concentrations in the seeds, help reverse insulin resistance. Fiber and saponins in bitter gourd slow down carbohydrate digestion and prevent high post-prandial blood sugar levels. Isolated compounds, bitter gourd extract, juices and powders have demonstrated potential in lowering blood sugar. Different groups of patients were treated by bitter gourd tablet (BGT) for 12 weeks. After 12 weeks treatment biochemical parameters from blood serum were analyzed. The significant differences of glucose, cholesterol, HDL, LDL, triglyceride, in BGT treated group compare to diabetic group were found. So, from present study it is, concluded that Bitter gourd tablets has beneficial effects on glucose tolerance.

Key words: Diabetes mellitus; bitter gourd; blood sugar

INTRODUCTION

Diabetes mellitus is a serious chronic metabolic disorder that has a significant impact on the health, quality of life, and life expectancy of patients, as well as on the health care system. Diabetes mellitus is a group of metabolic diseases characterized by elevated blood glucose levels (hyperglycemia) resulting from defects in insulin secretion, insulin action or both. Insulin is a hormone manufactured by the beta cells of the pancreas, which is required to utilize glucose from digested food as an energy source. Chronic hyperglycemia is associated with microvascular and macrovascular complications that can lead to visual impairment, blindness, kidney disease, nerve damage, amputations, heart disease, and stroke (American Diabetes Association, 2008). The heart disease is a major cause of death in diabetic patients (Wilson, 2002 and Stamler et al., 1993) and coronary artery disease and atherosclerosis are mainly involve in the increased incidence of cardiovascular dysfunction (Sowers et al., 2001 and Lteif et al., 2003). Hypertension and diabetes are interrelated metabolic disorders that strongly predispose an individual to atherosclerotic cardiovascular disease (CVD) [Bakris et al., 2000; Epstein and Sowers (1999); and Weir, 1999].

The Bitter melon (Momordica charantia) or Bittergourd fruit (BF), commonly known as karella (L), family: Cucurbitaceae), is grown in tropical countries in South Asia, South America and Africa. The juice of bittergourd fruit has been proved for hypoglycaemic effects in experimental type 1 diabetes and in type 2 human diabetes (Platel and Srinivasan (1997) and Ahmed, 2004). The tablets of bittergourd can increase glucose uptake by tissues in vitro (Welihinda et al., 1986). The active fractions from fruits of M. charantia such as saponins (Lotlikar et al., 1966 and Matsuda et al., 1998) and peptides (Khanna et al., 1981) had hypoglycemic effects. To date, close to 100 in vivo studies have demonstrated the blood glucose-lowering effect of this bitter fruit. The fruit has also shown the ability to enhance

cells' uptake of glucose (Miura et al., 2001) to promote insulin release, and potentiate the effect of insulin (Ali et al., 1993 and Vikrant et al., 2001). In view of various effects of bitter gourd tablets, this study was designed to assess the effect of bitter gourd tablets on glucose tolerance.

MATERIALS AND METHODS

Preparation of Bitter gourd tablets

Bitter gourd fruits were obtained from the local market, washed thoroughly, and the bitter gourd (BG) tablets were made from shade dried powdered fresh whole fruit. The average sized fruit weights around 7 gm when dried. Each tablet contained 1 gm of dried fruit and each patient received 2 tablets thrice daily, after meals. Riboflavin was given as placebo, as placebo identical to BG could not be made and riboflavin is not known to have any hypoglycemic effect and it is freely available. All patients were asked to continue their routine anti diabetic treatment, which included dietary modification and oral hypoglycemic agents such as sulfonylureas and biguanides.

Objective of the study

This study was conducted to evaluate the usefulness of Momordica charantia in mild to moderate type 2 diabetes mellitus using a randomized controlled study design.

Place of study

This study was conducted in a tertiary care 50 bed teaching hospital in northth India. Clearance was obtained from the Institutional Medical Ethics Committee for this study.

Inclusion and exclusion criteria

Consecutive type 2 diabetic patients who attended the medical outpatients with fasting plasma glucose (FBS) of 140–200 mg/dl and post prandial plasma glucose (PPS) of 200–300 mg/dl were recruited to the study. Patients were excluded if they were diagnosed to have type 1 diabetes mellitus or had FBS >200 mg/dl and PPS >300 mg/dl. Diabetic patients with infection or with diabetic related complications, Pregnant women, lactating mothers and patients on insulin for sugar control were also excluded from the study.

Sample size

Sample size was calculated to get a 30 mg/dl reduction in FBS/PPS, keeping alpha error at 5% level and beta error at 10% level, 25 patients were required to be recruited in each arm. Patients were randomized to receive either bitter gourd tablets (26 subjects) or placebo (24 subjects).

Treatment protocol

Initial screening included routine blood and urine tests including FBS/PPS. Glycemic control was assessed by fructosamine assay since it has an advantage over HbA1C in assessing the short-term glycemic control (2 to 3 weeks). At the end of 2 and 4 weeks, FBS/PPS and fructosamine assays were repeated. Patients were instructed to bring all the left over medicines on follow-up to ensure compliance. As the tablets were dissimilar, the investigator could not be blinded, the patients and laboratory personnel were blinded. Comparison of FBS/ PPS and fructosamine assays at 2 and 4 weeks was done by analysis of variance (ANOVA) for repeated measures.

Statistical analysis

Results were presented as Mean + SEM. Statistically differences between the means of the various groups were evaluated using one-way analysis of variance (ANOVA) followed by Turkey's test. Data was considered statistically significant at P value < 0.05.

RESULT AND DISCUSSION

In present study, it was found that there was increase in food & water intake and significant weight loss in diabetic patients as compared to control group. Treatment with bitter gourd tablets (BGT) significantly reduced the elevated food and water intake of diabetic patients. This indicates that BGT may improve characteristic symptoms of polyphagia & polydypsia of diabetes mellitus. In the present study also diabetic patients were found to have impaired glucose tolerance with high glucose level after one hour of glucose load compared to control group. The results of this study have demonstrated that oral administration of BGT. It is well known that dietary fibers facilitate slow absorption of glucose isn gastrointestinal tract (Wolver and Jenkins (1986)). These results support those of Sarkar *et al*., (1996), wherein they have demonstrated the hypoglycernic action of M. charantia in a validated animal model of diabetes. Currently, the cellular mechanisms involved in the hypoglycaemic effects of M. charantia are not yet fully established. However, a number of studies have suggested that M. charantia may either have insulin like secretagogue effect, it can stimulate peripheral glucose utilization or it may inhibit key gluconeogenic enzymes such as glucose-6-phosphatase and fructose biphosphatase.

Diabetic patients were found to exhibit significant ($P<0.05$) hyperglycemia compared to control groups in oral glucose tolerance which was improved by BGT treatment .There were significant ($P<0.05$) increase in cholesterol, very low density lipoprotein (VLDL), and triglycerides levels, and significant ($P<0.05$) decrease in high density lipoprotein (HDL)-cholesterol levels in diabetic patients as compared to control groups. Treatment with BGT significantly ($P<0.05$) reduced the cholesterol, VLDL and triglyceride levels in diabetic patients and increased the HDL-cholesterol levels.

Abnormalities in lipoproteins are very common in both NIDDM and IDDM. Diabetes leads to alterations in the plasma lipid and lipoprotein profile and increases risk of

Table 1: Effect of BGT treatment on oral glucose tolerance test of control and diabetic patients

Serum Glucose (mg/dl) at time interval	Normal control	Normal treated with BGT	Diabetic control	Diabetic treated with BGT
4 Week	127.32± 4.70	137.71± 3.61	236.23± 12.72	159.90± 5.67
8 Week	118.58±3.21	127.64±2.72	225.17±8.24	129.93±4.21
12 Week	110.18±3.17	118.70±2.50	214.48±8.29	116.49±4.67

Significantly different from diabetic control ($p < 0.05$)

coronary heart disease. In patients with type 2 diabetes hyper triglyceridemia and low HDL-cholesterol levels are common (Taskinen 1992). In addition to the hypoglycemic activity of BGT, it also possesses lipid lowering properties in diabetic patients. In the present investigation, serum cholesterol and triglyceride levels of diabetic patients were found to be significantly decreased by the treatment with BGT (Table 1).

CONCLUSION

In conclusion, it is a wonderful plant not only providing nutrition but also offering several components which show medicinal activities against number of diseases, the results of this study have clearly demonstrated that bitter gourd fruit tablets can have marked beneficial effects in the treatment of diabetes mellitus, bitter gourd fruit tablets administration may be useful as an adjuvant therapy with oral hypoglycaemic agents in the management of diabetes mellitus.

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