Effect of *Momordica charantia* (Karolla) Extracts on Fasting and Postprandial Serum Glucose Levels in NIDDM Patients*

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Summary

Effect of *Momordica charantia*, a bitter vegetable popularly known as Karolla, on fasting and post prandial (2 hours after 75 gm oral glucose intake) serum glucose levels were studied in 100 cases of moderate non-insulin dependent diabetic subjects. Drinking of the aqueous homogenized suspension of the vegetable pulp led to significant reduction ($p<0.001$) of both fasting and post-prandial serum glucose levels. This hypoglycaemic action was observed in 86 (86%) cases. Five cases (5%) showed lowering of fasting serum glucose only.

Introduction

Momordica charantia is a green bitter vegetable popularly known in Bangladesh as Karolla and is available everywhere in the country almost throughout the year. *M. charantia* has profound beneficial effects in diabetes mellitus.[1] Several studies have shown that the extract of this vegetable when administered orally can lower blood sugar level both in human diabetic subjects as well as in laboratory animals.[2-7] The knowledge about this property of *M. charantia* is still in preliminary stage and needs further characterization. The present study was conducted to re-examine whether drinking of *M. charantia* extract in the fasting state can lower the fasting and postprandial (2 hours after 75 gm oral glucose drink) serum glucose levels in moderate non insulin dependent diabetic subjects.

Materials and methods

This study was carried among one hundred consecutive cases of moderate non insulin dependent diabetes mellitus (NIDDM) patients at the Diabetic Association, Barisal branch during March to December, 1995. The patients who were free from major complications of diabetes or other concurrent illnesses were included in the study. Those with post-prandial serum glucose levels beyond range of 200-400 mg/dl were excluded from the study.

Fresh unripe vegetables from local markets were used to prepare the extract daily. Only the pulp excluding the seeds was used to prepare the extract. The amount of *M. charantia* (in gm) to be used to prepare extract for a particular patient was determined using the formula: Body weight (in Kg) x 2 [formulated by the author]. The required amount was homogenized in a mortar, blended with little water and water was added to make a final volume of 150 to 200 ml.

After selection of study subjects a detailed history was taken and thorough physical examination was done and the findings were recorded in the data sheet. Routine urine examination and serum

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urea levels were done. Three days before the experiment all antidiabetic agents were stopped and for preparation every patient was advised to take a diet of 2000 Cal containing at least 300 gm carbohydrate. Diabetese enhancing drugs were also stopped during prepration.

After preparation for 3 days, the patients attended Diabetic Association Clinic in fasting state for two consecutive days. On the first day a fasting blood sample (S_1) and a post prandial (2 hours after 75 gm oral glucose drink) blood sample (S_2) were obtained. On the next day a fasting blood sample (S_3) was taken; then the patient was asked to drink the *M. charantia* extract; blood sample (S_4) was taken exactly after one hour of *M. charantia* drink; then the patient took 75 gm oral glucose drink and gave a postprandial blood sample (S_5) after two hours. Sample S_3 and S_2 was considered as control and S_4 & S_5 as the test. Paired t-test was done to observe the significant difference (if any) between the control and test samples.

Blood samples were collected from antecubital vein. As soon as blood got clotted the sample were centrifuged to separate serum. Serum glucose levels were estimated by glucose oxidase PAP (peroxidase anti-peroxidase) method (calorimetric).

Results

Out of 100 NIDDM cases of this series 58 (58%) were male and 42 (42%) were female. The average age was 48.6±8.62 years (table-I). Eighteen cases were newly detected and yet to start any antidiabetic treatment and the rest 82 were known diabetic and had been taking oral hypoglycaemic agents. Table-II has shown the body mass index (BMI) status of the participants.

Table-I: *Characteristics of the study subjects*

Features	Range	Average	SD
Age (in years)	35-78	48.6	±8.62
Body weight (in kg)	58-88	68.3	±9.74
Duration of diabetes (in years)	0-18	5	±3

Table-II: *Distribution of diabetic subjects by BMI*

BMI	Male		Female		Total	
	Number	Percent	Number	Percent	Number	Percent
19-22	06	06	03	03	09	09
22-25	35	35	21	21	56	56
25-28	15	15	18	18	33	33
≥28	02	02	00	00	02	02
Total	58	58	42	42	100	100

M. charantia extract drink in fasting state led to decrease of fasting and postprandial (2 hours after 75 gm oral glucose drink) serum glucose levels. This hypoglycaemic effect was observed in 86 (86%) out of the 100 cases of this series. In the remaining 14(14%) cases 5(5%) showed lowering of fasting serum glucose only while the postprandial levels increased. In the remaining 9(9%) cases both fasting and postprandial glucose levels increased. Effects of *M. charantia* on fasting serum glucose was determined by comparing the samples S_3 and S_4. Similarly, effect of the extract on postprandial serum glucose was determined by comparing samples S_2 and S_5 (table-III).

Table-III: *Effect of M. charantia juice extract on fasting & 2 hours after oral glucose challange*

Day	Blood Samples	Serum Glucose Levels Mean (±SE) mg/dl
Day - 1	S_1	152.4(±3.1)
	S_2	257.2(±5.4)
Day - 2	S_3	159.6(±4.1)
	S_4	130.5(±3.7)
	S_5	221.9(±3.9)

* $p \leq 0.001$ when compared S_3 vs S_4
* $p \geq 0.001$ when compared S_2 vs S_5

Discussion

This study showed that *Momordica charantia* got the serum glucose lowering property both in fasting and postprandial conditions. Similar

hypoglycemic property of it was observed by other investigators.[3,4] The weaknesses of the present observation include that the study was not blinded, the sample was not an ideal random one, and the instructions to be followed by the patients at home could not be supervised. The study design was also a limitation. The confounders were not considered during analysis.

The extract failed to lower serum glucose levels in 14 patients. This is difficult to explain. However, the probable explanation may lie in the fact that all the patients of NIDDM may not have the same underlying pathogenesis and therefore might responded to *M. charantia* in a different manner.

The active principle(s) in *M. charantia* extract responsible for hypoglycaemic property is yet to be identified. A well done study involving both NIDDM and IDDM model rats concluded that the active principle(s) is in the pulp rather than in the seeds.[2] They also observed functioning beta cells are necessary for the hypoglycaemic effects of the extract. They suggested that the hypoglycaemic effect of the active compound(s) in *M. charantia* is probably mediated either by improving the insulin secretory capacity of beta cells or by improving the action of insulin.[5]

Many other speculation were put forward to explain the antidiabetic effect of *M. charantia.* Some authors suggested increased peripheral utilization of glucose as the mechanism underlying hypoglycaemic action as they observed no change in the serum insulin levels following *M. charantia* consumption.[6] Other investigators claimed presence of insulin like compounds or insulinomimetic substances in *M. charantia.*[7]

Stereoscopic and chemical analysis of fraction of *M. charantia* showed that one of its fraction contains 21 free amino acids along with several unknown components and another fraction consists of peptides with molecular weight (MW) between 600-700 showing insulin releasing properties in isolated rat islets.[8]

It is now being increasingly obvious that further progress of knowledge in this area depends on identification, isolation and characterization of the active principle(s) in *M. charantia* and determining the mode of actions.

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References

1. Chopra RN, Chopra IC, Handa KL, Kapur LD. Indigenous drugs of India. 2nd ed. Calcutta: UN Dhur & Sons, 1953.
2. Ali L, Khan AKA, Mamun MIR, et al. Studies on hypoglycaemic effects of fruit pulp, seed and whole plant of *Momordica charantia* on normal and diabetic model rats. Plan Med 1993; 56: 408-12.
3. Leartherdale BA, Panesar RK, Atkina TW, et al. Improvement in glucose tolerance due to *Momordica charantia* (Karolla). BMJ 1981; 282: 1823-5.
4. Aslam M, Stockley IH. Interaction between curry ingredient (Karolla) and drug (Chlorpropamide) Lancet 1975; 1: 607.
5. Pabrai PR, Sehra KB. Effect of *Momordica charantia* on blood sugar in rabbits. Indian J Pharm 1962; 24: 209-13.
6. Guppy SS, Seth CB. Effect do *Momordica charantia* linn (Karolla) on glucose tolerance in albino rats. J Indian Med Assoc 1962; 39: 581-4.
7. Kedar P, Chakarabartic CH. Effect of bittergourd (*Momordica charantia*) seed & glybenclamide in streptozocin induced diabetes mellitus. Indian J Exp Biol 1982; 20: 232-5.
8. Anonymous. Insulin releasing effects of *M. charantia* fraction on isolated rat islets [Editorial]. Diabetogia 1995; 38 (Supl, August): 1-3.