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Hypoglycemic potential of *Momordica charantia* Linn in Streptozotocin induced diabetic Albino mice

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Abstract

In order to check hypoglycemic property of *Momordica charantia*, experiments were conducted in streptozotocin induced diabetic albino mice. The LD_{50} of STZ was seen to be 650 mg/kg bw. Significant reduction in blood glucose level was seen within 24 hours after administration of ethanolic extract of MC. On administration of subsequent doses of ethanolic extract, significant decrease has also been seen in serum glucose level, creatinine, ALT, AST, AP of STZ induced albino mice. Thus one or other part of MC can be used in lowering down blood glucose level.

Keywords: *Glucose*, *Kidney function*, *Liver function*, *Momordica charantia*

Introduction

Diabetes mellitus is a metabolic disorder affecting carbohydrate, fat and protein metabolism. It represents a heterogeneous group of disorders causing hyperglycemia, which is due to impaired carbohydrate "glucose" utilization resulting from a defective or deficient insulin secretary response. Along with hyperglycemia, there is also an abnormality in serum lipids (Reaven, 1988). The disease causes morbidity and long-term complications and an important risk factor for cardiovascular diseases (Yeh *et al.*, 2003). To-date there are different groups of oral hypoglycemic drugs and insulin for clinical use, having characteristic profiles of side effects. Management of diabetes without any side effects is still a challenge to the medical system. This leads to increasing the demand for complementary and alternative medicine with antidiabetic activity and less side effects.

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Numerous herbal preparations have been shown to affect blood glucose levels through various mechanisms, although they are usually limited by toxicity or relative lack of efficacy compared with standard medications. The lack of standardization of ingredients and preparation also causes problems. *Momordica charantia* L. belonging to the family "Cucurbitaceae" is a vegetable indigenous to tropical areas, including India, Asia, South America and Africa, also known as balsam pear. MC is also, used for treating various diseases, one of which is diabetes mellitus (Virdi *et al*., 2003). The hypoglycemic potential of MC has been demonstrated in normal and diabetic rats(Shibib *et al*., 1993 and Srivastava *et al*., 1993). MC can improve glucose metabolism (Welihinda *et al.*, 1986) and the over all condition of persons with diabetes, not only through a direct hypoglycemic effect but also by improving lipid metabolism (Virdi *et al.*, 2003). From reviewing the literature the mechanism(s) whereby MC lower blood glucose remains uncertain. Thus, the aim of the present study is to evaluate the LD_{50} and biochemical effect of MC ethanolic extract in diabetic mice. This will be a guide to the separation and synthesis of the most active plant

substance for clinical application on one hand and its proper utilization in traditional medicine on the other.

Materials and Method

Plant Material

We purchased 1 kg of unripe fresh fruits of MC from local market in Patna and certified by Botany Department of Patna University.

Extraction of Plant materials

The fruits were cut into small pieces and placed in percolator and then submerged into 95% double distilled Ethanol for 24 hours.After 24 hours ethanol was decanted into conical flask and the extract was stored in deep freezer. The process was repeated for 3 to 4 times so that all the extract from plants came into the ethanol and extract was collected in the same conical flask. The ethanol with plant extract was placed into the Rota vapor (BUCHI-011) under low pressure to separate the Ethanol from plant extract. The temperature of water bath should be maintained between 45^0 C to 50^0 C. Ethanol was vaporized and collected into another bottle flash and plant extract was left into the same bottle flask.

Test animals

In the experiments performed, adult albino mice of both sexes weighing 25-30 g were used. Standard diet was provided and water was available on bottle. Following an over night fast, whole blood was obtained without anaesthesia from the retro orbital venous plexus (Madway *et al*., 1969); All animal procedures were performed after blood collection.

LD_{50}experiment

The LD_{5O} was determined using mice according to the method described by Karber (1931). The MPD was also determined. The symptoms of acute toxicity and postmortem finding were recorded.

Study design and dosage

The animals were divided into two groups, one normal, while other was rendered diabetic by injection of 100 mg/kg of STZ dissolved in 1 mm citrate buffer at pH 4.5 for 2 consecutive days. Diabetic groups were further divided into 2 subgroups of ten mice each. The first subgroup was not treated with any thing and maintained as control. The second subgroup was treated with 200 mg/kg extracts of MC fruit respectively for 21 days.

Also, the diabetic untreated mice were maintained for further study in parallel to that of diabetic treated one.

Assay

Serum glucose, creatinine, serum alkaline phosphatase, transminases. AST and ALT, were measured by kits.

Statistical Data

Data are shown as mean ± SE. The statistical analysis was performed with the analysis of standard deviation. The results obtained at the end of each time phase were compared with those obtained from zero time from the same group.

Results and Discussion

LD_{50} evaluation

The toxic symptoms of MC alcoholic extract in mice included increased respiratory rate and strong heart beats. After 2 h post injection, the animals suffered from general depression, shallow deep respiration and very weak hearts that ended by death. The LD_{50} of the ethanolic extract of MC was found to be 650 mg/kg.

Effect of serum glucose level (Fig.1)

The administration of MC ethanolic extract induced a significant decrease in serum glucose levels as compared with its zero time. But there were no reduction shown by control diabetic group in the period of 21 days.

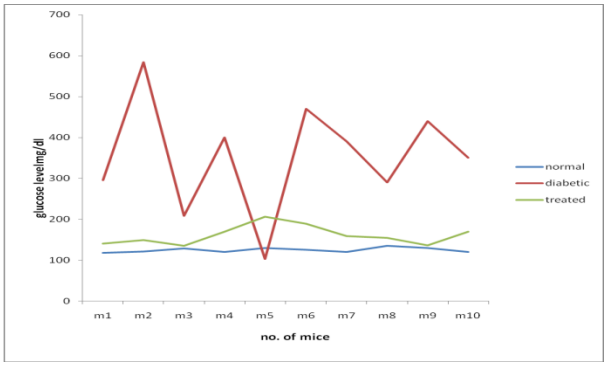

Fig.1: Effect of serum glucose level

Effect on Kidney function (Fig. 2)
Contrary to normal mice, the administration of MC ethanolic extracts exhibited a highly significant effect in serum creatinine levels.

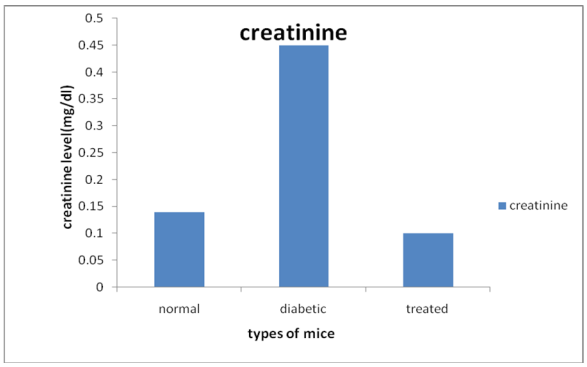

Fig.2: Effect on Kidney function

Effect on liver function (Fig.3a,b,c)
Also contrary to normal mice, the administration of MC ethanolic fruit extracts caused a very highly significant effect on enzymes of liver function "ALT, AST and AP" at 21days of treatment.

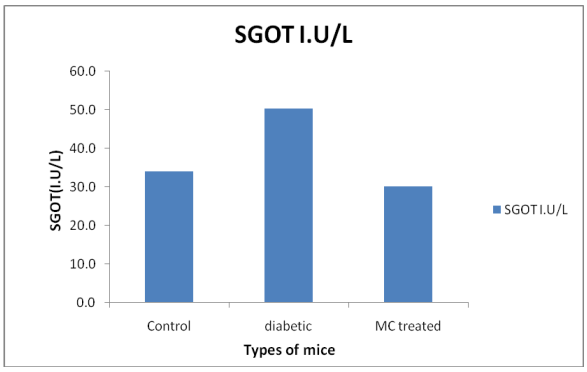

Fig.3a

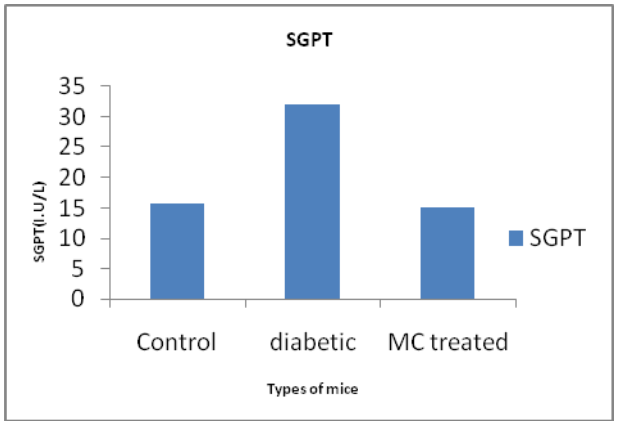

Fig.3b

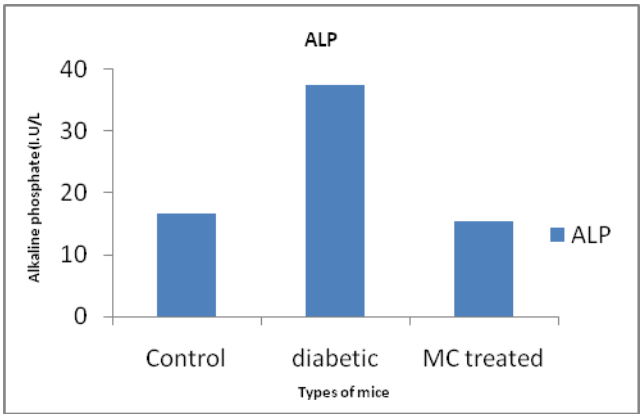

Fig.3c

In the present study, the toxic effect of ethanolic extracts of MC was measured. LD_{50} was calculated. The post mortem examination revealed congestion of internal organ. The obtained results in the diabetic mice using dose of 200 mg/kg bw/day. On the other hand, data from the present study demonstrated that the administration of MC ethanolic extracts to diabetic mice induced a significant decrease in serum glucose levels. This finding run parallel with that obtained by Ali *et al*. (1993), Srivastava *et al*. (1993), Rao *et al*. (1999), Chen *et al.* (2003), Matsuura *et al*. (2002), *Yeh et al*. (2003) and Miura *et al*. (2004). It was also reported by Chen *et al.* (2003) that MC has been shown to inhibit glucose absorption, promote hepatic glucose utilization (Meir and Yaniv, 1985 and Shibib *et al.*, 1993), possess an insulin-like polypeptide (Khanna *et al*., 1981), and even to increase insulin positive cell number in the pancreas (Ahmed *et al.*, 1998). Furthermore, an insulin like protein called "insulin p" isolated from MC has been reported to possess hypoglycemic properties when injected subcutaneously (Baldwa *et al.*, 1977, Khanna *et al*., 1981 and Ng *et al.*, 1986). At the same time the administration of MC ethanolic extracts to diabetic mice revealed significant change in kidney and liver function during the experimental period of 21 days. In STZ-induced diabetes mellitus, the rise in blood glucose is accompanied by an increase in serum creatinine, ALT, AST, AP. After the treatment of diabetic mice with MC ethanolic extracts for a 21days period caused a significant reduction in glucose level, creatinine, ALT, AST and AP. This finding of the present study on kidney and liver function are compatible with many published

results (Rao *et al.*, 1999, Jayasooriya *et al*., 2000 and Ahmed *et al.*, 2001). Administration of MC ethanolic extract in diabetic mice induced a significant decrease in glucose level, creatinine, ALT, AST and AP. Also, the seed powder of MC has also been shown to have a hypolipidemic effect in diabetic rabbits (Kedar and Chakrabarti, 1982). In conclusion, it is obvious from the present study that MC has beneficial effects on blood glucose level as well as improving kidney & liver function. These results could be used in the medical treatment in case of deficiency of insulin hormone by using a medicinal plant.

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