

Hypoglycemic potential of *Morus indica*. L and *Costus igneus*. Nak.—A preliminary study

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Powdered leaves (500 mg/kg body weight) of medicinal plants *M. indica* and *C. igneus* known to possess therapeutic effect were supplemented to streptozotocin induced diabetic rats. Leaf powders of both the plants were able to reduce blood glucose levels in the animals by 38 and 21% respectively after 15 days of supplementation. The preliminary results suggest that both the plants possess potent hypoglycemic activity.

Keywords: *Costus igneus*, Diabetes, Hypoglycemic effect, *Morus indica*.

Diabetes mellitus is a chronic disease characterized by high blood glucose levels due to absolute or relative deficiency of circulating insulin levels. Though different types of oral hypoglycemic agents are available along with insulin for the treatment of diabetes mellitus, there is increasing demand to use the natural products with antidiabetic activity. Insulin cannot be used orally and continuous use of the synthetic drugs causes side effects and toxicity. Because of their effectiveness, less side effects and relatively low cost¹, herbal drugs are prescribed widely even when their biologically active compounds are unknown. Many Indian medicinal plants have been found to be useful in successfully managing diabetes and from some of them active principles have been isolated²⁻⁵.

Traditional plants with antidiabetic potential may provide a useful source of new oral hypoglycemic compounds for development as pharmaceutical entities or as simple dietary adjuncts to existing therapies^{2,6,7}. *M. indica* commonly known as mulberry, (*Shahtoot* in Hindi, *Tut* in Bengali and Marathi, *Hipnerle* in Kannada and *Shetur* in Gujrati)

is a fast growing deciduous plant, known to possess medicinal applications as it contains diuretic, hypoglycemic and hypotensive properties⁸. *C. igneus* (Sanskrit, *Katar Katar*) also known as Fiery costus or Spiral flag or insulin plant is used in India to control diabetes and it is known that diabetic people eat one leaf daily to keep their blood glucose low. The hypoglycemic effect of *M. indica* has been studied in animal model wherein the plant in the dehydrated powder form was supplemented at 25% level in the diet⁷. This level is practically not feasible and also the effect of *M. Indica* on the key enzymes of carbohydrate metabolism, such as aldolase and glucose-6-phosphate dehydrogenase has not been reported. Also, there are no scientific documentation regarding the hypoglycemic effect of *Costus igneus*. Hence the present experiment has been designed to study the hypoglycemic potential of mature leaves of both the plants in streptozotocin induced diabetes mellitus in rats.

Chemicals—Streptozotocin was procured from Sigma Chemicals, Bangalore. GOD-POD kit for the estimation of blood glucose was procured from Span Diagnostics (Surat, India). All the other chemicals used were of analytical grade and purchased locally.

Plant material—Fresh Mulberry leaves (*Morus indica*, MIP) were obtained from the Department of Studies in Sericulture, University of Mysore, India, and leaves of insulin plant (*Costus igneus*, CIP) were purchased from local horticultural farm. Both the plants were identified by a botanist and the voucher specimen has been preserved in the Department of Botany, University of Mysore.

Processing of leaves—Fresh leaves of mulberry and insulin plant were brought in bulk, cleaned, dried overnight (55°-60°C) in an oven, ground, passed through sieve and stored in airtight container at refrigeration temperature (4°C) before use.

Animals—Male albino rats (24) of Wistar strain weighing 150-200 g procured from Central animal house Department of Zoology University of Mysore were used. It is well known that there will be secretions of reproductive hormones in female animals, hence, male rats were used for the study.

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Permission was taken from the Animal Ethical Committee of the University for conducting the study. The animals were housed in individual cages and were allowed to acclimatize with cereal-pulse based diet which consisted of wheat flour (62%), defatted soya flour (18%), groundnut oil (10%), sugar (7%), vitamin mix (1%) and mineral mix (2%) and water was provided *ad libitum*.

Experimental design—Based on their weights using randomized block design the rats were divided into following 4 groups with 6 animals each:

Group I- Healthy control rats.

Group II- Diabetic group without treatment.

Group III- Diabetic group treated with Mulberry leaf powder.

Group IV- Diabetic group treated with Insulin leaf powder.

After overnight fast, animals of group II, III and IV were rendered diabetic by a single ip injection of streptozotocin (STZ; 55 mg/kg body weight)⁹ prepared in freshly prepared 0.1 M citrate buffer. The diabetic animals were provided 5% glucose solution for 24 hr following streptozotocin injection to prevent initial drug-induced hypoglycemic mortality. After 72 hr of injection, blood was drawn from retro orbital plexus (RPO) of anaesthetized overnight fasted animals to check the fasting blood glucose. Rats with fasting blood glucose more than 250 mg/dl were selected for the experimental group. Based on the results of *in vitro* studies (on glucose diffusion and adsorption), both MIP and CIP at a level of 500 mg/kg body weight were provided to the rats. The animals were maintained with above treatment for 15 days. MIP and CIP were sprinkled on the top layer of the diet provided to the animals, to ensure consumption of the selected dose. During the study period, food and water intake of the animals were monitored and expressed as intake/week \pm SD. The weights of the animals were monitored weekly. Blood was drawn from ROP once a week and blood glucose was estimated immediately by Glucose-Oxidase Peroxidase kit in protein free supernatant.

Statistical analysis—Data were subjected to statistical analysis using one way ANOVA and Student's *t* test using SPSS software.

Body weight—The body weight of the diabetic control group decreased significantly by the end of first week (4%) and by 8% ($P < 0.05$) at the end of second week (Table 1). There was a decrease in the body weights of the MLP and CIP treated groups also

at the end of first week, however the decrease was less (5 and 6.9% respectively) than in the untreated diabetic group at the end of second week.

Food and water intake—During the first week of the study, the average weekly food intake was significantly low ($P < 0.05$) in the experimental groups (III- 42.9 g and IV - 47.7 g) compared to the healthy control group (67.8 g). However, during the second week a significant increase in the food intake of the animals treated with MIP and CIP was observed (III – 81.8 and IV – 90.1 g respectively) compared to healthy control group (68.7 g), while the food intake of uncontrolled diabetic group was significantly ($P < 0.05$) higher (101 g) compared to other groups (Table 1). Water intake was 163, 476, 250 and 265 ml in control, DC, MIP and CIP groups respectively at the end of second week respectively.

Blood glucose—By second week, the blood glucose increased in untreated diabetic group from 286 ± 25 to 459 ± 63.7 mg/dl when compared to 72 ± 7.2 mg/dl in the healthy control. Supplementation of MIP and CIP for 15 days decreased the blood glucose significantly ($P < 0.05$) (Table 2). In the MIP treated group, the blood glucose decreased (38%) from an initial of 257 ± 69.4 to 158 ± 109.6 mg/dl at the end of 15 days. In the CIP treated group, there was a significant decrease (21%) in the blood glucose from an initial level of 335 ± 69.7 to 263 ± 86 mg/dl after 15 days. But in the untreated diabetic group the blood glucose increased from 286 ± 25 to 459 ± 63.7 mg/dl. Urine sugar which showed a threshold of 2.8 and 3.8% at the beginning for MIP and CIP groups respectively decreased to 1.5 and 1.7% during the

Table 1—Effect of *M. indica* and *C. igneus* on changes in body weight and food consumption of the rats. [Values are mean \pm SD from 6 rats in each group]

Group	Body weight (g)		Food intake (g)	
	Initial	1 st week	1 st week	2 nd week
Healthy control	144 \pm 17.2 ^a	67.8 \pm 7.7	68.7 \pm 3.7 ^a	184 \pm 9.9
DC	192 \pm 7.5 ^b	88.8 \pm 6.5 ^a	101 \pm 7.5 ^b	177 \pm 6.5 ^a
MIP	156 \pm 13.4 ^c	42.9 \pm 2.5 ^b	81.8 \pm 9.7 ^c	148 \pm 13.9 ^b
CIP	159 \pm 17.3 ^d	47.7 \pm 7.8 ^c	90.1 \pm 7.3 ^d	148 \pm 16.2 ^c

Values carrying superscripts a, b and c in columns differ significantly ($P < 0.05$) when compared with the healthy controls. DC = Diabetic control, MIP = *Morus indica* leaves powder, CIP = *Costus igneus* leaves powder

Table 2—Hypoglycemic effect of *M. indica* (MIP) and *C. igneus* (CIP) in streptozotocin induced rats
[Values are mean \pm SD from 6 rats in each group]

Group	Blood glucose (mg/dl)		
	Initial	1 st week	2 nd week
Healthy control	82 \pm 11.3 ^{al} (1 \pm 0.0)	84 \pm 8.1 ^{bl} (1 \pm 0.0)	72 \pm 7.2 ^{cl} (1 \pm 0.0)
DC	286 \pm 25 ^{am} (4 \pm 0.001)	423 \pm 83.4 ^{bm} (4 \pm 0.001)	459 \pm 63.7 ^{cm} (4 \pm 0.001)
MIP	257 \pm 69.4 ^{an} (2.8 \pm 0.8)	176 \pm 83.4 ^{bn} (2.3 \pm 0.5)	158 \pm 109 ^{cn} (1.5 \pm 1.2)
CIP	335 \pm 69.6 ^{ao} (3.8 \pm 0.4)	267 \pm 87.7 ^{bo} (2.8 \pm 1.2)	263 \pm 86 ^{co} (1.7 \pm 0.5)

Values carrying superscripts a, b and c in rows differ significantly ($P < 0.05$).

Values carrying superscripts l, m, n and o in columns differ significantly ($P < 0.05$).

Values given in the parenthesis represent % urine sugar, 1- Nil, 2- Traces, 3- 1%, 4- >2%.

second week in both the experimental groups.

Increased food and water consumption observed in the experimental groups in comparison to normal rats indicates polyphagic condition and loss of body weight due to excessive breakdown of tissue proteins⁶. Treatment with MIP and CIP decreased the food intake and there was lesser increase in the body weight of the animals. The average weekly water intake was significantly higher in both the experimental groups compared to the healthy control group throughout the study. The preliminary data of the present study indicates that both MIP and CIP are

effective in lowering the blood glucose. Among the two plants, MIP was found to be more effective compared to CIP. The longterm hypoglycemic effect and on the enzymes of carbohydrate metabolism of the above samples is currently being tested in comparison with the standard oral hypoglycemic agents and insulin treatment.

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