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The effect of *Premna integrifolia* Linn. (Verbenaceae) on blood glucose in streptozotocin induced type 1 and type 2 diabetic rats

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A total of more than 400 plants display hypoglycemic effects, but few of them have been investigated scientifically [1]. *Premna integrifolia* Linn. syn. *P. obtusifolia* R.Br. (Verbenaceae) grows commonly in the Indian and the Andaman coasts. The decoction of the root is a cordial, stomachic, laxative, and useful in liver disorders and diabetes [2, 3]. Some traditional healers use this as hypoglycemic agent. The plant possesses hypoglycemic action in rats [4, 5]. The present study investigated the effect of powder and alcoholic extract of the stem-bark of *Premna integrifolia* L. on blood glucose levels in streptozotocin induced Type 1 and Type 2 model rats in different prandial states.

The powder and the alcoholic extract did not show any hypoglycemic activity in Type 1 rats in fasting and 30 min before the glucose load state. When the drug was administered simultaneously with glucose, the powder did not alter blood glucose concentration, but the extract significantly ($p < 0.05$) opposed the rise of blood glucose in Type 1 rats (Table 1).

In Type 2 rats, a rise ($p < 0.05$) in the glucose level was evident in the powder group at the fasting state, revealing the possibility of negative action on β cell or enhancing gluconeogenesis at the fasting state. The extract had no effect at this fasting state. Both the powder and the extract did not alter the blood glucose level in Type 2 rats, when they were fed 30 min before glucose load. The extract group, when fed simultaneously with glucose, improved glucose tolerance ($p < 0.02$) in Type 2 rats (Table 2).

We conclude that *Premna integrifolia* L. powder did not show any hypoglycemic effects, but the extract showed a mild antihyperglycemic effect under our experimental conditions due to the possible effects of delaying intestinal glucose absorption in the GI tract or due to the increase of hepatic or peripheral glucose disposal.

Table 1: Effect of *Premna integrifolia* L. on Type 1 diabetic rats

Group	Serum glucose level mmol/l (p value)			
Fasting	0 min	60 min		120 min
Control (n = 10)	25.50 ± 1.22	23.70 ± 1.20		22.88 ± 1.24
Powder (n = 9)	26.40 ± 1.71 (0.669)	24.87 ± 1.24 (0.509)		22.40 ± 1.43 (0.796)
Extract (n = 9)	26.91 ± 1.11 (0.411)	25.79 ± 0.84 (0.182)		24.49 ± 0.77 (0.298)
30 min before glucose load	0 min	60 min	105 min	iobv
Control (n = 6)	27.44 ± 1.38	33.70 ± 1.99	31.82 ± 1.70	10.65 ± 1.70
Powder (n = 6)	26.89 ± 3.20 (0.878)	33.48 ± 1.58 (0.933)	30.48 ± 2.13 (0.634)	10.19 ± 4.57 (0.927)
Extract (n = 7)	27.40 ± 1.94 (0.988)	35.10 ± 2.37 (0.665)	32.26 ± 1.12 (0.828)	12.56 ± 2.17 (0.512)
Simultaneously with glucose load	0 min	30 min	75 min	iobv
Control (n = 7)	22.55 ± 0.88	30.43 ± 1.67	30.47 ± 1.83	15.78 ± 3.44
Powder (n = 6)	22.21 ± 1.05 (0.805)	32.66 ± 1.56 (0.356)	31.46 ± 1.96 (0.720)	19.70 ± 1.62 (0.352)
Extract (n = 8)	26.49 ± 1.69 (0.069)	30.20 ± 1.41 (0.919)	29.53 ± 1.44 (0.691)	6.74 ± 2.19 (**0.040**)

n = number of rats
iobv = sum of increments over basal value

Table 2: Effect of *Premna integrifolia* L. on Type 2 diabetic rats

Group	Serum glucose level mmol/l (p value)			
Fasting	0 min	60 min		120 min
Control (n = 9)	8.60 ± 0.23	9.10 ± 0.29		8.41 ± 0.46
Powder (n = 6)	9.16 ± 0.41 (0.223)	11.10 ± 0.77 (**0.050**)		10.07 ± 0.83 (0.080)
Extract (n = 7)	9.73 ± 0.47 (0.037)	11.66 ± 1.50 (0.142)		11.29 ± 1.58 (0.070)
30 min before glucose load	0 min	60 min	105 min	iobv
Control (n = 6)	10.43 ± 0.85	20.73 ± 0.77	19.25 ± 1.30	19.12 ± 3.47
Powder (n = 6)	10.11 ± 0.72 (0.780)	18.64 ± 2.46 (0.448)	18.04 ± 2.89 (0.717)	16.47 ± 4.34 (0.644)
Extract (n = 7)	9.69 ± 0.98 (0.589)	22.54 ± 0.20 (0.065)	22.34 ± 0.40 (0.064)	25.51 ± 2.10 (0.132)
Simultaneously with glucose load	0 min	30 min	75 min	iobv
Control (n = 12)	9.96 ± 0.59	19.93 ± 0.64	20.51 ± 0.59	20.52 ± 1.48
Powder (n = 10)	11.05 ± 0.61 (0.217)	20.96 ± 1.01 (0.381)	21.01 ± 1.28 (0.714)	19.88 ± 1.80 (0.786)
Extract (n = 15)	10.97 ± 0.52 (0.206)	17.82 ± 1.29 (0.159)	17.62 ± 1.39 (0.071)	13.49 ± 2.24 (**0.015**)

n = number of rats
iobv = sum of increments over basal value

Experimental

1. Plant material

The stem barks of *Premna integrifolia* L. were collected from the Medicinal Plant Project Garden at the Gonoshashthaya Kendra, Savar, Dhaka. Manjurul Kadir Miah of the Bangladesh National Herbarium, Dhaka, identified the plant and a voucher specimen (MAB010) was deposited at the Department of Pharmacy, Jahangirnagar University, Savar, Dhaka. The stem bark was dried at 50 °C and finely powdered by a grinder.

2. Extraction procedure

The powder was extracted by a soxhlet extractor with 98% ethanol for a total of 50 h. The extract was concentrated using a rotary vacuum evaporator and dried in a freeze dryer.

3. Animals

Male Long-Evans rats (180–220 g), bred at the BIRDEM animal house, were used for the whole study. Diabetes simulating Type 1 was induced by intraperitoneal injection of streptozotocin (65 mg/kg body weight) to adult (age 3–4 months) rats. Type 2 was induced by intraperitoneal injection of streptozotocin (90 mg/kg body weight) to 48-hour-old pups [6].

4. Experimental procedure

Solutions/suspensions of the extract or powder (1.25 g/kg body weight) were fed to rats (6–15 rats in each group) by a steel tube under mild ether anesthesia. We conducted a series of experiments on Type 1 and Type 2 diabetic model rats at different prandial states, fasting, simultaneously fed with glucose load (2.5 g/10 ml/kg body weight), and 30 min before glucose load (2.5 g/10 ml/kg body weight) [7].

5. Blood glucose estimation

Blood samples were collected by amputation of the tail-tips under mild ether anesthesia, and the serums were separated by centrifugation (4000 rpm for 10 min). The glucose levels in the serum samples in duplicate were estimated by the GOD-PAP method (Boehringer mannheim GmbH) with absorbance measured by a microplate reader (Bio-Tek, USA, EL340) at 490 nm. A standard curve for glucose was drawn for each experiment and the blood glucose values were calculated from it using the Kinetic Calc software.

6. Statistical analysis

Statistical analyses were performed by SPSS 7.5 for Windows. Independent samples t-test was done as the test of significance. Values were considered significantly different if $p < 0.05$. Data were expressed as mean ± SEM.

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