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Oral hypoglycaemic effects of *Momordica dioica* in the rat

B.M.R. Fernandopulle[1], E.H. Karunanayake[2], and W.D. Ratnasooriya

[1]*Department of Pharmacology,* [2]*Department of Biochemistry, Department of Zoology, University of Colombo, Colombo 3, Sri Lanka*

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Introduction: Traditionally, the fruit extract of *Momordica charantia* L. (family: Cucurbitaceae; genus: *Momordica*) is widely used in Asia and Australasia to treat diabetes mellitus [1]. Another cucurbit, *M. foetida*, is used for the same purpose in West Africa [1]. *M. charantia* has been scientifically evaluated in many parts of the world, both in animals [2–4] and humans [5–7] and proven to have beneficial hypoglycaemic activity.

A wild relative of *M. charantia*, named *M. dioica* (Sinhalese; Thumba karawila, Tamil; Palupalagakalungai or Thumbai), is found in the dry low country regions of Sri Lanka [7]. Although there is a strong possibility that *M. dioica* may also possess such activity it has not yet been scientifically evaluated.

The present study was undertaken to evaluate the oral hypoglycaemia activity of the fruit extract of *M. dioica* in rats.

Materials and methods: Fresh fruits of *M. dioica* were purchased from the local market in the district of Moneragala, Sri Lanka, in December 1990 and January 1991, and their identity was authenticated by Professor R.N. De Fonseka, of the Department of Botany, University of Colombo, Sri Lanka. The fruits were washed, deseeded, cut into thin slices and minced in a domestic mincer. The pulp obtained was squeezed through four layers of gauze and the filtrate was stored in aliquots at −20°C or freeze dried. The frozen aliquots were thawed or the freeze dried extracts wre macerated in a mortar and reconstituted in distilled water to the required volume prior to experimental use.

Healthy, male Sprague-Dawley rats (weighing 175 ± 25 g (means ± SEM)), bred in the animal house of the University of Colombo, were used in all experiments. The animals were housed in stainless steel cages (6–8 per cage) in well ventilated rooms (natural photoperiod of approximately 12 h light, 24 h room temperature 28–30°C). All rats were given standard food pellets (Oils and Fats Co. Ltd, Sri Lanka) and unless otherwise stated had free access to food and tap water. The rats were fasted overnight for 16 h before the experimental procedures.

To evaluate the effects of *M. dioica* on fasted rats, on the morning of the study at 09.00 h the animals were lightly anaesthetised with ether, and blood (0.1 mL) was withdrawn from the tail vein using a microcap (Drummond Scientific Company, USA) for the estimation of basal blood glucose values. Immediately afterwards, the animals were randomly divided into two groups (n = 10). Each group was orally fed with either water (1 mL/100 g b.wt., control), or *M. dioica* fruit extract (1 mL/100 g b.wt.). Blood samples were collected from the tail vein at hourly intervals over the next 4 h for the estimation of blood glucose levels.

To ascertain the effects of the fruit extracts during acute glycaemia, a glucose tolerance test was performed. The experiments were carried out on subsequent days of the same week, test and control groups being included each day. After withdrawal of blood samples from the tail vein for the determination of fasting blood glucose levels, the animals fasted for 16 h. They were randomly divided into two groups (n = 10) and dosed orally with either distilled water (control, 1 mL/100 g b.wt.) or *M. dioica* fruit extract (0.5, 1 or 2 mL/100 g b.wt.; the 0.5 mL and 2 mL/100 g dose was freeze dried and reconstituted in 1 mL/100 g b.wt. of distilled water).

30 min later, the oral glucose tolerance test was performed: all animals were given an oral dose of glucose (1 mL/100 g b.wt., 50% w/v), and blood samples were collected from the tail vein at hourly intervals (post glucose) for 4 h, for the estimation of blood glucose.

In a subsequent experiment, the effects of the fruit extract on subacute administration were determined in male rats (7–8 weeks old, 100 ± 25 b b.wt., n = 6). The animals were randomly divided into two groups. The control group was given distilled water 1 mL/100 g b.wt., while the test group received an equal dose of *M. dioica* fruit juice (1 mL/100 g b.wt.) every morning between 08.00 h and 10.00 h. This feeding schedule was carried out for 60 consecutive days. The rats were observed daily for overt signs of toxocity and a weekly weight chart was maintained. Animals were fasted overnight on day 60 and after collecting samples of blood for the determination of fasting blood glucose concentration, the oral glucose tolerance test was performed as described previously. Blood glucose was estimated at 30, 60, 120 and 180 min post glucose.

The equipotency of *M. dioica* to a standard hypoglycaemic drug, tolbutamide, was determined by performing the glucose tolerance test as described previously. Tolbutamide at different dosages of 1 mg, 2.5 mg, 5 mg and 10 mg/100 g b.wt. was dissolved is sodium hydroxide (0.05 N, 1 mL/100 g b.wt.) and given orally to four groups of rats (n = 4). The control group (n = 4) received the vehicle (NaOH, 0.05 N; 1 mL/100 g b.wt.). 30 min after which the oral glucose tolerance test was performed as described previously.

In all experiments, blood glucose was determined by the glucose oxidase method as described by Hugget and Nixon [8].

The percent glycaemic change was calculated as a function of time by applying the formula.

$$\% \text{ glycaemic change} = \frac{G_x - G_o}{G_o} \times 100$$

G_o = fasting blood glucose value; G_x = concentration at time x.

The area under the 4 h glucose curve (AUC) was calculated by plotting graphically the time expressed in hours against the per cent glycaemic change from the fasting value. The AUC was calculated by the trapezium method [10] and expressed as the mmol h dL^{-1}.

In each study, the results are expressed as means ± SEM. A p value of less than 0.05 was considered significant. Student's t-test for unpaired data was used as the statistical test.

Results: The effect of the fruit extract of *M. dioica* on fasting blood sugar concentrations as compared to those of controls