Pakistan J. Sci. Ind. Res., Vol. 24, No. 1, February 1981

EFFECT OF *MOMORDICA CHARANTIA* LINN. (KARELA) ON BLOOD GLUCOSE LEVEL OF NORMAL AND ALLOXAN-DIABETIC RABBITS

Muhammad Amin Athar, Muhammad Yaqub and Mohammad Shoib Akhtar

Department of Chemistry, University of Agriculture, Faisalabad.

(Received February 16, 1980; revised August 21, 1980)

Hypoglycaemic effect of the whole dried and powdered *Momordica charantia* fruit was studied in normal and alloxan–diabetic rabbits. Four different doses of *Momordica charantia* powder i.e., 0.25,0.5, 1.0 and 1.5 g/kg body weight were administered orally after suspending in 1% carboxymethyl–cellulose. In normal rabbits, the 0.25 g/kg dose did not significantly affect the blood glucose level, but 0.5, 1.0 and 1.5 g/kg doses produced significant hypoglycaemia. In alloxan–diabetic rabbits the 0.25 and 0.5 g/kg doses did not significantly decrease the blood glucose level. However, 1.0 and 1.5 g/kg doses produced a significant hypoglycaemia.

The maximum decrease of blood glucose in normal and alloxan–diabetic rabbits occurred at 10 hr interval. The time required for the blood glucose to return to normal was usually more than 24 hrs. Theses results have been discussed in the presence of available literature and it is hypothesized that the whole powdered *Momordica charantia* fruit may contain more than one type of hypoglycaemic agents. These may be an alkaloid (producing effect only in normal rabbits) and an insulin-like substance which is capable of lowering the blood glucose level not only in normal rabbits but also in the diabetic rabbits.

INTRODUCTION

Considerable developments have been made in the management of *Diabetes mellitus* yet a wide scope is left in the search for newer orally effective antidiabetic agents. Plants have been used as a source of drugs in the treatment of diseases. This suggested the need to explore the hypoglycaemic activity in indigenous medicinal plants.

It has been reported by Said [1], Farnsworth and Segelman [2] and Rivera [3] that the fruit of *Momordica charantia* commonly known as Karela possesses hypoglycaemic activity. Their findings are further supported by its use in Unani medicine. Stimulated by the folk-belief refering to this plant as having antidiabetic properties and by the fact that it is quite frequently prescribed in Eastern Medicine, this investigation was carried out. Thus attempts have been made to study the effects of various doses of the dried *Momordica charantia* fruit powder on blood glucose levels of normal and alloxan–diabetic rabbits.

MATERIALS AND METHODS

A. *Plant Material.* Fresh green fruits of *Momordica charantia,* known as Karela were obtained in sufficient quantity from the local market. It was washed, dried, powdered and then stored in well-closed cellophane bags at 4^{o} in the refrigerator.

B. *Chemicals.* Alloxan monohydrate, carboxymethylcellulose (CMC), α—D-glucose, Xylene and all the chemicals and reagents used were of analytical grades obtained from E. Merck, Darmstadt, West Germany or B.D.H. Laboratories Poole, England.

C. *Animals used.* The investigation was carried out on 25 male, adult and healthy albino rabbits weighing 750-1000 g. The rabbits were kept under good laboratory conditions, offered a commercial feed and allowed water *ad libitum.* They were divided into 5 groups numbered I to V, each of 5 animals. Group I was the control whilst Groups II to V received the drug.

D. *Preparation of Diabetic Rabbits.* The rabbits were made diabetic by injecting intravenously 150 mg/kg body weight of alloxan monohydrate. The rabbits having blood glucose levels of more than 200 mg/100 ml were considered as diabetic.

E. *Preparation and Administration of Drug.* Amount of dried powdered *Momordica charantia* fruit required for each animal on body weight basis was titurated with about 6 ml of 1% CMC solution and the final volume was made up to 10 ml. Eight days after alloxan treatment, the drug was administered orally to unfasted

animals by using the stainless steel fedding needle.

Collection of Blood. The rabbit was held in a wooden rabbit holder and 0.2 ml of blood was collected from an ear vein. To prevent coagulation of the blood a heparinized syring was used. During the collection of the blood, it was sometimes necessary to dampen the rabbits ear with xylene to promote blood flow. After collecting the blood, the pricked side of the ear was rubbed with cotton wool soaked with absolute alcohol to protect the rabbit against infection.

Quantitative Estimation of Blood Glucose. The blood glucose was determined by the orthotoluidine method of Fings *et al.* [4].

RESULTS

Effect of Momordica charantia on Blood Glucose in Normal Rabbits. The mean blood glucose levels of the control and drug–treated animals after oral administration of different doses of *Momordica charantia* powder at various time intervals are shown in Table 1. The blood glucose level of the normal (control) rabbits remained same at all the time intervals. The oral administration of *Momordica charantia* to the second group, in 0.25 g/kg dose, did not decrease blood glucose level significantly. However, the 0.5 g/kg dose produced a significant decrease in blood glucose. The effect of the drug at this dosage level started in less than 5 hr and reached a maximum after 10 hr . The blood glucose level then increased gradually but it was still significantly lower than the control after 24 hr.

The 1.0 g/kg dose produced a more pronounced hypoglycaemia than the 0.5 g/kg dose. Its effect reached a maximum in 10 hr after which the blood glucose level rose gradually, but was still significantly lower than the control level after 24 hr. A similar, but more profound, effect was observed at the 1.5 g/kg dosage level.

Effect of Momordica charantia *on Blood Glucose in Diabetic Rabbits.* The mean blood glucose levels of control and drug treated animlas after administration of different doses of *Momordica charantia* powder at various time intervals are shown in Table 2.

The blood glucose levels of the control group remained virtually the same throughout. The administration of 0.25 and 0.5 g/kg of drug produced no significant decrease in blood glucose levels. It is evident from Table 2 that there was a slight decrease in blood glucose at 0.5 g/kg dose level, but this was not statistically significant. Higher doses produced significant lowering of the blood glucose level in the alloxan–diabetic rabbits. The decrease in blood glucose was greatest after 10 hr, beyond which the level started to rise. At the 1.0 g/kg dose, the glucose level returned to the initial level after 24 hr, but at a dose of 1.5 g/kg it remained significantly lower than the initial level even after 24 hr.

DISCUSSION

In this study, the whole dried powdered fruit of *Momordica charantia* was orally administered as a suspension in 1% carboxymethylcellulose solution to the normal and alloxan–diabetic rabbits. The whole fruit, instead of an extract was intentionally used on the assumption that the total fruit may contain, in addition to an active principle, some synergistic compounds because the whole fruit is customarily added to the various folkloric medicinal pre-

Table 1. Mean blood glucose levels of normal rabbits expressed in mg/100 ml ± SEM at various time intervals after oral treatment with 1 % carboxymethylcellulose solution (Control, Group I) and dried fruit of *Momordica charantia* 0.25, 0.5, 1.0 and 1.5 g/kg body weight, orally suspended in 1 % CMC (Group II to V).

	Groups and dosage of *Momordica charantia*				
Time interval (hr)	1 % CMC (group I)	0.25 g/kg (group II)	0.5 g/kg (group III)	1.0 g/kg (group IV)	1.5 g/kg (group V)
Zero	95 ± 1.5	97 ± 3.5	100 ± 2.2	92 ± 4.3	99 ± 1.9
5	9[illegible] ± 1.6	91 ± 3.1	86 ± 2.1	74 ± 3.7	62 ± 1.3
10	95 ± 1.7	92 ± 2.9	77 ± 0.9	62 ± 2.4	46 ± 0.80
24	95 ± 2	95 ± 1.8	92 ± 1.8	78 ± 3.7	70 ± 0.66

Number of assays for each observation = 5, SEM = Standard error of means, CMC = Carboxymethylcellulose.

Table 2. Mean blood glucose levels of diabetic rabbits expressed in mg/100 ml ± SEM at various time intervals after oral treatment with 1 % carboxymethycellulose solution (Control, Group I) or dried fruit of *Momordica charantia* 0.25, 0.5, 1.0 and 1.5 g/kg body weight orally suspended in 1 % CMC (Group II to V).

Time interval (hr)	Groups and dosage of *Momordica charantia*				
	1 % CMC (group I)	0.25 g/kg (group II)	0.5 g/kg (group III)	1.0 g/kg (group IV)	1.5 g/kg (group V)
Zero	283±9	279±8	286±8	322±28	274±20
5	282±9	272±8	272±8	292±23	232±15
10	281±9	275±8	264±10	244±28	184±17
24	282±8	278±8	280±8	294±28	217±17

Number of assays for each observation = 5, SEM = Standard error of means, CMC = Carboxymethyl cellulose.

parations. Alloxan treatment causes permanent destruction of β-cells in the islets of langerhans [5]. Thus alloxan was chosen as adiabetogenic agent for the present study.

From the data obtained it is obvious that the administration of various doses of *Momordica charantia* fruit caused a decrease in blood glucose level of normal and alloxan–diabetic rabbits. As shown in Fig. 1 and 2, the whole dried powdered *Momordica charantia* fruit produced significant and consistent hypoglycaemic effect in normal rabbits as well as in those with chemically induced insulin deficiency.

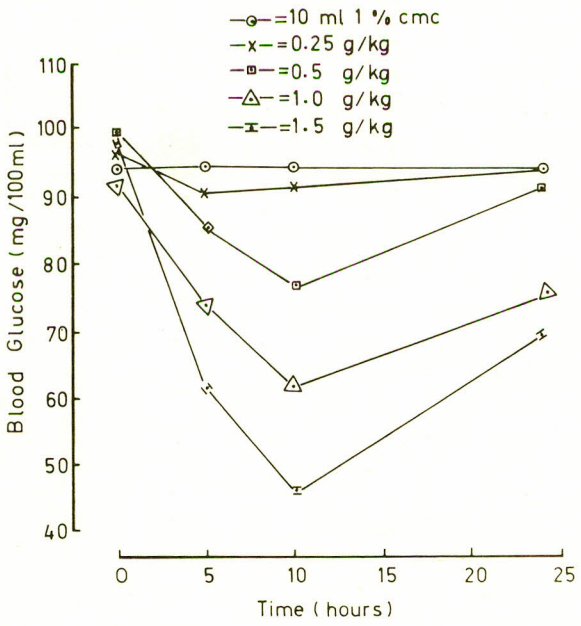

Fig. 1. Blood glucose levels of normal rabbits expressed in mg/100 ml of various time intervals after oral administration of 1% CMC solution and *Momordica charantia* dried fruit powder (0.25, 0.5, 1.0 and 1.5 g/kg body weight orally suspended in 1% CMC.

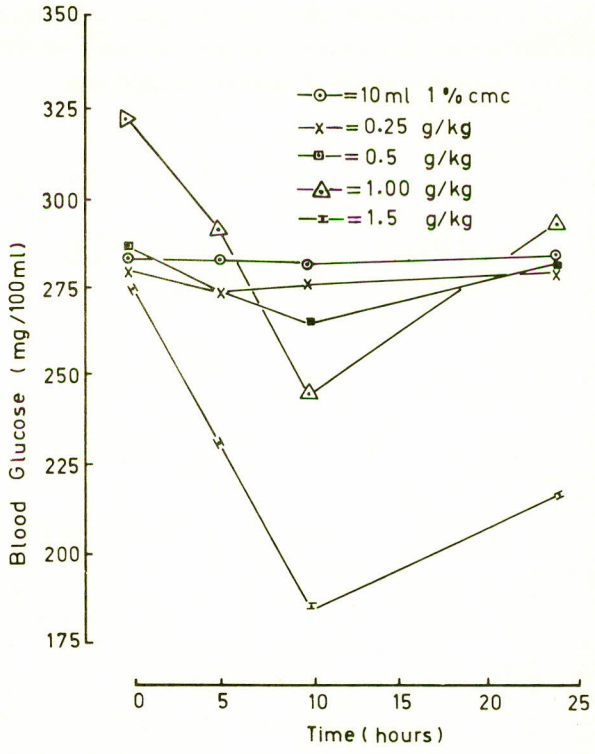

Fig. 2. Blood glucose levels of diabetic rabbits expressed in mg/100 ml of various time intervals after oral administration of 1% CMC solution and *Momordica charantia* dried fruit powder (0.25, 0.5, 1.0 and 1.5 g/kg body weight orally suspended in 1% CMC.

The phytochemical studies have revealed that the *Momordica charantia* fruit is rich in proteins. It has been reported that a pure protein (vegetable insulin) has been isolated from *Momordica charantia* [6]. The exogenous administration of insulin is well known to produce hypoglycaemia in both normal and alloxan–diabetic subjects [4]. On the other hand this fruit is rich in other nitrogenous substances, it might also contain an alkaloid or a similar substance Nadkarni [7] and Rivera [3] have shown that *Momordica charantia* fruit contains some alkaloids. Some alkaloids like vindolinine and leurasine have already been shown to exert high degree of hypoglycaemic activity in the normal animals only [8]. It is, therefore, suggested that the active principles of *Momordica charantia* may be an alkaloid or a like substance producing effect only in the normal rabbits and insulin like substance which sinks the blood glucose not only in the normal animals but also in the diabetic animals. However, production of hypoglycaemia by some synergistic compounds or by some other entirely different mechanism cannot be excluded. For example the plants rich in manganese have been reported to produce hypoglycaemia [9]. In addition, lowering of blood glucose, by nicotinic acid rich plants like Trigonella *Foenum graceum* has also been reported by Shani [10]. Therefore, further comprehensive chemical and pharmacological investigations are needed to elucidate the exact mechanism of hypoglycaemic effect of *Momordica charantia*.

REFERENCES

1. M. Said, *Hamdard Pharmacopoea of Eastern Medicine* (Hamdard National Foundation, Times Press, Karachi. 1969), p. 42.
2. N.R. Farnsworth and A.B. Segelman, Hypoglycaemic plants Tile Tile, **57**, 52 (1971).
3. G. Rivera, Am. J. Pharm., **113**, 281 (1941).
4. C.S. Fings, C.R. Ratliff and R.T. Dunn, *Clinical Chemistry* by G. Toro and P.G. Acherman (Little Browning and Company, Boston, 1970) p. 1507.
5. J. Larner, and C. Haynes, *The Pharmacological Basis of Therapeutics* (Macmillan Publishing Co. Inc New York, 1975), fifth eddition , p. 1507
6. P. Khanna, T.N. Nag and S.C. Jain, IIIrd International Congress of Plant Tissue and Cell Culture, Lincert, England (1979).
7. K.M. Nadkarni, *Indian Materia Medica* (Popular Book Depot, Bombay 1945), p. 805.
8. H.W. Lewis, M.P.H. Elvin Lewis, *Medical Botany: Plants Affecting Man's Health* (John Wily and Sons, New York, 1977), Vol. I pp. 36, 98, 218 and 515.
9. A.H. N.W. Levin and C.A. Elliott, Chem. Abst., **58**, 3757 g. (1962).
10. J.A., Shani, A. Goldschmied, B. Joseph, Z. Alrouson, and E.G. Sulman, Arch. Int. Pharmacodyn., **210**, 27 (1974).