ANTIDIABETIC EVALUATION OF MUCUNA PRURIENS, LINN SEEDS

Pages with reference to book, From 147 To 150

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ABSTRACT

Effects of powdered Mucuna pruriens seeds on blood glucose levels were investigated in normal and aioxan-diabetic rabbits. In norma/group 0.5,1 and2 g/kg of M. pruriens pulv significantly decreased the blood glucose levels while in alloxan-diabetic rabbits only 1 and 2 g/kg body weight caused a significant fall. The reference drug, acetohexamide in 500 mg/kg dose significantly reduced the blood glucose levels but in normal rabbits only. High levels of trace elements like manganese, zinc, and others were found in these seeds. Therefore, it is conceivable that M. pruriens seeds contain hypoglycaemic principles, may be both organic and mineral, which seem to act indirectly by stimulating the release of insulin and/or by a direct insulin-like action (JPMA 40: 147, 1990).

INTRODUCTION

The seeds of the plant, Mucuna pruriens, Linn (family: Leguminosae), locally known as Kawanch have been used since olden days in the traditional medicine to treat diabetes mellitus[1]. In addition, the seeds are considered to possess netvine tonic, aphrodisiac and anthelmintic properties[2]. A study was therefore carried out to investigate the hypoglycaemic activity of the M. pruriens seeds in normal and alloxan-diabetic rabbits. In addition, some elemental contents were determined to see their possible role in the mechanism of their hypoglycaemic effect.

MATERIALS AND METHODS

Alpha-D-glucose and alloxan monohydrate were purchased from B.D.H. Laboratories, Poole, England while glacial acetic acid, benzoic acid (sublimed), 0-toluidine, thiourea and trichloracetic acid were of E. Merck, Darmstadt, West Germany. Acetohexamide (Dimelor)R was obtained from Eli Lilly, Basingstoke, England. Adult male rabbits of a local strain, weighing 1-2kg were fed on green fodder and tap water ad lib. They were randomly divided into groups of 6 animals each. Similarly, groups of 6 animals each were made diabetic by injecting 150mg/kg body weight of alloxan intravenously. Eight days after injecting alloxan, the rabbits withblood glucose levels of 200-500 mg/ 100ml were conside4red as diabetic and used in the experiments.

Preparation and administration of drugs

The amount of M. pruriens pulv required for each rabbit was weighed and suspended in 15ml of 2% aqueous gum tragacanth solution and administered orally to each animal by using a feeding needle. Acetohexainide was also similarly administered.

Determination of blood glucose levels

Just after drug administration, 0.2ml of blood was collected from a marginal ear vein, further samples were collected at 2, 4, 8, 12 and 24 hours interval. The blood. glucose levels were determined by the 0-toluidine method[3].

Elemental analysis

Some elemental constituents of M. prunens seeds were determined by the atomic absorption

spectroscopy[4]. Statistical analysis The data have been expressed as Means ± SEM (Standard Error of Means) and Student "t" test was used to check their significance[5].

RESULTS

Effect on blood glucose levels of normal rabbits

TABLE 1. Mean blood glucose levels of normal rabbits (mg/100ml ± Sem) at various time intervals.

Time Interval (hours)	Control Group (2% gum Sol.)	Groups treated with M. pruriens Seeds			Treated with Acetohexamide 500 mg/kg
		0.5 g/kg Body Weight	1 g/kg Body Weight	2 g/kg Body Weight	
0	82 ± 2.5	91 ± 3.5	93 ± 2.6	90 ± 2.4	84 ± 2.4
2	93 ± 1.2	81 ± 3.8^{NS}	88 ± 3.0^{NS}	82 ± 1.2*	66 ± 5.7*
4	80 ± 2.5	76 ± 3.2*	75 ± 1.6.*	73 ± 3.2**	70 ± 2.8 **
8	89 ± 1.6	74 ± 2.5*	71 ± 3.2**	70 ± 1.8**	71 ± 1.6**
12	79 ± 1.7	84 ± 2.4^{NS}	70 ± 2.5**	72 ± 0.6**	78 ± 1.9^{NS}
24	80 ± 1.3	88 ± 3.9^{NS}	85 ± 3.5^{NS}	80 ± 2.3^{NS}	79 ± 2.3^{NS}

NS = Not significant decrease as compared to zero hour level (P 0.05)
** = Highly significant decrease as compared to zero hour level (P 0.001)
* = Significant decrease as compared to zero hour level (P 0.05)
Number of animals for each observation = 6

Table 1 shows that the gum tragacanth did not significantly affect the blood glucose levels. However, treatment with 0.5 g/kg of M. pruriens seeds (pulv) caused a significant (P <0.05) decrease in blood glucose levels only at 4 and 8 hours after drug administration. Blood glucose levels with 1 g/kg dose at 4,8 and 12 hours intervals were significantly (P <0.05) lower than those at zero hour. However, blood glucose at 24 hours, did not differ from zero hour level (P >0.05). Rabbits treated with 2g/kg of the pulv showed more marked bypoglycaemia as the blood glucose at2, 4,8 and 12 hours were significantly (P <0.001) reduced. Nevertheless, at 24 hours blood glucose levels did not show any significant difference from zero level. The maximum reduction in blood glucose level at all the dosage levels was observed at 4 hours and the dose response curve was linear.

Effect on blood glucose levels in alloxan-diabetic rabbits

TABLE II. Mean blood glucose levels of diabetic rabbits (mg/100 ml ± Sem) at various intervals.

Time interval (hours)	Control Group (2% gum sol.)	Groups treated withf M. pruriens			Treated with Acetohexamide 500 mg/kg
		0.5 g/kg	1 g/kg	2g/kg	
0	310 ± 3.3.	311 ± 6.5	315 ± 5.3	313 ± 3.7	301 ± 12.4
2	312 ± 4.3	303 ± 5.8^{NS}	310 ± 5.7^{NS}	312 ± 3.7^{NS}	299 ± 13.8^{NS}
4	314 ± 4.7	299 ± 4.2^{NS}	290 ± 4.0*	280 ± 3.3.**	296 ± 14.7^{NS}
8	308 ± 4.2	308 ± 6.9^{NS}	263 ± 3.8**	250 ± 4.2**	294 ± 7.5^{NS}
12	306 ± 3.6	308 ± 6.3^{NS}	276 ± 2.9**	244 ± 3.7**	297 ± 11.5^{NS}
24	309 ± 3.3	305 ± 4.7^{NS}	310 ± 4.1^{NS}	298 ± 5.3^{NS}	293 ± 14.4^{NS}

NS = Not significant decrease as compared to 0 hour level (P 0.05)
** = Highly significant decrease as compared to 0 hour level (P 0.001)
* = Significant decrease as compared to O hour level (P 0.05)
Number of animals for each observation = 6

As seen clearly from table II blood glucose levels of the diabetic rabbits treated with 2% gum did not significantly differ at all time intervals checked. Treatment with 0.5 g/kg of theM. pruriens also could not significantly change the blood glucose. However, significant (P <0.05 or 0.001) reduction of the blood glucose levels were produced by 1 g/kg of the powder at 4,8 and 12 hours but the values at 2 and

24 hours were not significantly different from zero hour. Treatment with 2 gfkg of the powder produced a highly significant decrease in blood glucose at 4, 8 and 12 hours but at 24 hours, the decrease was not significant.

As expected, acetohexamide (500 mI/kg) did not alter the blood glucose levels in the diabetic rabbits.

Elemental analysis

The levels of zinc, calcium, magnesium, manganese, phosphorus, copper and iron in the M.pruri ens seeds were determined by atomic absorption spectroscopy (Table III).

TABLE III. Metallic contents of M Pruriens seeds determined by atomic absorption spectroscopy.

Element	Wave length nm	Concentration* ug/g
Zinc	213.9	30
Calcium	422.7	15000
Magnesium	285.2	8100
Manganese	279.5	120
Phosphorus	213.6	2200
Copper	324.8	10
Ferrum	248.3	500

* = Mean of three determinations

Levels of manganese, zinc and calcium in these seeds were relatively very high as compared to those found in many vegetables and fruits as reported by Underwood[6].

DISCUSSION

The present study indicated that oral administration of Mucunapruriens seeds decreasedblood glucose levels in normal rabbits. The hypoglycaemic effect started before 2 hours and reached its maximum at 4 hours. The drug effect persisted at 8 hours after which it started to vanish and became non- significant at 24 hours. Thus M.pruri ens seeds possess significant bypoglycaemic activity. Previously, production of hypoglycaemic response in normal animals has also been reported using several other plants[7-9]. For comparison, acetohexamide was administered orally which produced significant hypoglycaemic effect only in the normal state. Its effect was found to be non-significant at 12 hours while the hypoglycaemia produced by 1 and 2 g/kg doses of M. pruriens seeds was significant still 12 hours showing that the pulv has exerted a more prolonged effect. Table II shows that in the diabetic rabbits, 1 and 2 g/kg doses of the pulv significantly decreased the blood glucose levels. However, the drug appears to be more potent in normals. As expected, acetohexamide (500 mg/kg), could not produce hypoglycaemia in the alloxandiabetic rabbits because insulin release cannot be stimulated in these rabbits as alloxan is well known to produce selective beta cytoxicity[10]. The biguanides produce hypoglycaemia by increasing the glycolysis and uptake of glucose in muscles and by reversing gluconeogenesis in the liver and absorption of glucose in the intestines11. However, they do not produce hypoglycaemia in the normal

subjects because the increase in peripheral glucose utilization is compensated by an increase in hepatic glucose output[11]. Table III shows that M. pruriens seeds contain high levels of minerals, especially that of calcium, phosphorus, manganese and zinc. It is, therefore, possible that in normal rabbits the plant pulv might have produced hypoglycaemia at least in part due to its mineral contents by facilitating glucose uptake by the cells and by increasing the rate of phosphorylation. Furthermore, alloxan treatment causes selective beta cell toxicity due to its complexation with biological metals in them. ThusM pruriens might have also produced hypoglycaemia in the alloxan diabetic rabbits by providing the B-cells the chelated minerals. Furthermore, the plant drug could also initiate the release of insulin due to its high manganese and other trace minerals whose deficiency has been shown to inhibit glucose utilization[12]. Hence the hypoglycaemic effect of certain plants including Lupine species, alfalfa, Atriplex helimus, etc. have already been shown to be due to their high manganese contents[13]. In conclusion, it is hypothesized thatM.pruriens seeds contain more than one type of hypoglycaemic principles which produce significant decrease in blood glucose levels in normal and alloxan-diabetic rabbits. The active ingredients may include some indirectly acting organic and inorganic substances and/or some orally effective insulin-like compound(s). It may also be suggested that mineral contents of the medicinal plant (Table III) would also help correction of volume depletion and thus decrease the release of stress hormones triggered through general adaptation syndrome described by Sclye[14].

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