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Research Article

ANTIDIABETIC ACTIVITY OF STEM BARK OF *NEOLAMARCKIA CADAMBA* IN ALLOXAN INDUCED DIABETIC RATS

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Abstract:

Different doses of ethanolic fraction of stem bark of neolarckia cadamba were evaluated for hypoglycemic activity in normal and alloxan diabetic rats. The oral administration of ethanolic extract of 0.5g/kg body weight exhibited a significant antihyperglycemic activity in alloxan diabetic rats, whereas in normal rats no hypoglycemic activity was observed.

Keywords: Hypoglycmic activity, Alloxan diabetic rats, Neolarckia cadamba.

1. Introduction:

Diabetes mellitus is metabolic disorder characterized by hyperglycemia and alterations in carbohydrate, fat and protein metabolism, associated with absolute or relative deficiencies in insulin secretion and/or insulin action. Through different types of oral hypoglycemic agents are available along with insulin for the treatment of diabetes mellitus, there is a growing interest in herbal remedies, due to the side effects associated with these therapeutic agents. Because of perceived effectiveness, minimal side effects in clinical experience and relatively low cost, herbal drugs are widely prescribed even when their biologically active compounds are unknown.

Tirumala hills (Rayalaseema region, Andhra Pradesh, India), which lie geographically in the South-Eastern Ghats, are known for the rich heritage of the flora. A number of plants with known and unknown medicinal values are available her, which have to be explored for the use in the effective treatment of diabetes mellitus. One such plant is *neolamarckia cadamba*

N.cadamba (NC) belongs to family Rubiaceae. It is a small evergreen endemic tree. NC stem bark has been in use for the treatment of diabetes by tribal people. Decoction of this stem bark given for diarrhoea. A long with the roots of *pimpinella tirupatiensis*, the infusion of the dry stem bark is given in the treatment of venereal disease and peptic ulcers.

2. Material and methods

2.1 Collection of plant material:

Stem bark of *neolamarckia cadamba* were collected from Tirumala hills and identified by the taxonomist of the Herbarium, Department of Botany, S.V.University, Tirupathi. The stem bark was dried in shade, powdered and the powder was used for the extraction of antidiabetic principles in 95% ethanol.

2.2 Preparation of the extracts:

The active principles of NC stem bark were extracted in to 95% ethanol. NC stem bark powder was soaked in 95% ethanol in glass jar for 2 days at room temperature and the solvent was filtered. This was repeated three to four times until the extract gave no colouration. The extract was distilled and concentrated under reduced pressure in the Buchi rotavapour R-114 and finally freeze-dried. This extract was used for further studies. The phytochemical screening of the NC stem bark was carried out by the modified method of Das and Bhattacharjee. Flavonoids were extracted according to the methods of Harbone and Markham. Phenolic acids were extracted according to the methods of Bate-

Smith and Ibarhim and Towers. The flavonoids and phenolic acids were quantitatively estimated by the method of swain and Hills.

2.3 Induction of diabetes:

Diabetes was induced in male wistar albino rats, aged 4 months by intraperitoneal administration of ice-cold aqueous alloxan monohydrate (150mg/kg body weight) by the method described earlier. After a fortnight, rats with marked hyperglycemia were selected and used for the study. All the animals were allowed free access to tap water and pellet diet and maintained at room temperature in plastic cages.

Experimental design:

The rats were divided into 11 groups and each group consisted of six rats.

Group 1 normal untreated rats

Group 2 diabetic untreated rats

Group 3 normal rats treated with 0.25g/kg b.w of plant extract

Group 4 normal rats treated with 0.5g/kg b.w of plant extract

Group 5 normal rats treated with 0.75g/kg b.w of plant extract

Group 6 normal rats treated with 1.0g/kg b.w of plant extract

Group 7 diabetic rats treated with 0.25g/kg b.w of plant extract

Group 8 diabetic rats treated with 0.5g/kg b.w. of plant extract

Group 9 diabetic rats treated with 0.75g/kg b.w of plant extract

Group10 diabetic rats treated with 1.0g/kg b.w of plant extract

Group11 diabetic rats treated with 0.2g/kg b.w of Glibenclamide.

After an overnight fast, the plant extract suspended in distilled water was fed to the experimental rats by gastric intubation, using a force feeding needle. Group 1 and group 2 rats were fed distilled water

alone. Blood samples were collected for the measurement of blood glucose from the tail vein at 0, 1, 3, and 5h after feeding the plant extract. Blood glucose was measured by using Dextrostix with ames glucometer and the results were compared with those of 11 th group of rats which were treated with 0.2g/kg b.w of glibenclamide.

Table 1:

Effects of different doses of ethanolic fraction of *Neolamarchia kadamba* bark on fasting blood glucose levels (mg/dl) of normal and diabetic rats (Mean ± S.D.).

Groups	Blood glucose at different hours after the treatment			
	0 hr.	1 hr.	3 hr.	5 hr.
1	73.5 ± 8.9	73.2 ± 8.9	71.5 ± 7.6	69.8 ± 7.1
2	271.2 ± 8.2*	268.7 ± 8.2	267.0 ± 9.2	265.0 ± 11.5
3	78.3 ± 4.6	86.3 ± 91.5	78.3 ± 6.0	77.6 ± 4.9
4	76.0 ± 7.0	91.5 ± 9.2	76.3 ± 6.1	74.5 ± 7.6
5	76.0 ± 8.2	90.6 ± 8.6	76.3 ± 6.9	76.0 ± 9.0
6	66.1 ± 12.7	84.0 ± 10.4	66.5 ±11.7	65.5 ±12.6
7	280.8 ± 12.5*	270.5± 11.3	264.1 ± 11.7 †	259.1 ± 12.5 †
8	283.0 ± 8.4*	264.8 ±12.3	232.0 ± 13.5 †	215.6 ±11.9 †
9	258.8 ± 8.8*	248.8 ± 6.4	239.6 ± 6.9 †	225.1 ± 7.0 †
10	255.6 ± 13.4*	247.0 ± 7.9	239.3 ±10.4 †	227.8 ± 11.2 †
11	271.5 ± 7.1*	250.6 ± 5.2 †	209.8 ± 5.8 †	187.0 ± 6.1 †

The values given in parentheses are percentage of decrease in blood glucose.

* P < 0.0001 compared with the initial level of blood glucose (0h) of normal rats.

† P < 0.0001 compared with the initial level of blood glucose (0h) of the rats in the respective group.

The results are expressed as mean ±S.D. Significance of differences between normal and diabetic groups were determined using the Student's *t*-test.

3. Results

The phytochemical screening of NC stem bark revealed the presence of flavonoids, phenolic acids, sterols/triterpinoids, alkaloids, tannins and anthocyanins. The NC stem bark contained 7.83 mg of Flavonoids and 12.26 mg of phenolic acids per 100 g of dry weight of thestem bark powder. The effect of the different doses of ethanolic extract of NC stem bark on the fasting blood glucose levels of both normal and diabetic rats are given in Table 1. The fasting blood glucose levels of diabetic untreated rats (Group 2) were significantly higher than those of normal untreated rats (Group 1). The ethanolic extracts of NC bark powder extract at a dosage of 0.5 g/kg b.w. produced the maximum fall of 23.8% in the blood glucose levels of diabetic rats after 5 h of treatment. But none of the doses of ethanolic extract produced any hypoglycemic effect in normal treated rats. Treatment with glibenclamide at a dosage of 0.2 g/kg b.w. resulted in 31.1% fall in the blood glucose levels of diabetic rats after 5 h of treatment.

Discussion

In the present study, ethanolic extract of stem bark of NC at a dose of 0.5 g/kg b.w. could produce a significant fall in blood glucose levels by about 24% in diabetic rats, after 5 h of treatment. But none of these extracts could produce any hypoglycemic effect in normal rats. The aqueous and hexane extracts of stem bark of NC have not shown significant antihyperglycemic activity .Hence the ethanolic extracts may be considered to have good antihyperglycemic active principles without

causing any hypoglycemic effect unlike insulin and other synthetic drugs. The phytochemical screening of NC stem bark revealed the presence of flavonoids, phenolic acids, sterols/triterpenoids, alkaloids, tannins and anthocyanins. Flavonoids, sterols/triterpenoids, alkaloids and phenolics are known to be bioactive antidiabetic principles (Oliver- Bever, 1986; Ivorra et al., 1989; Atta-Ur-Rhemann and Khurshid Zaman, 1989; Kameswara Rao et al., 1997). Flavonoids are known to regenerate the damaged beta cells in the alloxan diabetic rats (Chakravarthy et al., 1980). Phenolics are found to be effective antihyperglycemic agents (Manickam et al., 1997). In the present study, 7.83mg% of flavonoids and 12.26 mg% of phenolic acids were found to be present in the NC stem bark. The antidiabetic effect of ethanolic extract of NC stem bark may be due to the presence of more than one antihyperglycemic principles and their synergistic properties. In this study, the antihyperglycemic activity caused by glibenclamide in alloxan-induced diabetic rats is an indication of the presence of some beta cells, as glibenclamide is known to stimulate insulin secretion from beta cells. The ethanolic extract of NC stem bark may have stimulating effect on the remnant beta cells . However, further experiments are required to elucidate the exact mechanism of action. The decreased activity at the higher doses (>0.5 g/kg b.w.) of the plant extract could be due to reduced or no effect of the components present in the extract at higher doses .The ethanolic extract did not produce any hypoglycemic effect in normal rats. The normal rats being in homeostasis, these plant extracts could cause less suppression of normal regulatory mechanisms involved in carbohydrate metabolism (Vats et al., 2002).

CONCLUSION

The present investigation clearly reveals the importance of stem bark of *Neolamarckia cadamba* as an economical antidiabetic agent. The plant bears a potential for further research to isolate antidiabetic principle.

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