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Antidiabetic activity of *Adina cordifolia* (Roxb) leaves in alloxan induced diabetic rats

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ABSTRACT

Objective: To investigate the antidiabetic activity of hydro-alcoholic extract of *Adina cordifolia* (Roxb.) leaves (HAEACL) in alloxan induced diabetic rats at 250 and 500 mg/kg doses. **Methods:** Glibenclamide (10 mg/kg, s.c.) was used as the standard which produced a significant reduction in blood glucose levels. The blood glucose levels of experimental animals were determined at 0, 2, 4 and 6 h after treatment with the plant extract by using glu-oxidase peroxidise reactive strips and glucometer. **Results:** Treatment with HAEACL at 500 mg/kg dose decreased the blood glucose level significantly. However, the lower doses (250 mg/kg) of HAEACL produced a little decrease in blood glucose level. It showed that there was a dose dependent decrease in blood glucose level in the alloxan induced diabetic rats as compared to the control group. **Conclusions:** The present study shows that HAEACL possessed significant antidiabetic activity.

1. Introduction

Diabetes mellitus (DM) is a group of metabolic disorders characterized by hyperglycemia; is associated with abnormalities in carbohydrate, fat and protein metabolism; and results in chronic complications including microvascular, macrovascular, and neuropathic disorders[1]. It is currently estimated that at least 171 million people worldwide have diabetes, and this figure is likely to more than double by 2030. Moreover, approximately 3.2 million deaths every year are attributable to complications of diabetes; six deaths every minute[2]. Apart from currently available therapeutic options like insulin, sulfonylureas, biguanides, thiazolidinediones etc, many herbal medicines have been recommended for the treatment of diabetes due to their lesser side effects and increased acceptability. Now a days, there are a number of plants which are known for their antidiabetic potential[3-6]. More than 800 plants have been studied for their antidiabetic activity[7,8]amongst thousands of plants used in various regions of the world. *Adina cordifolia* (Roxb.) (Rubiaceae), Syn. *Haldinia cordifolia* (Roxb.) is found scattered in deciduous forests throughout the greater part of India, ascending to an altitude of 900 m in the sub-Himalayan tract[9]. Traditionally, it is used as astringent, febrifuge and antiseptic[10]. The coumarins from the root bark of *Adina cordifolia* and their thiosemicarbazone derivatives possessed antiamoebic property[9]. The *A. cordifolia* stem has been evaluated for its antiulcer potential[11]. The leaf extract of *A. cordifolia* have been examined for antifertility property[12]. Therefore, the present study was aimed to investigate the antidiabetic activity of hydro-alcoholic extract of the leaves to ascertian their ethnobotanical uses.

2. Materials and methods

2.1. Plant material

Leaves of Adena cordifolia (Roxb.) (Rubiaceae) were collected from botanical garden of IFTM University, Moradabad and authenticated by Dr. Tarrique Hussain,

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scientist, National Botanical Research Institute (NBRI), Lucknow. A Voucher specimen of all the plants has been preserved in the Department of Pharmacognosy, school of pharmaceutical sciences, IFTM university, Moradabad for further references.

2.2. Plant extraction

The collected leaves were washed with clean water and air-dried for 2 weeks. The dried leaves were powdered coarsely in a mechanical grinder and the coarsely powdered material was exhaustively macerated in a mixture of ethanol and water (50:50) for 7 days to allow for proper extraction (cold extraction). The extract was filtered with filter paper. The liquid filtrate was concentrated and evaporated to dryness in vacuo at 40 °C using a rotary evaporator to obtain good yield and hydro-alcoholic extract was kept in desiccator until further use.

2.3. Phytochemical screening

Phytochemical screening of the crude extract was carried out using standard procedures[13], to reveal the presence of chemical constituents such as alkaloids, flavonoids, tannins, terpenes, saponins, anthraquinones, reducing sugars, cardiac glycosides and others.

2.4. Animals

Experiments were performed on either sex of Wistar rats (150-200 g). Animals were procured from the animal house of the IFTM University, Moradabad and maintained on a natural day-night cycle (12hr dark: 12hrs light) at room temperature of about 24-26 °C, with free access to standard food pellets and water *ad libitum*. Experiments were carried out between 10:00-17:00 hours. The experimental protocol was approved by the Institutional Animal Ethics Committee, IFTM University, Moradabad.

2.5. Induction of diabetes

The animals were fasted for 24 h and the diabetes was induced experimentally by a single intraperitoneal injection of a freshly prepared solution of Alloxan monohydrate (Sigma, USA) at a dose of 120 mg/kg body weight[14]in 0.1 M cold citrate buffer of pH 4.5. After 72 h, rats with blood glucose levels (BGLs) above 250 mg/dl were considered diabetic and selected for the experiment.

2.6. Investigation of antidiabetic activity

The rats were divided into five groups comprising 6 animals in each group and treated as follows:

Group I: Normal rats were receiving citrate buffer (10 ml/kg) for 15 days.

Group II: Diabetic rats were receiving citrate buffer (10 ml/kg) for 15 days.

Group III: Diabetic rats were treated with HAEACL (250 mg/kg b.w.) orally for 15 days.

Group IV: Diabetic rats were treated orally with HAEACL (500 mg/kg b.w.) for 15 days.

Group V: Diabetic rats were given Glibenclamide (10 mg/kg b.w.) subcutaneously for 15 days.

The change in blood glucose levels of experimental animals was determined at 0, 2, 4 and 6 h after administration of extract by using glu-oxidase peroxidase reactive strips and glucometer (one touch basic plus) and readings were recorded.

2.7. Statistical analysis

The Dunnett's test was employed for statistical comparison. $P<0.05$ were considered significant in relation to control and standard. All values are presented as mean ± SEM.

3. Results

3.1. Phytochemical screening

The *A. cordifolia* leaf extract was found to contain tannins, saponins, flavonoids, non-reducing sugars, gums and mucilage etc.

3.2. Antidiabetic activity

When Alloxan induced diabetic rats were treated with hydro-alcoholic extract of *Adina cordifolia* (Roxb.) leaves (250 and 500 mg/kg b.w.) orally, a dose dependant reduction of blood glucose levels was observed. After a single dose of

Table 1

Effect of HAEACL on blood glucose levels in Alloxan-induced diabetic rats (mean ± SEM, n=6)

Group	Treatment	Blood glucose level (mg/dL) in hours			
		0h	2h	4h	6h
I	Normal control	79.58±1.67	76.12±2.21	76.79±2.112	76.49±1.912
II	Diabetic control	262.13±0.891	261.16±0.801	260.30±0.799	259.551±0.752
III	HAEACL (250 mg/kg)	271.14±0.373*	248.47±3.531*	223.73±2.775*	213.68±2.142*
IV	HAEACL (500 mg/kg)	263.92±1.785	240.47±3.531*	227.29±3.254*	210.415±3.31*
V	Glibenclamide (10 mg/kg)	270.09±0.482*	228.28±2.821*	210.41±1.763*	188.21±0.699*

Values are in mean±S.E.M. (n=6).

Statistical analysis of data was carried out by one-way ANOVA followed by Dunnett's test.

*$P<0.01$ when compared to diabetic control.

the extract given to the alloxan-induced diabetic rats, there was a significant ($P<0.01$) reduction in blood glucose levels of the diabetic rats compared to control. The maximum effect was observed at 6 h with the various doses of the extract exerting comparable effect. However, the effect of the extract was less than that of the standard drug, glibenclamide (Table 1).

4. Discussion

Investigation of antidiabetic activity of the hydro-alcoholic extract of *Adina cordifolia* (Roxb.) leaves was performed in alloxan induced diabetic rats. The extract showed significant antidiabetic activity at the dose of 500 mg/kg body weight. A lot of research work has been published citing the antidiabetic activity. A number of medicinal plants and their remedies are used for the treatment of diabetes in Ayurveda as well as in traditional systems. However, many other active agents obtained from plants have not been well characterized[15]. Glibenclamide, like other sulphonylureas, is effective in mild diabetic state and ineffective in severe diabetic animals where pancreatic β-cells are completely destroyed[16].

In the present study, the hydro-alcoholic extract of *A. cordifolia* (Roxb.) was given to diabetic rats continuously for a time period of 15 days which resulted in dose-dependent reduction of blood glucose level compared to diabetic control rats. The extract was found to contain tannins, phenolic compounds, flavonoids, saponins, gums & mucilage, etc. These constituents may be responsible for the antidiabetic activity.

Antidiabetic effects of a majority plants are attributed to their ability to restore the function of pancreatic tissues by causing an increase in the insulin secretion or inhibit the intestinal absorption of glucose[17,18]. *A. cordifolia* leaf extract may have acted through the above mechanism resulting in the antidiabetic activity.

In conclusion, the present study shows that hydro-alcoholic extract of *A. cordifolia* leaves exhibits antidiabetic property. This confirmation justifies its use in ethnomedical medicine for the treatment of diabetes.

Conflict of interest statement

We declare that we have no conflict of interest.

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