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Research Article

HYPOGLYCEMIC ACTIVITY OF AQUEOUS EXTRACT OF *BERBERIS ARISTATA* STEMS BARK IN STZ-INDUCED RATS

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ABSTRACT

The aim of this study was to investigate the antidiabetic activity of stem bark of *Berberis aristata* DC (family-Berberidaceae) extract in STZ-induced diabetic *Albino Wistar* Rats. A comparison was made between the action of aqueous extracts of *B. aristata* and a known antidiabetic drug glimepiride. Biochemical estimation of lipid profile was also determined in diabetic rats. The aqueous extracts of *B. aristata* stem bark were obtained by simple maceration method and were subjected to standardization by pharmacognostical and phytochemical screening methods and standardized extracts are subjected for antidiabetic activity. The aqueous extract of *B. aristata* stems bark showed significant (P<0.01) antidiabetic activities and also deceases total cholesterol (TC) and significant increase in HDL-C level when compared with diabetic control. These extracts also prevented body weight loss in diabetic rats. The drug has the potential to act as an antidiabetic drug.

Keywords: *Berberis aristata*, Berberidaceae, Phytochemical, Streptozotocin (STZ).

INTRODUCTION

Berberis aristata DC (Berberidaceae) is an erect, spinous, deciduous shrub, growing in dry hot places of Himalayas from Garhwal to Bhutan up to altitude of 1800-3000 m, usually 1.8-3.6 meter in height.[1] Stem barks of *B. aristata* have astringent, febrifuge and stomachic effect[2,3,4] and are used to treat piles, spleen and diarrhoea, malaria, menorrhagia, diabetes.[5,6,7,8] *B. aristata* contains isoquinoline alkaloids mainly berberine and other phytoconstituents of *B. aristata* are oxyberberine, aromaline, kakrachine, palmatine, oxyacanthine, taxilamine and jatrorrhizine, some of the alkaloids are reported as being found in the chloride salt form.[9] Our efforts were directed to study the antidiabetic activity of stem bark of *B. aristata.*

MATERIAL AND METHODS

Plant material

The stem bark of *B. aristata* were procured from the Khari Baoli market of Delhi and identified by Prof. M. P. Sharma, Department of Botany, Faculty of Science, Jamia Hamdard New Delhi. A voucher specimen of drug is preserved in the Phytochemistry Research Laboratory, Department of Pharmacognosy and Phytochemistry, Faculty of Pharmacy, Jamia Hamdard.

Preparation of the extracts

The air dried powdered drug (500 g) was extracted with water. Aqueous extract of *B. aristata* was evaporated to dryness under pressure to give solid residue. The residue was stored at 0-4 ° C for subsequent experiments.

Animals

Albino Wistar rats (150-200 g) were obtained from Central Animal Facility, Jamia Hamdard University and maintained in 25 ± 1°C, with 55 ± 5 % humidity with 12 hr light/dark cycle. The animals were given standard pellet diet (Lipton Rat Feed, Ltd., Pune) and water *ad libitum* throughout the experimental period. The Institutional Animal Ethics Committee approved the experiments. All the extracts and the standard drugs were administered orally.

Chemicals

All chemicals and reagents used were of analytical grade. Streptozotocin was obtained from chopra chemicals (Delhi, India).

Drugs

Standard drug: glimepiride prepared in tween 80 solution; Test drug: plant extract, in CMC (1 %) solution.

Induction of diabetes

The animals were fasted for 16 hour prior to the induction of diabetes. STZ freshly prepared in citrate buffer (pH 4.5) was administered i.p. at a single dose of 50 mg/kg. Development of diabetes was confirmed by polydipsia, polyurea and by measuring blood glucose concentrations 72 hour after injection of STZ. Rats with blood glucose level of 250 mg/dl or higher were considered to be diabetic and selected for experiment.

Experimental design

Estimation of blood glucose in STZ-induced diabetic rats treated with plant extracts

The rats were randomized into 5 groups comprising 6 animals in each group as given below. The glimepiride and different doses of extracts were administered in aqueous solution (1% v/v CMC in water) once per day. The dosing was done at 10.00 AM daily. The body weight of animals was monitored to adjust the dosing.

Group I: normal control rats, received normal saline.

Group II: diabetic control rats, received STZ in single dose (50 mg/kg, i.p.).

Group III: glimepiride treated diabetic rats, received standard drug, glimepiride (0.1 mg/kg, p.o.) 3 days after STZ treatment and continued for 21 days.

Group IV: BA_1 treated diabetic rats, received BA_1 extract (250 mg/kg, p.o.) 3 days after STZ treatment and continued for 21 days.

Group V: BA_2 treated diabetic rats, received BA_2 extract (500 mg/kg, p.o.) 3 days after STZ treatment and continued for 21 days.

Biochemical estimation

Initial, 7^{th} 14^{th} and 21^{st} day non fasting blood glucose levels were determined just before administering the drugs. On the last day of experiment, blood samples were collected from tail vein from each animal. Serum was separated from the blood by centrifuging at 3000 rpm for 20 minutes for biochemical estimations of TC[10] and HDL-C.[11]

Estimation of blood glucose

The blood glucose level was estimated with One Touch Basic Glucometer (Accu Chek Active, Roche, Germany). Serum total cholesterol (TC), high-density lipid cholesterol (HDL-C), were estimated by using standard enzymatic colorimetric kits (Span diagnostic Ltd. Surat, India).

Statistical Analysis

Values are expressed as mean ± standard error of the mean. Statistical significance was calculated by using one-way analysis of variance (ANOVA) followed by Dunnett's t-test. The values were considered statistically significant when the P- value was less than 0.05 (P<0.05). (Table I and table II)

RESULT AND DISCUSSION

Effect of aqueous extract on blood glucose level in STZ-induced diabetic rats given in Table I, shows the level of blood glucose in normal and experimental animals in each group. Oral administration of BA_1, BA_2 and Glimepiride reduced the blood glucose level significantly (P<0.01) when compared with diabetic control[12]. Effect of aqueous extract on serum lipid profile and body weight in STZ-induced diabetic rats given in Table II, shows the serum level of lipids total cholesterol (TC) and HDL-C in normal and experimental animals in each group. STZ treatment resulted significant (P<0.01) elevation of total cholesterol and reduction in HDL-C levels as compared to normal control rats[13]. However, there was a significant (P<0.01) reduction in total cholesterol and a significant elevation in HDL-C level in diabetic rats treated with BA_1 and BA_2. The mean body weight of diabetic rats was considerably decreased as compared to normal animals. While, aqueous extract of *B. aristata* and glimepiride treatment significantly prevented the lowering in body weight at the end of 21st day when compared with the diabetic control animals.

Table 1: Effects of aqueous extract of *B. aristata* stem bark on blood sugar level

Groups	Blood glucose (mg/dl)			
	Initial	7th day	14th day	21st day
Normal control	93.83±4.79	115.69±1.02	115.50±1.56	118.5±1.17
Diabetic control (STZ, 50 mg/kg)	368.33±5.05	373.50±1.73	367.33±3.22	375.33±4.46
Diabetic + Glimepiride (0.1 mg/kg)	374.67±5.06*	161.33±2.21*	124.67±1.80*	104.50±3.19*
BA_1 (250 mg/kg)	361.50±9.84*	182.67±2.80*	134.67±1.40*	117.50±1.17*
BA_2 (500 mg/kg)	369.00±6.69*	215.17±2.41*	150.33±1.35*	134.33±2.41*

All values are Mean ± SEM; n=6

* P<0.01 when compared with diabetic control

Table 2: Effect of aqueous extract of *B. aristata* on serum lipid profile and body weight in STZ-induced diabetic rats

Groups	Lipid profile		Body weight	
	TC	HDL-C	Initial	Final
Normal control	114.17±17	47.50±1.178	166.83±3.28	179.83±3.44
Diabetic control	252.83±2.70	35.66±0.42	168.67±2.44	156.83±1.83
Diabetic + Glimepiride	113.00±2.36ns	44.33±0.95ns	170.00±2.94	184.50±2.69
BA_1 (250 mg/kg)	119.17±2.97*	39.00±0.93*	173.17±5.30	194.17±3.94
BA_2 (500 mg/kg)	137.50±1.33*	35.00±0.77*	163.50±5.16	158.83±2.96

All values are Mean ± SEM; n=6

*P<0.01 when compared with normal control

ns not significant when compared with normal control (*P>0.05).

CONCLUSION

We conclude that the aqueous extract of *B. aristata* have potent antidiabetic effects in STZ-induced diabetic rats. The present investigation has also opened avenues for further research especially with reference to the development of potent formulation for diabetes mellitus from *B. aristata* stem bark.

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