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Kamala Chandak

Associate Professor, Department of Pharmacognosy, SKB College, of Pharmacy, Kamptee, Nagpur, Maharashtra, India

Archana Bhuyar

Smt. Kishoritai Bhoyar College of Pharmacy, Kamptee, Nagpur, Maharashtra, India

Shalaka Dabhekar

Smt. Kishoritai Bhoyar College of Pharmacy, Kamptee, Nagpur, Maharashtra, India

Narendra Rahangdale

Smt. Kishoritai Bhoyar College of Pharmacy, Kamptee, Nagpur, Maharashtra, India

Milind Umekar

Smt. Kishoritai Bhoyar College of Pharmacy, Kamptee, Nagpur, Maharashtra, India

Corresponding Author:**Kamala Chandak**

Associate Professor, Department of Pharmacognosy, SKB College, of Pharmacy, Kamptee, Nagpur, Maharashtra, India

Antidiabetic potential of aqueous extract of *Allium cepa* Linn. Red bulbs skin in Alloxan induced diabetic rats

Kamala Chandak, Archana Bhuyar, Shalaka Dabhekar, Narendra Rahangdale and Milind Umekar

Abstract

The plant *Allium cepa* Linn (Liliaceae) is commonly known as Pyajj in Hindi and Onion in English and its bulbs are reported to possess hypoglycemic activity. The skin of red variety onion bulbs is reported to contain flavonoids and various other phytoconstituents. This study is planned to evaluate the anti-diabetic potential of aqueous extract of *A. cepa* Linn. Red onion bulbs skin in alloxan induced (150 mg/kg) diabetic rats. Three doses (50mg, 100 mg/kg and 200 mg/kg) of the aqueous extract of bulbs skin were administered orally to diabetic rats. The blood glucose level was measured at 0, 1, 2, 3, 5 hours after the treatment. Metformin hydrochloride drug (120 mg/kg) was used as a reference standard.

The aqueous extract of *Allium cepa* bulbs skin at (100mg/kg and 200mg/kg,) dose level produced significant ($P < 0.001$) reduction in blood glucose level at 3rd and 5th hours of treatment in diabetic rats. The Maximum % reduction in blood glucose level was observed to be 48.5 (100th mg/kg) and 63.4 (200mg/kg) of extract dose after 5 hour of administration as compared with untreated diabetic control. The results were also comparable with the reference standard drug wherein the % reduction in glucose level was found to be 61.61 at 5 hours.

Keywords: *Allium cepa* red bulbs skin, alloxan induced, antidiabetic activity

Introduction

Diabetes mellitus is a chronic metabolic disorder which occurs due to deficient production of insulin by the beta cells of the pancreatic islets. Insufficiency of this hormone in the body results in hyperglycaemia and the symptoms of diabetes include an excess of sugar in the blood and urine, hunger, thirst and a gradual weight loss^[1, 2].

It has become a major public health and economic problem across the globe. There is tremendous rise in the number of diabetics worldwide due to stress, life style changes, consumption of high fat diet; obesity etc.^[3] Still there is no satisfactory effective therapy in modern medicine to cure diabetes^[4]. Although along with insulin different types of oral hypoglycemic agents are available for the treatment of diabetes but there is an increased demand to use natural anti-diabetic products among patients^[5, 6].

There are many plants and plant extracts which possess significant hypoglycaemic activity. From ancient times such natural materials have been used for the treatment of diabetes mellitus and are also currently being extensively used in traditional medicine world- wide^[2].

One of such plants is *Allium cepa* (Liliaceae), is a perennial herb but widely cultivated as an annual all over India and in almost every country of the world for its bulbs and seeds. Onion bulbs are largely used as an article of food and condiment. A variety of secondary metabolites, including flavonoids, phytosterols and saponins, have been identified Are used as tonic, diuretic, expectorant, stomachic etc.

Onions have long been used in traditional medicine for the management of diabetes. It derives hypoglycaemic action from disulphides. It has been envisaged that by virtue of their thiol groups these disulphide act as sparing agents for insulin by competing with it for inactivating compounds. The Aqueous extract of bulbs is reported to lower blood glucose levels in alloxan induced diabetic rats^[7, 8, 9, 10].

The phytochemical screening of outer dry skin of red species of bulbs showed presence of various metabolites like carbohydrates, tannins, saponins, flavonoids, glycosides etc. It has been found that quercetin and quercetin 4'-O-glucopyranoside are the major flavonoids present in red onion peel. Ethanol extract of peel extract is reported to possess antispasmodic activity^[11, 12, 13].

Materials and Methods

Plant Material: Collection and Authentication

Allium cepa bulbs of red variety were purchased from local vegetable market of Kamptee, Nagpur district, Maharashtra, India and authenticated from Botany department of university campus, RTM, Nagpur University. Nagpur whose voucher specimen no. was 9533.

Preparation of Aqueous extract

Thin outer scales were removed from *A. cepa* bulbs, dried and pulverized into coarse powder.

100 g dried, coarse powder was taken and extract was prepared by maceration technique using distilled water. Residue was removed by filtration and filtrate was concentrated by rotary vacuum evaporator.

Preliminary phytochemical screening

Preliminary phytochemical screening of the extract was carried out to determine the presence of various plant metabolites by various standard tests and procedures [14, 15].

Experimental Animals

Sprague Dawley rats of either sex (150-200g) were used. They were procured from Smt. Kishoritai Bhojar College of Pharmacy, Kamptee, Nagpur. The experimental protocol was approved by the Institutional Animal Ethical Committee. The animals were housed under standard environmental conditions at the animal house.

Treatment protocol: Induction of Diabetes

The rats were kept for fasting for 18 hours before experimentation procedures but allowed free access to water. The diabetes was induced by Alloxan monohydrate

(150mg/kg, i.p.) in saline solution. The blood samples were withdrawn from tail vein before and after 48 hours of Alloxan injections and were analyzed for blood glucose levels using glucometer. The Alloxan induced animals showing more than 200mg/dl blood glucose were considered as diabetic and selected for further studies.

The selected hyperglycemic rats were divided into six groups of six animals each. Group I served as a normal control and received saline water only. Group II served as diabetic control and received distilled water. Group III served as standard group and received anti diabetic

Statistical Analysis of Data

The results were expressed as Mean \pm SEM. The significance of differences between means was evaluated by one-way Analysis of variance (ANOVA) followed by Dunnett's t-test and p values

< 0.05 were considered to be statically significant.

Results

Table 1: Preliminary Phytochemical Screening of Aqueous Extract of *A. cepa* Red Bulbs Skin

Phyto-constituents	Aqueous extract
Carbohydrates	+
Proteins and amino acids	-
Sterols	-
Flavonoids	+
Alkaloids	-
Tannins	+
Saponins	+

+ indicates Presence - indicates Absence

Table 2: Effects of aqueous extract of *A. Cepa* red bulbs skin on lowering of blood glucose levels in Alloxan induced diabetic rats:

Groups	Dose (mg/kg)	Blood Glucose Level At Hours (mg/dl)			
		0hr	1hr	3hr	5hr
Saline		321.8 \pm 29.6	339.1 \pm 19.19	354.83 \pm 17.5	409.0 \pm 19.4
Metformin HCl	120 mg	274.8 \pm 20.4	197.5 \pm 21.9***	132.6 \pm 9.0***	105.5 \pm 3.5***
Aq. Extract <i>A. Cepa</i>	100 mg	288.0 \pm 29.5	258.5 \pm 27.0	228.6 \pm 9.0***	148.5 \pm 5.8***
Aq. Extract <i>A. Cepa</i>	200 mg	300 \pm 4.7	270 \pm 6.3	200 \pm 2.6***	110 \pm 2.4***

Values are given as mean \pm SEM (n=6), *** p < 0.0001 compared with diabetic saline control group.

Table 3: % Reduction in blood glucose by different extract doses of *A. cepa* and standard drug Metformin in diabetic rats

Treatment	Dose (mg/kg)	% Reduction in blood glucose		
		1hr	3hr	5hr
Metformin HCl	120mg	28.13	51.75	61.61
Aq. Ext. <i>A. cepa</i>	100mg	10.3	20.7	48.5
Aq. Ext. <i>A. cepa</i>	200mg	10	33.4	63.4

Results and Discussion

On concentration of the aqueous extract of *A. Cepa* red bulbs skin, a solid dark brown mass was obtained and the percentage yield of the extract was found to be 12.67%. Phytochemical screening of the aqueous extract showed the presence of various phyto-constituents such as carbohydrates, glycosides, flavonoids, saponins and tannins. The aqueous extract (100 and 200 mg/kg) showed a significant (p < 0.0001) reduction in fasting blood glucose levels in alloxan induced diabetic rats on oral administration whereas no significant activity was observed with 50mg/kg dose. The Maximum % reduction in blood glucose level for extract dose 100 and 200 mg/kg was found to be 48.5 and 63.4 respectively after 5th hour of the administration. The anti-

hyperglycemic effect of the extract was found to be dose dependent. The results were comparable with that of reference standard drug Metformin HCl where the percentage reduction was 61.61 at 5th hour.

A wide range of plant constituents such as terpenes [19], tannins [20], polysaccharides [21] steroids [22], coumarins [23], some flavonoids and related compounds [24, 25] are reported to possess hypoglycaemic property and are used in treatment as well as management of diabetes.

As the aqueous extract is found to contain carbohydrates, glycosides, flavonoids, saponins, tannins, so these constituents either single or in synergy with others may be responsible for significant blood glucose lowering activity of this extract.

Conclusion

The aqueous extract of *A. Cepa* red bulbs skin possesses significant antidiabetic effect. However, more research work is required to be carried out to isolate and identify the phytochemical constituents responsible for anti-hyperglycemic effects. Likewise the mechanism of action of the same can be studied.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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