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Diuretic activity of whole plant extract of *Achyranthes aspera* Linn

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ABSTRACT

Achyranthes aspera Linn (Amaranthaceae), commonly known as Apamarga in Ayurveda and is found as a weed that has been traditionally used for a number of ailments. The plant is indigenously used as diuretic, spermicidal, anti-allergic, cardiovascular, nephroprotective, antiparasitic, hypoglyceamic, analgesic and antipyretic. In the present study the methanolic extract of whole plant of Achyranthes aspera was investigated for its diuretic potential. The diuretic effect was found out by Lipschitz et al method using furosemide as standard drug. The methanolic extract treated rats showed high diuretic effect as compared to control but this effect was less than furosemide. Significant increase in renal clearance of sodium, potassium and chloride ions was observed in treated and standard groups.

Key Words: *Achyranthes aspera*, Pharmacological activity, Diuretic, Furosemide, Renal clearance.

INTRODUCTION

Pharmacological research on the medicinal properties of phytochemicals has become mandatory, to establish the claimed medicinal properties of herbs [1]. Diuretics are drugs that increase the rate of urine flow, sodium excretion and are used to adjust the volume and composition of body fluids in a variety of clinical situations. Drug-induced diuresis is beneficial in many life-threatening disease conditions such as congestive heart failure, nephritic syndrome, cirrhosis,

renal failure, hypertension, and pregnancy toxaemia. Naturally occurring diuretics include caffeine in coffee, tea, and cola, which inhibit Na^+ reabsorption and alcohol in beer, wine and mixed drinks, which inhibit secretion of ADH [2]. *Achyranthes aspera* Linn, Amaranthaceae, commonly known as Latjeera in Hindi, Shikhari or Apamarga in Sanskrit, is an erect or procumbent, annual or perennial herb, found on road sides, field boundaries and waste places as a weed throughout India up to an altitude of 2100 m [3, 4]. It is widely used in traditional system of medicine as alterative & antiperiodic, antiphlegmatic, purgative, laxative, liver complaints, rheumatism, scabies and other skin diseases [5, 6]. The plant is also well known for its spermicidal, hypoglycemic, hepatoprotective, anti-inflammatory, analgesic, antipyretic and anti-arthritic activity [7, 8, 9, 10, 11]. No systematic studies have been reported for its diuretic activity. Therefore, an attempt has been made to evaluate the diuretic potential of methanolic extract of *Achyranthes aspera*.

MATERIALS AND METHODS

Plant collection and authentification

The fresh plant of *Achyranthes aspera* Linn (Amaranthaceae) for the research work was collected from the roadsides of Lucknow & Moradabad, in the month of September 2010 and was authenticated by *Dr. D.C. Saini*, Senior Scientist, Palaeobotany, Birbal Sahni Institute of Palaeobotany, Lucknow India. A voucher specimen no.11722 was submitted in the department of Pharmacognosy, Teerthanker Mahaveer College of pharmacy, Moradabad.

Preparation of plant extracts

The whole plant material was dried under sun & was mechanically reduced to moderate coarse powder and stored in an air tight container. The moderate coarse powder was subjected to successive extraction using different solvents in increasing order of polarity using Soxhlet Apparatus of 500 & 1000 ml (Petroleum ether, Chloroform, Ethyl acetate, Methanol & Water). All the respective solvents were recovered under reduced pressure with the help of rotary evaporator (Buchi Type) of Biogen Scientific.

Evaluation of Diuretic Activity

Animals

All animals were procured and housed in animal house maintained under standard hygienic conditions. Animal experiments were approved by Institutional Animal Ethics Committee (IAEC) of Pinnacle Biomedical Research Institute (PBRI) Bhopal (Reg No.1283/c/09/CPCSEA). Protocol Approval Reference No. PBRI/IAEC/132.

Grouping of Animals

Animals were housed in a group of four in separate cages under controlled conditions of temperature (22 ± 2°C). All animals were given standard diet (Golden feed, New Delhi) and water regularly. Animals were further divided in three groups with six animals in each group. Group I: Control, Group II: Standard (Furosemide 100mg/kg), Group III: Methanolic extract of *Achyranthes aspera* (400 mg/kg).

Biostatical Interpretation

Data were subjected to biostatical interpretation by one way ANOVA followed by Dunnet's Test. Values of $p<0.05$ were considered as level of significance.

Procedure

Lipschitz Method

Male rats (Wister albino strain) weighing 100 to 150gm were maintained under standard condition of temperature and humidity. 3 groups of six rats in each and were fasted and deprived of water for eighteen hours prior to the experiment. The first group of animals serving as control, received normal saline (25ml/Kg, p.o.) the second group received furosemide (100mg/Kg, i.p.) in saline; the third group received extract at the doses of 400 mg/Kg, respectively, in normal saline. The urine was collected in measuring cylinders up to 5 hrs after dosing. During this period, no food or water was made available to animals. The parameters taken for individual rat were body weight before and after test period, total concentration of Na^+, K^+, and Cl^- in the urine. Na^+, K^+ concentrations were measured by Flame photometry and Cl^- concentration was estimated by titration with silver nitrate solution (N/50) using three drop of 5% potassium chromate solution as indicator. Results are reported as mean ± SD, the test of significance ($p<0.01$ and $p<0.05$) was stastically [12, 13].

RESULTS

Diuretic activity

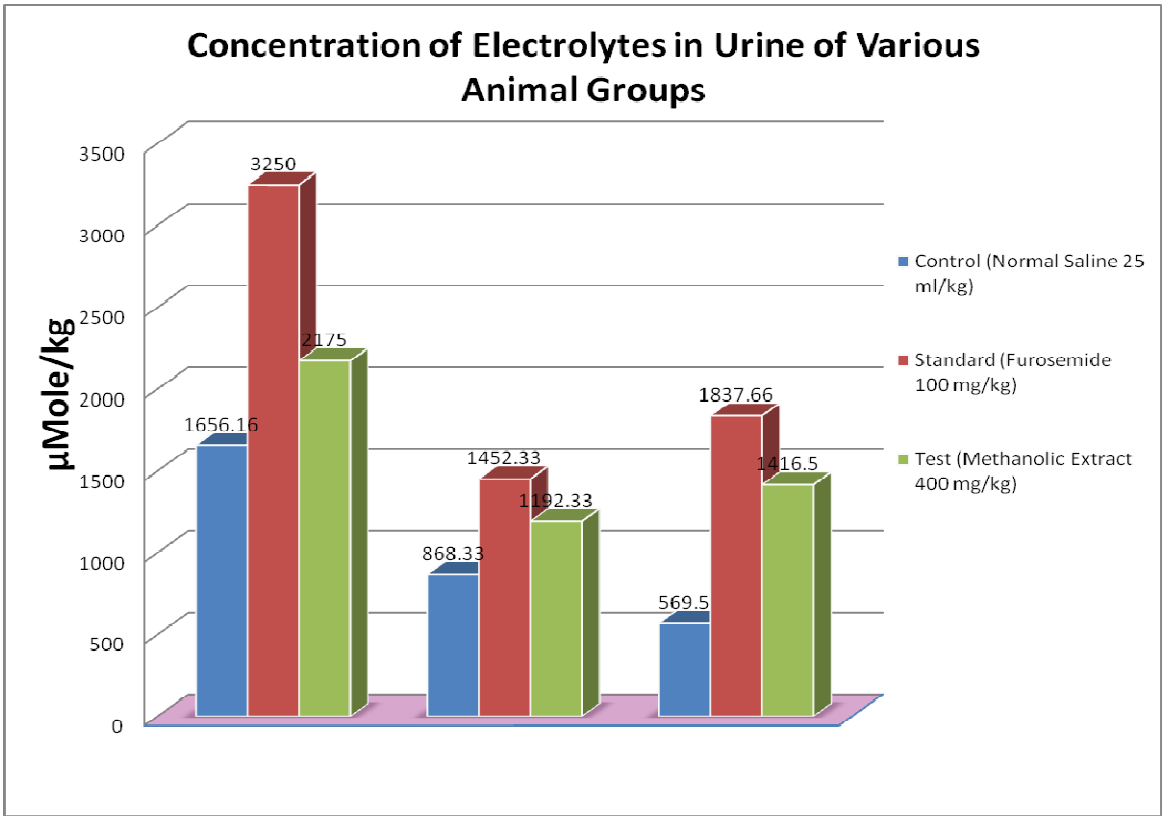
Effect on urine volume

Results are shown in the table 1. The methanolic extract of the whole plant of *Achyranthes aspera* at a dose of 400 mg/kg BW show marked diuresis during the 5 h of the test (*Achyranthes aspera* 2.316±0.343ml versus control 1.73±0.326ml, whereas in case of standard the volume was found to be 3.41±0.499ml; $P < 0.05$).

The methanolic extract of *Achyranthes aspera* significantly increased urinary output to that of the control (*Achyranthes aspera* 2.316±0.343ml versus control 1.73±0.326ml; $P < 0.05$), but the effect was much less than that of furosemide (3.41±0.499ml).

Table 1 Effect of methanolic extract of *Achyranthes aspera* on urine excretion and ionic concentration in rats

GROUPS	Treatment	Volume of Urine in ml	Na^+ ion µMole/kg	K^+ ion µMole/kg	Cl^- ion µMole/kg	Na^+/K^+
Vehicle	Normal saline (25ml/kg, p.o.)	1.73±0.326	1656.16±41.81	868.33±47.25	569.5±36.72	1.907
Standard	Furosemide (100mg/kg, i.p.)	3.41±0.499	3250±114.24	1452.33±41.30	1837.66±63.09	2.237
Test	Extract (400 mg/kg)	2.316±0.343	2175±63.04	1192.33±31.68	1416.5±37.25	1.824



Effect on urinary electrolyte excretion

The effect of single doses of furosemide (100 mg/kg BW) and the methanolic whole plant extract of *Achyranthes aspera* (400 mg/kg BW) on electrolyte (Na^+, K^+ and Cl^-) excretion in the 5 h urine in presented in Table 1. The plant extract enhanced the excretion of the electrolytes ($P < 0.05$) which was less than that of the furosemide. The Na^+ ion concentration in case of test extract was 2175±63.04 µMole/kg against control i.e. 1656.16±41.81 µMole/kg; K^+ ion concentration of extract was 1192.33±31.68 µMole/kg, with the concentration of control 868.33±47.25 µMole/kg. Similarly the Cl^- ion concentration of extract treated group was 1416.5±37.25 µMole/kg as well as for the control 569.5±36.72 µMole/kg. Na^+/K^+ ratio of 1.824 was obtained for the alcoholic extract whereas for the control group value for Na^+/K^+ ratio is reported to be 1.907. The results when compared indicate that the electrolytic concentration of was found to be more than that of the control and less than furosemide.

DISCUSSION

Diuretics relive pulmonary congestion and peripheral edema. These agents are useful in reducing the syndrome of volume overload, decreases cardiac workload, oxygen demand and plasma volume, thus decreasing blood pressure**.** Thus, diuretics play an important role in hypertensive patients [14]. Urine volume, concentration of electrolytes in urine such as sodium, potassium and chloride were the parameters measured while assessing the diuretic potential of the extract. The

present study revealed that, methanolic extract of *Achyranthes aspera* significantly increased the urinary output as well as urinary electrolyte concentration at a dose of 400mg/kg per oral.

Present study shows that the methanolic extract of *Achyranthes aspera* whole plant possess good diuretic activity. Na^+ ion, K^+ ion and Cl^- ion concentration were increased, 2175±63.04, 1192.33±31.68, 1416.5±37.25 µMole/kg were obtained for extract respectively. The normal value for Na^+ ion, K^+ ion and Cl^- ion concentration is reported to be 1656.16±41.81, 868.33±47.25, 569.5±36.72 µMole/kg. Significant increase in Na^+, K^+ and Cl^- ion excretion was observed in methanolic extract treated animals but it was less than the furosemide control which is a very essential requirement of an ideal diuretic.

CONCLUSION

The results obtained in this study provide a quantitative basis to explain the traditional folkloric use of *Achyranthes aspera* as a diuretic agent; it is also used for the treatment of hypertension and renal disease. The extract has diuretic effect supporting the ethno-pharmacological use as diuretics. This effect may be explored in the use of the plant in the management of some cardiovascular diseases.

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