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Diuretic activity of ethanolic extract of *Pistia stratiotes* in rats

R.K. SAHU[1]*, A. ROY[1], A.K. JHA[2] and U. SHARMA[3]

[1]Department of Pharmacognosy, Oriental College of Pharmacy, Bhopal (India).
[2]Shri Shankaracharya Institute of Pharmaceutical Sciences, Bhilai, Durg (India).
[3]Institute of Pharmacy, Jalpaiguri (India).

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ABSTRACT

Kidney, the excretory organ of our body serves the important function of excretion of waste products, regulation of fluid volume and electrolyte content of the extracellular fluid. Diuretics are drugs capable of increasing levels of urine. The diuretic activity of ethanol extract of *Pistia stratiotes* (ETPS) leaves was studied in male wistar albino rats at 5th h and 24th h intervals. The animals were divided into 5 groups: control, urea, furosemide, 200mg/kg and 400mg/kg ethanol extract. The ethanol extract was administered intraperitoneally (i.p) and all animals were pretreated with saline before starting the experiment. The urine volume (in ml) at 5th h and 24th h duration were measured. The urine output increased significantly in urea, furosemide and both ETPS groups. Ethanol extract increased the urine volume and electrolytes balance in a dose dependent manner. The results indicate that ETPS has significant diuretic activity, which supports the traditional claim about the *Pistia stratiotes* being used as a diuretic.

Key words: *Pistia stratiotes,* Diuretics, Furosemide, Urine volume, intraperitoneally

INTRODUCTION

Pistia stratiotes Linn (Araceac) commonly known as Jal-kumbhi in Hindi, is an aquatic herb occurring throughout the greatest part of India in ponds & streams. This aquatic plant usually propagates by means of stolons which break easily from the plant accounts. Reproduction also takes place by seed. The leaves can be up to 14 cm long and have no stem. They are light green, with parallel veins, wavy margins and are covered in short hairs which form basket-like structures which trap air bubbles, increasing the plant's buoyancy. It forms a dense mat on water surface and causes serious clogging of water ways. Water lettuce is often used in tropical aquariums to provide cover for fry and small fish. It is also helpful as it outcompetes algae for nutrients in the water, thereby preventing massive algal blooms[1-3].

According to ethnomedical information, it was found to possess various medicinal properties. The *P. stratiotes* leaves are used in traditional medicine for the treatment of ring worm infection of the scalp, syphilitic eruption, skin infection, ulcers, boils and wounds. The oil extract of *P. stratiotes* is used in the treatment of worm infestation, tuberculosis, asthma and dysentery, and is applied externally to treat skin diseases, inflammation, piles, ulcers, syphilitic infections and burns[4,5]. Reports on the biological activities of the whole plant are very limited. Hence an attempt was to make to investigate the diuretic activity of leaves in male wistar albino rats.

MATERIAL AND METHODS

Collection of Plant Material

The leaves of *Pistia stratiotes* were collected in Sarangarh, near Raigarh, Chhattisgarh in the month of April. It was identified by the research scientists at the Agriculture University, Raipur (Chhattisgarh), India.

Preparation of extracts

The dried and powdered leaves (400gm) were successively extracted on a Soxhlet apparatus, employing petroleum ether, ethanol and distilled water respectively. The extracts were further concentrated under reduced pressure with a rotary evaporator. Leaves of *P. stratiotes* yielded 1.6%, 16.3% and 11.9% w/w powdered extract with petroleum ether, ethanol and distilled water respectively. The dried ETPS was suspended in distilled water and used for further studies.

Animals

For this study, male wistar albino rats (180-230 g) were employed throughout. All the animals were quarantined for 10 days under standard conditions of temperature (27.3 ^{o}C, 65±10% of relative humidity) and light (12-h light/dark cycle), and fed a standard diet and tape water *ad libitum*.

EXPERIMENTAL

Pharmacological evaluation

Five groups of six male wistar albino rats each weighing between 180-230g/kg, b.w. were used. All the animals received normal saline (25ml/kg, b.w) orally, prior to start of the experiment. Group I which received normal saline was treated as control. Group II received urea (1kg/kg). Group III received furosemide (5mg/kg). Group IV and V received the ethanol extract at the dose of 200mg/kg and 400mg/kg body weight respectively. Immediately after administration of the drug, the rats were each placed in metabolic cages, specially designed to separate urine and faecal matter and observed at room temperature. The animals were denied food and water during the experiment. The urine volume was collected after 5th h and 24th h of the intraperitoneal administration and urine volume (ml/day) was measured[6,7].

Diuretic activity and Urinary volume excretion

The volume of the urine excreted after 5th h and 24th h of study by control, urea, furosemide and ETPS (200mg and 400mg/kg, b.w.) was expressed as percent of the liquid administered giving rise to a measure of "Urinary excretion" (U.E) - independent of group weight, thus

$$\text{Urinary Exretion} = \frac{\text{Total urinary output}}{\text{Total liquid administered}} \times 100$$

The ratio of (U.E) in test group and control group was denoted. Diuretic action, which was used as the measure of degree of diuresis[8].

$$\text{Diuretic action} = \frac{\text{Urinary exretion in test group}}{\text{Urinary excretion in control group}} \times 100$$

$$\text{Diuretic activity} = \frac{\text{Diuretic action of drug}}{\text{Diuretic action of urea}} \times 100$$

Statistical analysis

The results are expressed as mean ± SEM of six independent experiments. Statistical significance between group was evaluated by one-way analysis of variance (ANOVA) followed by Turkey's multiple comparison test. A $P < 0.05$ value was considered as statistically significant.

RESULTS

The total urine volume over the period of 5th h and 24th h were measured for the extracts, (200mg and 400mg/kg, b.w), standard diuretics (urea and furosemide) and control. Urea, furosemide and 200mg and 400mg/kg of ETPS increased the urine flow significantly at 5th h and 24th h when compared with control. The 400 mg/kg of ETPS excreted two times more volume of urine as compared to control, so that it increased urine flow in a dose dependent manner.

From the result it reveals that ETPS exhibited diuretic activity at both doses (200mg and 400mg/kg, b.w) like furosemide at 5th h and 24th h and its effect was dose dependent (Table 1). The diuretic activity of a drug is considered to be good if it is above 1.50, moderate if it is within 1.00-1.50, little if it is between 0.72-1.00 and nil if it is less

Table 1: Dose response diuretic activity of ethanol extract of *Pistia stratiotes* (ETPS) in normal rats at 5th and 24th hour by intraperitoneal administration

Groups	At 5 h After Drug Administration				At 24 h After Drug Administration			
	Urine Volume (ml)	Urinary Excretion (V_0/V_1)×100	Diuretic Action (UE_t/UE_c)	Diuretic Activity (DA_t/DA_u)	Urine Volume(ml)	Urinary Excretion (V_0/V_1)×100	Diuretic action (UE_t/UE_c)	Diuretic activity (DA_t/DA_u)
Control (25mL of 0.9%Nacl)	0.78±0.02	16.59	-	-	2.14±0.02	45.53	-	-
Urea(1g/kg)	0.98±0.03*	20.41	1.23	-	2.36±0.02*	49.17	1.08	-
Furosemide (5mg/kg)	2.50±0.03*	52.63	3.17	2.57	4.87±0.03*	102.52	2.25	2.08
ETPS (200mg/kg)	1.15±0.02*	23.71	1.43	1.16	2.51±0.03*	51.75	1.14	1.05
ETPS (400mg/kg)	2.45±0.06*	50.82	3.06	2.48	4.92±0.04*	102.07	2.24	2.07

Values are expressed as mean ± SEM (Number of animals, n=6); * Significantly different from the control at $P<0.05$, V_0= Total urinary output; V_1= Total fluid input; UE_t = Urinary excretion in test group; UE_c=Urinary excretion in control group; DA_t= Diuretic action of the test sample; wDA_u=Diuretic action of the Urea.

than 0.72. The 400 mg/kg of ETPS showed good diuretic activity, while 200 mg/kg of dose showed moderate diuretic activity.

DISCUSSION

As the above study shows that ETPS increase in total urine output over a period of 5th h and 24th h. Therefore ETPS has been shown to possess significant diuretic, which may be one of the reasons of its therapeutic application in various ailments such as treatment of renal disorders, treatment of liver disorders, ulcers and pain in muscles. Diuretic activity may be very useful in a number of conditions like hypertension, hypercalciuria and cirrhosis of liver[9,10]. The diuretic activities of the extracts were highly potent when compared to control. However, there were significant differences in urinary excretion followed by diuretic action and diuretic activity.

At the 5th h and 24th h, the ETPS extracts showed change in urine output at both dose levels tested (200mg and 400mg/kg). The diuretic effect of the ethanol extracts was significant at 5th h and 24th h. However, there is a slightly delayed effect at 24th h. Even though, the diuretic activity at 24th h at both doses was significant. It showed the extracts acted in time and dose dependent manner which could have been as a result of absorption of the active principle(s) in the crude preparations or the extracts could have been stimulating *in vivo* a diuretic compound(s).

The 5th h and 24th h cumulative urine output induced by the extracts and standard drugs were statistically significant compared with control (saline treated). The high dose produced the highest urine volume output over the 5th h and 24th h period, and the low dose produced significant urine output excretion but it was less compare with furosemide and more or less similar to that of urea.

In conclusion, ethanol extract of *Pistia stratiotes* has good diuretic activity, in comparison with furosemide high ceiling diuretic agent. These findings substantiate the claim of traditional use of the plant as diuretics. It deserves further studies to identify its active components and investigate their mechanism(s) of action.

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