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Research Article

Evaluation of Diuretic Activity of *Xanthium strumarium L.*

[*]P. SRAVANI, [1]S. MOHANA LAKSHMI, [1]A. SARAVANA KUMAR.

[*, 1] Sree Vidyanikethan College of Pharmacy, Tirupathi, Andhra Pradesh, India-517102.

Abstract

Xanthium strumarium L. (Family: Compisitae) is a common weed found in India. The whole plant, especially root and fruit is used as medicine. According to Ayurveda, *Xanthium strumarium L.* is used as anthelmintic, antipyretic, epilepsy, diuretic. The present study was undertaken to investigate diuretic effect of petroleum ether extract of the *Xanthium strumarium* (PEXS) in albino rats. Acute oral toxicity study was performed as per OECD guidelines. In acute oral toxicity study, mortality was not observed up to 2000 mg/kg bodyweight. PEXS were administered at the doses of 250 and 500 mg/kg, p.o. Furosemide (500 mg/kg, p.o) was used as positive control in study. The diuretic effect of the extract was evaluated by measuring urine volume, sodium and potassium content. Urine volume is significantly increased at two doses of PEXS 250 & 500 mg/kg body wt in treated rats. The excretion of sodium, Potassium levels was also increased by the PEXS. The diuretic effect of the extract was similar to furosemide. The PEXS had the additional advantage of chloride conserving effect. This study concludes that PEXS produced notable diuretic effect which appeared to be comparable to that produced by the standard diuretic furosemide. The present study provides a quantitative basis for explaining the folkloric use of *Xanthium strumarium* as a diuretic agent.

Key words: *Xanthium strumarium*, Diuretic activity, urine output, Flame Photometry, diuretic index, lipschitz value.

INTRODUCTION

Diuretic compounds that stimulate the excretion of water are potentially useful in many disorders including most of those exhibiting oedema such as congestive heart diseases, nephritis, toxemia of pregnancy, premenstrual tension, hypertension. And also play an important role in hypertensive patients & pulmonary congestion [1]. Diuretics like mannitol, thiazides, frusemide, and ethacrinic acid are used in now days. Among these diuretics had some toxic effects. These synthetic diuretics typically inhibit potassium secretion and leads to potassium retention [2].

Plants may serve as the alternative sources for the development of new diuretic agents due to their biological activities. Several plants used for the treatment of diuresis in different systems of traditional medicine have shown diuretic activity when tested on animal models. *Xanthium Strumarium L.* compositae, is a common weed found in India. The whole plant, specially root and fruit, is used as medicine. According to ayurveda, *Xanthium Strumarium L.* is anthelmentic, antipyretic, epilepsy, diuretic, cooling laxative, fattening, alexiteric, and tonic, digestive and improves appetite, voice, complexion, and memory. It cures leucoderma, poisonous bites of insects, salivation and fever. Seed yields semi-drying edible oil (30-35%). Which resembles sun flower oil and used in bladder infection, herpes can be used as manure where shell can be used as activated carbon [3]. On the basis of the traditional use of the plant as a diuretic, but no previous pharmacological (or) clinical study was carried out to test the diuretic activity of this plant. Since the diuretic effect of xanthium strumarium has never been experimentally confirmed, the main aim of the present investigation was to evaluate the claimed diuretic activity of *Xanthium Strumarium L.* in rats

[*]**Corresponding Author P. Sravani** E mail: parukotisravani@gmail.com

MATERIALS AND METHODS

Plant material

The whole plant of *Xanthium strumarium L.* was collected from Thirupathi, Talakona, Tirumala, Andhra Pradesh, India. The whole plant were dried under shade, powdered and stored in an air tight container.

Preparation of extract

The collected whole plant was dried at room temperature, pulverized by a mechanical grinder, sieved through 40mesh. About 120g of powdered materials were extracted with petroleum ether (60°-80°C) using soxhlet apparatus. The extraction was carried out until the extractive becomes colourless. The extracts is then concentrated and dried under reduced pressure. The solvent free semisolid mass thus obtained is dissolved in normal saline and used for the experiment. The percentage yield of prepared extract was around 8.3%w/w.

Preliminary Phytochemical analysis

The petroleum ether extract of *Xanthium Strumarium L.* was subjected to qualitative analysis for the various phyto-constituents. Standard methods were used for preliminary qualitative phytochemical analysis of extract [4].

Animals

Wister albino rats weighing between 150-200gm each were used for this experiment. They were procured from Sree Vidyanikethan College of Pharmacy, Tirupati, India. The animals were kept under standard condition in an animal house approved by committee for the purpose of control and supervision of experiments on animals (CPCSEA). They were housed in polypropylene cages and maintained at 27±2^{o}C; The animals were given standard diet. Ethical committee clearance was obtained from IAEC (Institutional Animal Ethics Committee) of CPCSEA (Ref. No. /AEC/XIII/05/SVCP/2008-09.

Acute toxicity study

Acute toxicity study of pet.ether extract of *Xanthium Strumarium L.* was determined by acute toxic class method of OECD guidelines. In acute oral toxicity study mortality was not observed up to 2000mg/kg body weight [5].

Evaluation of diuretic activity

The methods of Lipschitz et al. (1943), Mukherjee et al. (1996) and Murugesan et al. (2000) [6,7,8] were followed for the evaluation of diuretic activity. They animals were divided into four groups. Group-I was received only with saline solution. i.e. Normal control. Group-II was received furosemide at a dose of 500 mg/kg, p.o. and it was considered as positive control group. Group-III & Group-IV received the PEXS, at doses of 250 and 500mg/kg, (p.o) respectively. Twenty–four hours prior to the experiment, the test animals were placed into metabolic cages with total withdrawal of food and water. After oral administration of PEXS, the urinary output of each group was recorded at different time intervals from the graduated urine chamber at metabolic cage. Urine samples were analyzed for Na^+ and K^+ concentration by flame photometric method.

Experimental design

Animals were deprived of food and water 18 h before the experiment. They were hydrated with 5ml/kg of water prior to drug/extract administration. Immediately after dosing, animals were placed in metabolic cages (2 in one cage), specially designed to separate urine and faeces. The urine was collected in measuring cylinder up to 5 h after dosing. During this period, animals were deprived of food and water. The parameters measured were total urine volume, urine concentration of Na^+, K^+ and Cl^-. Concentration of Na^+ and K^+ were determined using Flame photometer while Cl^- concentration was estimated titrimetrically using 0.02N $AgNO_3$ with 5% potassium chromate as indicator. Appearance of brick red precipitate was taken as the end point.

Statistical analysis

The data were expressed as Mean ± S.E.M. and statistically analyzed using one way ANOVA followed by Tukey-Kramer's Multiple comparison test, $p<0.05$ was considered significant.

RESULTS

Preliminary Phytochemical analysis

The petroleum ether extract of *Xanthium Strumarium L.* revealed the presence of steroids, Alkaloids, Reducing sugars, tannins, gums, flavonoids.

Table 1. Effect of *Xanthium Strumarium L.* on urine volume and electrolyte concentration

Group	Treatment	Mean urine volume (ml)	Electrolyte Na^+	Concentration (m eq/l) K^+	Na^+ / K^+ ratio	Diuretic index	Lipschitz value
I	Normal saline (5 ml/kg, p.o)	4.66±0.08	72.6 ± 0.17	512.25 ± 0.45	14.17	---	---
II	Furosemide (5mg/kg, p.o)	9.95 ±0.09**	173.36±0.27**	876.8 ± 2.94**	19.77	2.13	---
III	PEXS (250mg/kg, p.o)	6.65 ± 0.09*	81.866 ± 0.16*	533.17 ± 1.60	15.35	1.42	0.66
IV	PESX (500mg/kg, p.o)	8.68 ± 0.09**	104.28 ± 0.24**	633.85 ±1.0**	16.45	1.86	0.87

Values expressed as Mean ± S.E.M. One way ANOVA: $p<0.01$ (urine volume, electrolyte concentration) considered extremely significant. Tukey-Kramer's multiple comparison test *$p<0.05$, **$p<0.01$; when compared with the control group.

- Diuretic Index=Mean urine volume of test/Mean urine volume of control.
- Lipschitz value = Mean urine volume of test/Mean urine volume of standard.

DISCUSSION AND CONCLUSION

The diuretic activities of the extracts were significant ($P < 0.05$) when as compared to control. The graded doses of the PEXS in normal saline showed a very significant increase in diuresis, natriuresis, kaliuresis, GFR (Table 1). All the extracts cause increase urine elimination and increase in Na+, K+ and Cl+ excretion as compared to normal saline. The extracts possibly act by the synergistic action mechanism of the [HCO3 −/Cl−], [HCO3 +/H+] [9] exchangers and the [N+/H+] antiporter, to cause diuresis. There was an increase in the ratio of concentration of excreted sodium and potassium ions after PEXS treatment. This indicates that the extract increases sodium excretion to larger extent than potassium, which is a very quality of diuretic with lesser hyperkalaemic side effect.

The *Xanthium Strumarium L.* extract exerted its diuretic activity possibly by inhibiting tubular reabsorption of water and accompanying anions, as such action has been hypothesized for some other plant species [10]. Therefore *Xanthium Strumarium L.* extract significantly increased the GFR due to (a) A detergent like interaction with structural components of glomeruluar membranes. (b) A decrease in renal perfusion pressure, attributable to decrease in the resistance of the afferent arteriole and/or an increase in the resistance of the efferent arteriole and/or. (c) The direct effect on the arteriole wall affecting glomerular blood flow [11].

As emphasized, diuretic properties of PEXS could be due to other active principles such as flavonoids, saponins, and organic acids [12]. It is also possible that diuretic effect of the water PEXS could be due to other secondary active(s) metabolites(s) [13]. The other possibility for the observed diuretic effect of PEXS water could be due to indirect changes of some physiological parameters before blood filtration step [14] and/or the consequence of the observed glycosuria [15].

The observed decrease of urine osmolality could be explained by a marked increase in urinary flow, which seemed to be more important than the possible urinary electrolytes excretion. Administration of the PEXS caused a diuretic response, which was accompanied with a slight increase in GFR. This finding suggests different mechanisms of action, like a direct effect on arterial pressure which could affect GFR or glomerular blood flow (10) or by decreasing renal perfusion pressure [16,14].

PEXS caused diuresis by a mechanism quantitatively similar to that of furosemide and more than one mechanism seems to be involved. The PEXS did not affect plasma urea levels, urine pH, plasma osmolarity and hematocrite indicating that the rapid physiological regulation of these important parameters was not altered after RR infusion.

On basis of the above results, we can conclude that PEXS treatment produced a marked diuresis when rats were acutely treated. In our study, no lethality was observed at least for the dose and duration used. However, advanced toxicological studies remain to be performed in mice and rats. It remains necessary to study eventual adverse effect(s) of this plant such as alteration of some neural, metabolic and hormonal parameters, which are undetermined in this study, before its recommendation to clinical use. The precise site(s) and the molecular and cellular mechanism(s) of PEXS action remain to be elucidated in further studies.

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