



Anti-Edema Activity of *Sida rhombifolia* in Albino Wistar Rats

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ABSTRACT

Diuretics increase the excretion of water from bodied which induce negative fluid balance and are useful in the treatment of diseases like edema and hypertension. In the present study “Anti-edema activity of ethanolic extract of *Sida rhombifolia* linn was assessed for diuretic activity of in male albino rats. Preliminary phytochemical studies carried out in the selected *S. rhombifolia* plant extract which indicated the presence of flavonoids, saponins, carotinoids, glycosides, tannins, phenols and carbohydrates. Acute toxicity studies of the ethanolic extract of the *S. rhombifolia* did not show any signs of harmfulness up to 2 g/kg body weight. Since there was no mortality, morbidity observed at a higher level dose. In this study 100 and 200 mg/kg doses were selected for assessment of diuretic activity. The diuretic activity of the extract was done by quantification of urine volume and electrolyte concentration. Different doses *S. rhombifolia* (100 mg/kg and 200 mg/kg) were administered orally to hydrated rats and the urine output was measured every hour, up to 3 hours. Furosemide (20 mg/kg) was used as standard drug, while normal saline (10ml/kg) was used as control. The treatment of *S. rhombifolia* at varying doses (100 mg/kg and 200 mg/kg) significantly ($P > 0.001$) increases the urine output (5.25ml, 11.13ml) and the excretion of Na^+ (301.16 PPM, 371.49 PPM). Likewise, a potassium-sparing effect at 24.06 PPM and 22.08 PPM was observed. Based on the remarks, the study can be concluded that *S. rhombifolia* extracts has diuretic property in a dose-dependent manner.

Keywords: Diuretics, *S. rhombifolia*, Glycosides, Tannins, Furosemide mortality, Morbidity.

INTRODUCTION

Diuretics are drugs which are used clinically by increase the flow of urine. These drugs are extensively used in the controlling of secondary type of hypertension, electrolytic balance and relief of edema in the human biological system. In this association excretion of sodium ions are used to maintain the blood

volume and composition of body fluids in varies kind of clinical conditions (Kakjing, et al., 2012). In clinically, diuretics are used to treat heart diseases, liver cirrhosis, hypertension, influenza viral infection, water poisoning, and certain kidney diseases.

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Some of the diuretics, such as acetazolamide, help to make the urine more alkaline medium and are helpful in increasing excretion of substances such as aspirin in cases of overdose or in poisoning conditions (Shaukat Shah, et al., 1978 & Ballew & Fink, 2001). Diuretics are sometimes abused by people with an eating disorder, especially people with bulimia nervosa, with the goal of losing weight. Many of the presently available diuretic remedies may lead the adverse effects such as impotence, muscle fatigue, ionic imbalance and weakness. In other way naturally available diuretics consist of caffeine in coffee, theophylline from tea which are prevent Na + reabsorption and alcohol in beer, wine prevent secretion of ADH level from the posterior pituitary gland (Rieg, et al., 2005). While almost all kind of the diuretics exhibited to be very effective in stimulating sodium excretion through urine, all these cause potassium loss and stimulated the search for potassium sparing diuretic. Henceforth we search for a new nontoxic diuretic agent that preserves therapeutic efficacy and however lacking of potassium loss in extracellular fluid is justified (Richard & Tannen, 1985 & Smellie & Heald, 2007). Phytotherapeutic preparations are cure about 80% population who is unable to get access to manufactured drugs and also it does not produce any harmful effects with therapeutic doses. Among the important diseases, hypertension plays a key role due to its impact on survival. Many control systems can be modulated by plant metabolites (Yuan et al., 2016).

Sida rhombifolia (https://en.wikipedia.org/wiki/Sida_rhombifolia) is commonly known as arrow leaf sida, it is a perennial or sometimes annual plant in the Family of Malvaceae, It is used in Ayurveda medicine, where it is recognized as kurumthotti. The stems are erect to sprawling and branched, growing 50 to 120 centimeters in height, with the lower sections being woody. The dark green, diamond-shaped leaves are arranged alternately along the stem, 4 to 8 centimeters long, with petioles that are less than a third of the length of the leaves. The leaves are paler below, with short, grayish hairs. The apical half of the leaves has toothed

or serrated margins while the remainder of the leaves is entire. The petioles have small spiny stipules at their bases. The moderately delicate flowers occur singly on flower stalks that arise from the area between the stems and leaf petioles. They consist of five petals that are 4 to 8 millimeters long, creamy to orange-yellow in color, and may be somewhat reddish in the center. Each of the five overlapping petals is asymmetric, having a long lobe on one side. The fruit is a ribbed capsule, which breaks up into 8 to 10 segments. The plant blooms throughout the year. Arrow leaf *sida* has significant medicinal applications for which it is cultivated throughout India. The crushed leaves are used to relieve swelling, the fruits are used to relieve headache, the mucilage is used as an emollient, and the root is used to treat rheumatism (John, 2001). Conversely, no more scientific diuretic studies carried out with *S. rhombifolia* in order to confirm its predictable beneficial possessions of the selected plant. Subsequently, the present study was assumed to corroborate the effectiveness of the extract of the *S. rhombifolia* as diuretic drug in experimental rats' model.

MATERIALS AND METHODS

Drugs and Chemicals

LASIX (Furosemide Sanofi Aventis), ethanol were used in this study. All substances were prepared immediately before use and the reagents were used as analytical grade.

Plant Materials

The leaves of *Sida rhombifolia* used in this study were collected from Vadakkangulam, Kavalkinaru (Tirunelveli District, Tamil Nadu, India). The plant was authenticated by Dr. Stephen, Department of Botany, American College, Madurai, Tamil Nadu.

Extract preparation

The freshly collected *S. rhombifolia* leaves were shade dried and coarsely powdered. The powdered materials were extracted with ethanol. The last traces of the solvent were removed and concentrated to dryness under vacuum using a rotary evaporator. The dried extract was weighed and then kept at -4°C until ready for use. The yield of the extract was 35.8 % (w/w). In each experiment, the

extract was diluted with water to desired concentration.

Animals

Adult male albino rat weighing about 200-250g were used in this study. They were maintained in clean, sterile, polypropylene cages and fed with commercial pellet rat chow (M/S Hindustan lever limited, Bangalore, India) and water ad libitum. The study was approved by the Institutional Ethical Committee (SARPC/IAEC/005/18-19), which follows the guidelines of Committee for the Purpose of Control and Supervision of Experimental Animals (CPSCEA).

Phytochemical screening

A Preliminary phytochemical screening of *S. rhombifolia* was conducted to determine the presence or absence of alkaloids, tannins, phenols, saponins, volatile oil, ascorbic acid, carbohydrates and glycosides by Wagner test, Braemer's test, Frothing test, Molisch's test and Borntrager's test (Morton Guava. In: & Morton, 1987).

DIURETIC ACTIVITY

Male albino rats weighing about 150-250gm were divided in to four groups of five animals each. The dosages of drugs were administered to the different groups.

Group I : Control (Normal saline 10ml/kg) for 7 days.

Group II : Frusemide (20 mg/kg, p.o.) for 7 days.

Group III : Received *S. rhombifolia* at the dose of 100mg/kg orally for 7 days.

Group IV : Received *S. rhombifolia* at the dose of 200mg/kg orally for 7 days.

Evaluation of diuretic activity

The method (Lipschitz et al., 1943) of with modification was employed for the assessment

of diuretic activity. According to this method, the animals were deprived of food and water for 18 hours prior to the experiment and each animal is placed in an individual metabolic cage 24h prior to commencement of the study for adaptation. In this study animals were divided into four groups of five animals each. Group I animals were received normal saline (10 ml/kg, p.o.) for 7 days Group II animals were received the standard diuretic, Frusemide (20 mg/kg, p.o.) for 7 days and group 3&4 animals were received alcoholic extracts of *S. rhombifolia*, 100,200 mg/kg body weight for 7 days respectively. On seventh day, immediately after administration of the extracts, Frusemide the rats were paired and placed in metabolic cages. Urine was recollected in a graduated cylindrical tube and its volume was recorded at 1-h intervals for 3h. Finally the Electrolytes (Na⁺, K⁺) concentrations and pH were estimated from pooled urine sample of each pair of rat at the end of the experiment, 3h after administration.

Analytical method (Robert, 2011)

Na⁺ and K⁺ concentrations were measured by flame photometer. The instrument was calibrated with standard solution containing different concentrations of Na⁺ and K⁺. P^H was directly determined on fresh urine samples using a pH meter, urine volume measured with a micropipette.

RESULTS

Preliminary photochemical screening

The phytoconstituents were identified by chemical tests, which showed the presence of various phytoconstituents in 50% ethanolic extract of *S. rhombifolia* presented in Table no.1.

Table 1: Phytochemical screening of the extracts of *S. rhombifolia*

S. No.	Phytoconstituents	<i>S. rhombifolia</i>
1	Glycoside	+
2	Carbohydrates	+
3	Flavonoids	+
4	Protein	+
5	Alkaloids	+
6	Tannins	+
7	Saponin	+

Diuretic activity of the alcoholic extract of *S. rhombifolia*

The result of diuretic activity of the alcoholic extract of *S. rhombifolia* at 100, 200 mg/kg showed that a dose dependent increase of urinary water excretion slightly modified the urinary pH and electrolytes concentration in normal rats. The results of 200mg/kg treated

group showed significant change in electrolytes concentration and urine volume ($P \leq 0.001$) compared with control group. In the present study, alcoholic extract treated groups at different doses (100mg/kg and 200mg/kg) showed significant effect on urinary potassium and sodium ion concentration. The values were presented in table 2&3.

Table 2: Effects of oral administration of *S. rhombifolia* on Urinary volume excretion

Groups	Dose	Volume of urine(ml/3h)	Diuretic index
Normal saline	10ml/kg	02.4±0.12	-
Frusemide	20 mg/kg	15.6±0.53	5.50
<i>S. rhombifolia</i>	100 mg/kg	5.25±0.32	1.187
<i>S. rhombifolia</i>	200mg/kg	11.13±0.48	3.637

Results are expressed as mean ± SEM from five observations as compared to Control group the two-tailed paired *t* test. Graph Pad's

software method, (** $P < 0.001$) by conventional criteria; this difference is considered to be statistically significant.

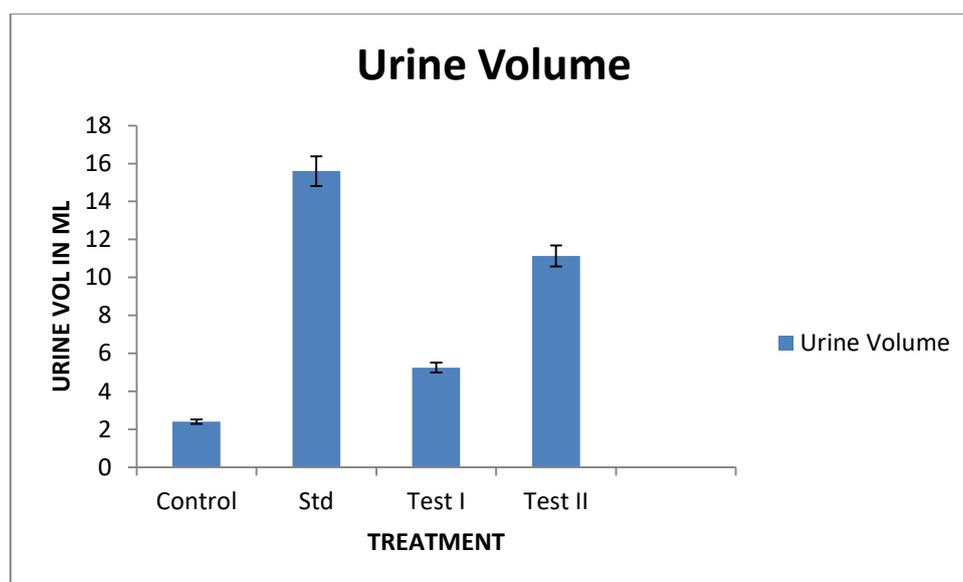


Fig. 1: Treatment Vs volume of Urine excretion in *S. rhombifolia* treated rats. The result of diuretic activity of the alcoholic extract of *S. rhombifolia* at 100, 200 mg/kg showed that a dose dependent increase of urinary water excretion.

Table 3: Effects of oral administration of *S. rhombifolia* on urinary electrolytic excretion in rats

Groups	Dose	Electrolyte Concentration in PPM		pH	Saluretic index	
		Na+	K+		Na+	K+
Normal saline	10ml/kg	242.71±0.53	28.85±0.76	6.13	-	-
Frusemide	20 mg/kg	390.83±2.45**	25.03±0.86**	7.54	0.610	0.132
<i>S. rhombifolia</i>	100 mg/kg	301.16±2.04	24.06±0.92	6.12	0.240	0.166
<i>S. rhombifolia</i>	200mg/kg	371.49±1.67**	22.08±1.29**	7.64	0.530	0.234

Results are expressed as mean ± SEM from five observations as compared to Control group the two-tailed paired *t* test. Graph Pad's software method, (** $P < 0.05$) this difference is considered to be statistically significant.

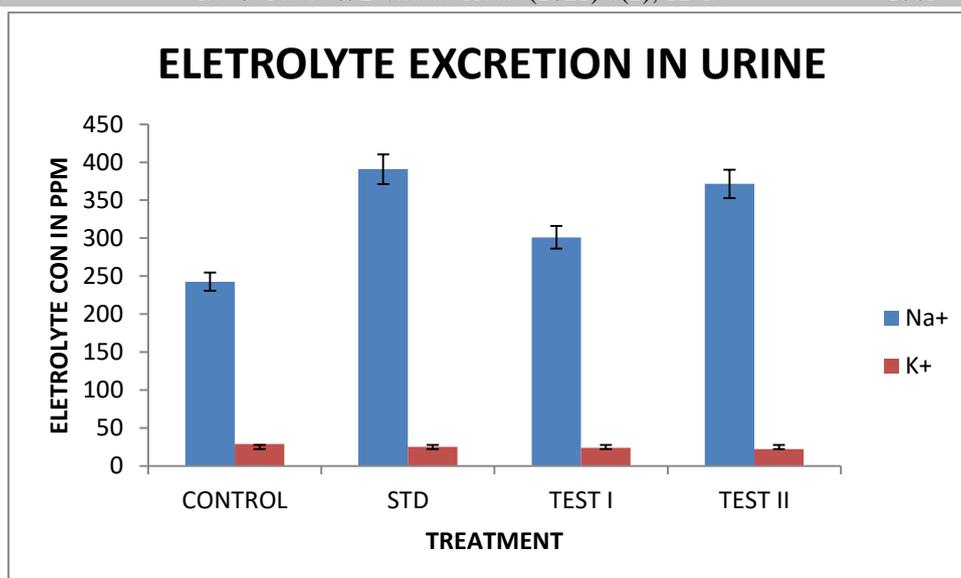


Fig. 2: Treatment Vs Electrolyte Concentration in PPM in *S. rhombifolia* treated rats. The result of diuretic activity of the alcoholic extract of *S. rhombifolia* at 100, 200 mg/kg showed that a dose dependent electrolytes concentration in normal rats.

DISCUSSION

Diuretics are drugs that increase the rate of urine flow; on the other hand, clinically helpful diuretics also increase the rate of excretion of Na⁺ (natriuresis) and of an associated anion, generally Cl⁻. NaCl in the body is the most important determinant of extracellular fluid volume, and most clinical applications of diuretics are intended for toward reducing extracellular fluid volume by decreasing total-body NaCl content (Rang et al., 2004). A sustained imbalance between dietary Na⁺ intake and Na⁺ loss is incompatible with life. A sustained positive Na⁺ balance would consequence in volume overload with pulmonary edema, and a sustained negative Na⁺ balance would result in volume reduction and cardiovascular collapse.

In the present study, alcoholic extract treated groups at different doses (100mg/kg and 200mg/kg) showed significant effect on urinary potassium and sodium ion concentration. Preliminary phytochemical studies revealed that ethanol extract of the leaves of *S. rhombifolia* contains several phyto compounds like alkaloids, proteins, saponin and flavonoids that could be partially or fully responsible for the increase of urinary excretion (diuresis) and moderate natriuretic activity in rats (Kokate & Gokhale, 1996 & Jeffery et al., 1989). Results of the study indicated an increase and quickening of the

elimination of fluid excess with urinary hypo osmolality and a moderate increase in natriuretic activity by dose dependent manner (Ntchapda, 2014). These results exhibit that the ethanol extract of the leaves of *S. rhombifolia* has a sensible diuretic activity. The increase of natriuresis in response to acute treatment by ethanol extract of leaves of *S. rhombifolia* may partially explain the increase in urine output in rats.

The investigation of the present study confirmed that the leaf extract of *S. rhombifolia* exhibited diuretic effects against experimentally induced animal models. Further studies will be required to get more information about the potential diuretic value of this *S. rhombifolia* plant, and to assess the effects of long-term administration on diuretic.

CONCLUSION

In conclusion, the oral administration of a (100,200mg/ kg) dose of the ethanol extract of the leaves of *S. rhombifolia* increased significantly in 03 h urine volume after treatment. In addition, treatment with the extract of the leaves of *S. rhombifolia* increased, in a dose dependent manner, the excretion of Na⁺, K⁺, Subsequently the results revealed above, it can be concluded that the ethanol extract of *S. rhombifolia* having significant diuretic activity by increasing the total urine volume output, increased excretion

of sodium with sparing of potassium levels when compared with control group animals.

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