

Evaluation of diuretic activity of hydroalcoholic extract of whole plant *Mimosa pudica*

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Introduction: Diuretics are required for various pathological conditions with fluid overload. Our study has evaluated the diuretic activity of hydroalcoholic extract of whole plant *Mimosa pudica* (HAEWMP) as an alternative/new drug which may induce diuresis. Materials and Methods: HAEWMP was prepared using Soxhlet's apparatus. Albino rats were divided into 5 groups of 6 rats each. Group-I (Control) received distilled water 25ml/kg orally. Group-II (Standard) received Hydrochlorothiazide 2.5 mg/kg orally, Group-III, IV and V 200 mg/kg, 400 mg/kg and 800 mg/kg. The urine samples were collected for all the groups at 5 and 24 hours and urine volume were measured. The urinary excretion percentage, diuretic activity and electrolytes (Na⁺, K⁺) were estimated. Results: HAEWMP exhibited significant dose dependent diuretic activity by increasing urine volume and also by enhancing elimination of Sodium (Na⁺), Potassium (K⁺). The diuretic activity of 200mg/kg and 400mg/kg was moderate and that of 800mg/kg was good. Conclusion: HAEWMP possesses significant diuretic activity and has a beneficial role in volume overload condition

Keywords: Diuretic, hydroalcoholic extract, *Mimosa pudica*, albino rat

Introduction

Diuretics are among the most widely prescribed drugs. They are drugs that increase the salt and water excretion from our body. These group of drugs have varying efficacy and have been used for various conditions like the treatment of renal, hepatic and cerebral oedema, hypertension, congestive cardiac failure.¹ While the high efficacy diuretics like furosemide act on the thin ascending limb of loop of Henle, the medium efficacy diuretics like hydrochlorothiazide act on the distal convoluted tubule. The weak diuretics like acetazolamide act on the proximal convoluted tubule by inhibiting the carbonic anhydrase enzyme whereas the epithelial sodium channel inhibitors as well as aldosterone antagonist act on the collecting duct. Mannitol which is again a weak diuretic can act by extracting water from the nephron.¹

A lot of plants have been evaluated for diuretic activity which has been confirmed in experimental animal.² The common species which have been proven with diuretic activity includes *Mangifera indica*, *Lepidium sativum*, *Achyranthes aspera*, *Euphorbia thymifolia*, *Bixa orellana*, *Taraxacum officinale*, *Allium sativum*, *Urtica dioica*, *Tribulus terrestris*, *Imperata cylindrica*, *Olea europaea*, *Phyllanthus amarus*, *Phyllanthus corcovadensis* and *Phyllanthus sellowianus*, *Equisetum bogotense*, *Equisetum fluviatile* and *Aerva lanata*.²

Mimosa pudica which is a perennial herb belongs to Fabaceae family.³ *Mimosa pudica* is a sensitive sleepy plant whose compound leaves fold in and droop on touch so as to protect from predators, reopening minutes later.² The scientific name is derived from Greek *Mimos* means a mimic which alludes to the sensitivity of the leaves and Latin *pudica*, means bashful, retiring, or shrinking.⁴ Studies have shown that *M. pudica* contains metabolites such as phenols and flavonoid compounds which possess various pharmacological properties.³ The phytochemical studies had revealed the presence of alkaloids such as mimosine, crocetin, tubulin, turgorines, flavonoids, tannin, and sitisine.^{4,5} Some studies have demonstrated that there is presence of both antioxidants and nitrites in *Mimosa pudica*

extract which have blood pressure lowering properties thus helping in maintenance of vascular health.⁶This study was done to determine the diuretic activity by observing the effect of hydroalcoholic extract of *Mimosa pudica* whole plant on water and electrolytes in urine of male albino rats.

MATERIALS AND METHODS

Plant material

The whole plant of *Mimosa pudica* was collected locally and was authenticated by the Central Pharmacognosy unit, Ayurveda Research Institute, Poojappura, Thiruvananthapuram. The fresh whole plants of *Mimosa pudica* was washed thoroughly in water to remove soil material. It was then cut into small pieces and shade dried.

Animals

Wistar strain albino male rats (150-200grams) were used. The animals were housed under standard laboratory conditions in the animal house of Trivandrum Medical College. The animals were fed standard pellet diet, maintained on a natural light and dark cycle and had free access to food and water. They were acclimatized to laboratory conditions before the tests. The experimental protocols were approved by the Institutional Animal Ethics Committee and ethical guidelines were followed throughout the study.

Drugs and Chemicals

Hydride tablet (Hydrochlorothiazide – 25 mg) of Micro Labs was used as standard for studying diuretic activity.

PREPARATION OF EXTRACT

Extract was prepared as per the method of Rosenthaler using Soxhlet apparatus. The solvent used was 50% water and 50% alcohol. About 2.4 kg of the plant yielded about 32.3 g of a sticky semisolid mass which was dark green in colour with a pungent odour. The hydroalcoholic extract of whole plant *Mimosa pudica*(HAEWMP) was stored in a refrigerator.

Diuretic action of *mimosa pudica* was investigated in male albino rats using the method of Lipschitz et al which was modified by Kau et al.^{6,7} Kau et al. recommended a method for screening diuretic agents in the rat using normal saline (4% body weight) as the hydrating fluid.⁷ Thirty animals weighing 100- 200 g were selected. They were weighed and divided into five groups each containing six rats. Three animals per group are placed in metabolic cages provided with a wire mesh bottom and a funnel to collect the urine. Stainless-steel sieves are placed in the funnel to retain faeces and to allow the urine to pass. The rats are fed with standard diet and water ad libitum. Fifteen hours prior to the experiment food and water are withdrawn. Three animals are placed in one metabolic cage.

For screening procedures two groups of three animals are used for one dose of the test compound. The control group received 25 ml/ kg each of 0.9% NaCl orally. Another group was given hydrochlorothiazide 2.5 mg/kg orally dissolved in isotonic normal saline as standard drug. The rats in the other three groups were given HAEWMP orally in the doses 200 mg/kg, 400 mg/kg and 800 mg/kg each. The drug was diluted in normal saline and administered in a constant volume of 25 ml/kg irrespective of dose levels. Urine excretion is recorded after 5 and after 24 hours. The sodium and potassium content of the collected urine is determined by flame photometry. Urinary excretion percentage and diuretic activity was calculated for all groups and compared.

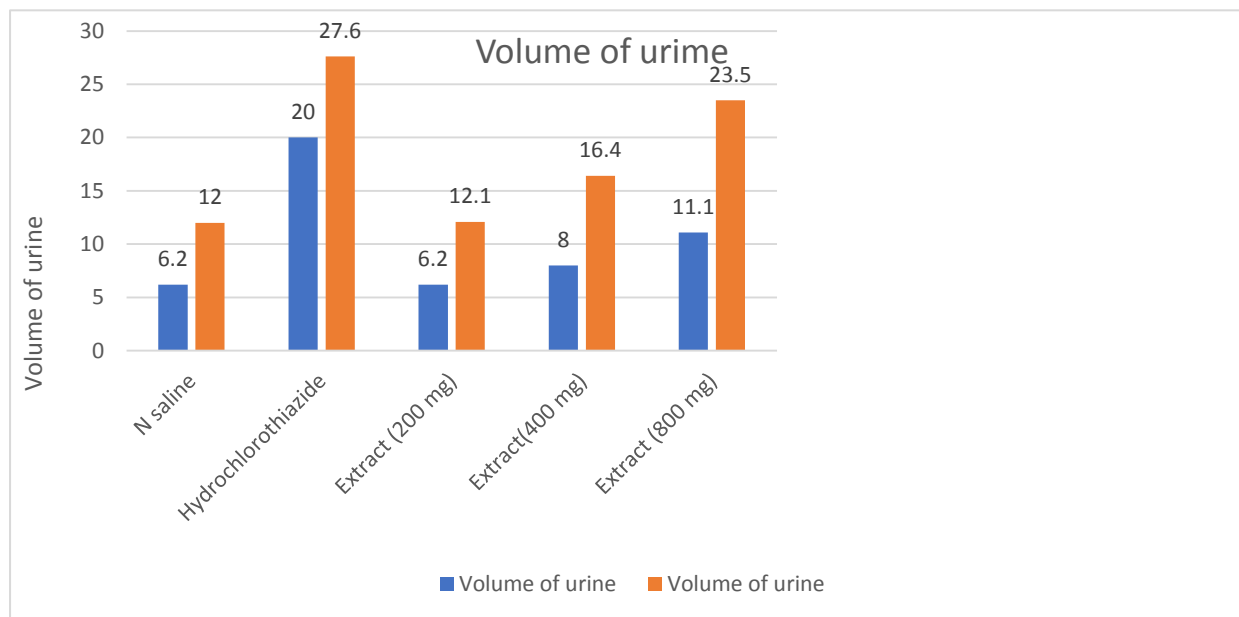
$$\text{Urinary excretion percentage} = \frac{\text{Volume of urine collected in hours}}{\text{Volume of fluid administered}} \times 100$$

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

Results

Diuretic activity was studied in male albino rats. 5 groups of six rats each were selected for the study. The following parameters were studied for assessing diuretic activity-Urinary volume at 5h and 24 h, urinary excretion percentage, diuretic activity and urinary electrolytes. Urine was collected from the metabolic cages at the end of 5 hours and 24 hours and measured.

As shown in Figure 1, there was a dose dependent increase in urine volume, from 12.1 ml at 200 mg/kg to a maximum of 23.5 ml at 800 mg/kg. But it was less than that of the standard drug, hydrochlorothiazide, which produced an excretion of 27.5 ml.



activity which was evident after 5 hours with a dose of 400 mg/kg which keeps on increasing with time and dose. However, these effects were less than that of the standard drug hydrochlorothiazide.

Table 1: Effect of *Mimosa pudica* on urinary excretion percentage on diuretic activity

Drug	Dose	Number	Urinary excretion percentage		diuretic activity	
			at 5 h	at 24 h	at 5 h	at 24 h
Normal saline	25 ml/kg	6	20.67	40	-	-
Hydrochlorothiazide	2.5 mg/kg	6	72.7	100.36	3.23	2.3
HAEWMP	200 mg/kg	6	24	48.4	1	1.008
	400 mg/kg	6	26.67	54.67	1.29	1.367
	800 mg/kg	6	40.36	85.45	1.79	1.958

Urinary sodium and potassium excretion composition were also analysed. As shown in Table 2, the electrolyte excretion was increased with increasing doses of the HAEWMP. Though there was an increase in potassium excretion with increasing doses of the HAEWMP, it was not much that of the standard drug. At the dose of 800 mg / kg, the HAEWMP caused sodium excretion more than that of the standard drug. Maximum diuretic and natriuretic activity were observed at the dose of 800 mg / kg.

Drug	Dose	Number	Sodium (mmol/L)	Potassium (mmol/L)
Normal saline	25 ml/kg	6	190	120
Hydrochlorothiazide	2.5 mg/kg	6	230	249
HAEWMP	200 mg/kg	6	194	128
	400 mg/kg	6	219	157
	800 mg/kg	6	248	177

Discussion

Diuretics are drugs which can increase urine output and produce changes in electrolyte composition of the body. They relieve pulmonary congestion and peripheral oedema, reducing the volume overload and offer symptomatic relief of orthopnoea and paroxysmal nocturnal dyspnoea. They decrease plasma volume and subsequently venous return to heart. This decreases cardiac work, oxygen demand and plasma volume and thus decreases blood pressure. We observed the diuretic activity of hydroalcoholic extract of *Mimosa pudica* in male wistar rats. On using three doses of HAEWMPs we found that there was a dose dependent increase in urine volume. The urinary excretion percentage was 85.45 and the diuretic activity was 1.95 times as compared to control at 24 hours with 800mg/kg. There was an increase in urinary sodium and potassium levels, with more natriuresis as compared to kaliuresis. At the dose of 800 mg / kg, the HAEWMP caused sodium excretion more than that of the standard drug. Maximum diuretic and natriuretic activity were observed at the dose of 800 mg / kg. Active phyto-principles such as flavonoids, saponins and terpenoids are known to be responsible for diuretic activity. The presence of these active principles in *Mimosa pudica* may be responsible for its diuretic activity. According to Hailu et al, diuretic activity is considered “nil”, “little”, “moderate”, and “good”, if the values were <0.72, 0.72–1.00, 1.00–1.5, and >1.5.⁸ Hence the hydroalcoholic extract at 200 and 400 mg/kg showed moderate diuretic activity whereas that at a dose of 800mg/kg showed good diuretic activity.

A study done by Baghel et al. evaluated the diuretic property of ethanolic as well as aqueous extract of *M.pudica* at 100mg/kg and 200mg/kg with Furosemide.⁹ They found that even though the ethanolic as well as aqueous extract did not demonstrate a diuretic activity at 100mg/kg it was shown at 200mg/kg.⁹ The aqueous extract of *M. pudica* leaves at 100 mg/kg showed significant diuretic activity with increased electrolytes excretion ($P<0.01$ for urine output, $P<0.01$ for Cl^- , $P<0.05$ for K^+ and $P<0.01$ for Na^+). They also demonstrated that increasing the dose of the test drug, however, did not bring about increase in diuretic property.¹¹ *M. pudica* leaves decoction in doses of 200, 500, 1000, and 2000 mg/kg in rats and dogs exhibited diuretic activity when evaluated by Ahmad et al.¹² 250 mg/kg dose produced 82% activity as compared to standard diuretic (hydrochlorothiazide 2.5 mg/kg) in rats. They also found that was significant natriuresis without kaliureis and hence may be combined with a moderate diuretic causing K^+ loss. Kalabharathi et al., found a dose dependent outflow at 100 mg/kg of ethanolic root extract of mimosa, however the results were not significant when the dose was increased to 400 mg/kg.¹³

Mimosa pudica extracts in different forms and different parts of the plants have demonstrated wound healing activity, antiulcer and hepatoprotective properties, antiophidian properties, antifertility property, hyperglycaemic effect, antidepressant and anxiolytic activity, anticonvulsant, antimicrobial activities.¹⁴⁻²¹

Conclusion

The hydroalcoholic extract of *Mimosa pudica* exhibited dose dependent diuretic activity by increasing urine volume. The diuretic activity of 200mg/kg and 400mg/kg was moderate and that of 800mg/kg was good. There was good natriuretic activity as compared to kaliureis. It has as a beneficial role in volume overload conditions.

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