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Diuretic effect of methanolic extract of *Musa paradisiaca* L root in rats

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ABSTRACT

Methanolic extracts of root stocks of *Musa paradisiaca* L (MEMP) was evaluated for its diuretic activity using modified method of Rao. The animals were grouped into different groups of six animals each. All the animals received priming dose of 0.9% sodium chloride solution (20 ml/kg body weight p.o.). The first group of animals, served as control, received normal saline (20 ml/kg body weight p.o.); the second group received the standard drug furosemide (10 mg/kg body weight p.o.) in 0.9% sodium chloride solution and The other two groups received (MEMP) in a dose of 500 & 250 mg/kg body weight suspended in 0.9% sodium chloride solution (p.o.). The urine volume was recorded for all the groups for 5h. and electrolyte concentration (Na⁺, K⁺ and Cl⁻) were measured. The extracts showed increase in total urine volume and electrolytes excretion (sodium Na⁺, potassium K⁺ and chloride Cl⁻). the metanol extract (500 mg/kg) significantly and markedly increased the urine output ($p < 0.01$). The pattern of diuresis induced by the methanol extract was almost similar to that produced by the furosemide. These findings suggest the possible traditional use of this plant as diuretics.

INTRODUCTION

Diuretic agents have very wide application in the treatment of various chronically diseases associated with edema. They are generally prescribed for the treatment of hypertension, congestive heart failure, glaucoma, diabetes insipidus and liver ailments. The modern era of diuretic therapy began in 1949 when sulphanilamide was discovered to possess diuretic and natriuretic properties.[1] *Musa paradisiaca* (M. paradisiaca) L. (Family: Musaceae), commonly known as "plantain" is a perennial tree-like herb widely distributed in the Tropics. Due to the enriched food value and versatile medicinal value, it is one of the most important fruits and vegetable crops of several countries. Fruits, leaves, peels, root and stalks from plantain plants have been used orally or topically as a medicine for treating diarrhoea and dysentery [2] in healing of intestinal lesions in colitis [3] antilithic [4] inflammation, pains and snakebite [5], antiulcerogenic [6] hypoglycaemic activity [7], hypolipidemic and antioxidant activity [8]. A constituent hydroxyanigofurone obtained from *Musa paradisiaca* shown to be potential chemopreventive agent against cancer. However, no systematic pharmacological studies have

been carried out in order to confirm its diuretic activity. Hence, in the present study diuretic activity of alcohol extracts of *root stock* of *Musa paradisiaca L* was investigated to justify the rationale behind using this plant as diuretic in hypertension. The present investigation was undertaken to confirm traditional medicinal use of the plant.

MATERIALS AND METHODS

Plant Material

Root stock of *Musa paradisiaca L* (Family: Musaceae), was collected from local areas of Wagholi, Pune (India) and authenticated by Indian Botanical Survey of India, Pune and voucher specimen has been deposited at the herbarium of Charak College of Pharmacy & Research, Wagholi, Pune, for further reference.

Processing of plant material [9]

The root stock was chopped in small pieces and dried under shade. They finally powdered and passed through 40-mesh sieve. The powder (500gm) was extracted by soxhlet apparatus using methanol. Appearance of colourless solvent in the siphon tube was taken as the end point of extraction. The extracts were concentrated to $\frac{3}{4}$ of its original volume by distillation. The extract was concentrated to $\frac{3}{4}$ of its original volume by rotary evaporator. The concentrated extracts were taken in a china dish and evaporated on a thermostat controlled water bath till it forms a thick paste and dried over a desicator. The yield was 11.40% w/w, alcohol.

Drugs and chemicals

All the drugs, chemicals, and reagents were procured from S.D. Fine Chemicals, (Mumbai, India). All the chemicals were of analytical grade.

Acute toxicity studies

Healthy female swiss albino mice of either sex weighing 18-22 gm, maintained under controlled conditions of temperature (20 –22⁰C) and humidity (55%) were used for toxicity study as per Up & Down or Staircase method.[10] The maximum no-lethal and the minimum lethal dose was thus determined using only about 10 mice, once the approximate LD₅₀ or the range between the maximum non-lethal and minimum lethal dose is found, a final and more reliable LD₅₀ assay is planned using at least 3 or 4 dose levels within this range with longer number of animals in each group. LD₅₀ is expressed in term of mg/kg. The maximum no-lethal dose was found to be 5000 mg/kg body weight; hence 1/10th of the dose was taken as effective dose (500mg/kg body weight) MEMP for diuretic activity.

Evaluation of diuretic activity

Animal:

Albino Wistar male rats (200-250g) procured from National Institute of Biosciences, Pune (Maharashtra). They were housed in standard conditions(room temperature 22±2⁰C, humidity 55% RH) for one week to acclimatize to laboratory conditions before starting the experiment; they were given free access to water and standard rat feed but 18h prior to the experiment, the rats were deprived of food but water ad libitum.

Diuretic activity

The modified method of Rao was employed for the assessment of diuretic activity.^[10] Male healthy Wistar albino rats (200-250g) were divided into different groups of six animals each. All the animals received priming dose of 0.9% sodium chloride solution (20 ml/kg body weight p.o.). The first group received vehicle saline (20 ml/kg body weight p.o.), served as control; the

second group received the standard drug furosemide (10 mg/kg body weight p.o.), served as standard. The other two group received MEMP (500 & 250 mg/kg body weight p.o.), suspended in normal saline. After oral administration, each animal was placed in an individual metabolic cage specially designed to separate faeces and urine at room temperature. The volume of urine collected was measured at the end of 5 hr and the total urine volume and concentrations of Na⁺, K⁺ and Cl⁻ in the urine were determined. The concentration of the electrolytes in urine were expressed in terms of mmol/L.

Statistical analysis

The values were expressed as mean \pm SEM. The results were analyzed by using ANOVA followed by Dunnett's t-test. Statistical significance on comparison with standard drug and control groups, p values less than 0.05 were considered as significant.

Table1. Effect of *Musa paradisiaca* L. in urine excretion of rats.

Groups	Dose	Total Urine volume(ml)	% change in Urine excretion	Na ⁺ (mmol/L)	% change in Na ⁺ excretion	K ⁺ (mmol/L)	% change in K ⁺ excretion	Cl (mmol/L)	% change in Cl ⁻ excretion	Na ⁺ /K ⁺
Control	20 ml/kg	5.1 \pm 0.46	100	80.35 \pm 3.69	100	46 \pm 2.91	100	106.77 \pm 6.63	100	1.75
Standard	10mg/kg	13.0 \pm 0.86**	254	123.84 \pm 4.67**	154.13	88 \pm 4.76**	191.30	146 \pm 6.16**	136.74	1.41
MEMP	250 mg/kg	6.5 \pm 0.43 *	127.45	102.59 \pm 6.21 *	127.68	67.20 \pm 5.65 *	146.09	136 \pm 6.34 *	127.38	1.53
MEMP	500mg/kg	10.9 \pm 0.78**	213.73	107.88 \pm 4.47**	134.26	80.85 \pm 5.45**	175.76	128.32 \pm 4.53**	120.18	1.33

Values are expressed as mean \pm SEM (n = 6); *p < 0.05 and **p < 0.01 compared with control (ANOVA followed by Dunnett's test).

RESULTS AND DISCUSSION

The diuretic action of MEPM was evaluated using furosemide which is a high-ceiling loop diuretic, under controlled laboratory conditions. As diuretic therapy may lead to number of life-threatening electrolytic disorders and toxicities, so safety profile studies was carried out following a sub chronic administration of extracts. Results showed that there was absence of mortality and overt signs of toxicity. This would amplify the heterogeneous array of diuretic curatives available for safe and effective treatment for urolithiasis, edema and cardiovascular diseases^[11] the results of the present study revealed urine volume was expressed in ml/5 h. Na⁺ and K⁺ concentrations were measured by Flame photometer and Cl⁻ concentration was estimated by titration with silver nitrate solution (N/50) using 3-5drops of 5% potassium chromate as an indicator. [12,13] The ratio of the concentration of Na⁺/K⁺ at the end of 5 h, were calculated to assess the diuretic potential of MEMP.

The observed Na⁺/K⁺ ratio for furosemide and MEMP (250 & 500 mg/kg) were 1.41, 1.53 and 1.53 respectively, as compared to 1.75 for control. The present result shows significant diuretic potency and their effect on electrolyte excretion of MEMP comparable to the standard drug furosemide that alcohol extract induced diuresis was strong and accompanied with high natriuresis, chloruresis, and kaliuresis (p < 0.01). Further there was low Na⁺/ K⁺ ratio, so the alcohol extract seem to be acting like loop diuretics which inhibits Na⁺, K⁺ and Cl⁻ co-transport at thick ascending loop of Henle. K⁺ excretion was increased perhaps due to high Na⁺ load reaching the distal tube. These findings suggest the possible traditional use of this plant in urolithiasis to wash out the crystal from the urinary bladder.

CONCLUSION

In conclusion, methanolic extracts of *Musa paradisiaca L* have diuretic effect supporting the ethnopharmacological use as treatment in urolithiasis. Our results have shown that the extracts administered at the dose of 500 mg/kg body weight (p.o.) have significant effects on urinary excretion of electrolytes and supports basis for the traditional use of *Musa paradisiaca L* in urolithiasis. .

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