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Study on the diuretic activity of *Euphorbia fusiformis* Buch.-Ham. in albino rats

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Abstract

The present study was undertaken to evaluate diuretic activity of *Euphorbia fusiformis* root powder in Wistar strain albino rats. Randomly selected animals were divided into three groups of six animals each. The root powder was suspended in distilled water and administered orally at a dose of 90 mg/kg therapeutically equivalent dose (TED) and 180 mg/kg (TED × 02) to overnight fasted rats. The diuretic activity was evaluated by determination of urine volume and urinary electrolyte concentrations. Test drug showed significant increase in urine volume and urinary electrolyte excretion in a dose-dependant manner. Thus, from this study, it can be concluded that roots of *E. fusiformis* possess diuretic activity.

Key words: Albino rats, diuretic activity, *Euphorbia fusiformis*, urine volume

Introduction

*Euphorbia fusiformis* Buch.-Ham. (Synonym: *Euphorbia aqualis*, Euphorbiaceae) is a rare medicinal plant found in Bengal,[¹] Uttar Pradesh,[²] Konkan[³] and Central Eastern Ghats of Tamil Nadu.[⁴] In Gujarat state, it is found in Dangs, Rajpippala and Chotaudaipur regions.[⁵] The ethnobotanical value of this plant is due to its action as a remedy for several diseases like rheumatism, gout, paralysis and arthritis,[⁶] liver disorders and diarrhea.[⁷] The tuberous roots of this plant were used by *Bhagats* (tribal physicians) of Dangs forest for the treatment of various abdominal disorders, especially for tumors of abdomen, and urinary stones. However, after extensive literature search, we came to know that only few pharmacological studies have been carried out on this plant, namely, its anti-inflammatory[⁸] and antibacterial activities.[⁹,¹⁰] Further, there is no work reported on roots of this plant to support the claims of *Bhagats* that it could be used to treat urinary stones. Thus, the present study was carried out to evaluate the diuretic activity of *E. fusiformis* root powder in experimental animals, which may be helpful as diuresis therapy in urinary stones.

Materials and Methods

Animals

Wistar strain albino rats of either sex, weighing 200±10 g, were selected from the animal house attached to IPGT and RA, Gujarat Ayurved University, Jamnagar. They were housed at 25±3°C with constant humidity 40–60%, on a 12-hour natural day and night cycle. They were fed with diet Amrut brand rat pellet feed supplied by Pranav Agro Industries, Baroda, and tap water ad libitum. Institutional Animal Ethics Committee had approved the experimental protocol (approval number: IAEC 04-05/01/MSc.01), and the care of animals was undertaken as per the CPCSEA guidelines.

Test drug

Fully mature tuberous roots of *E. fusiformis* Buch.-Ham. (family Euphorbiaceae) were collected from Waghai forest, Dangs, Gujarat, India, and the material was authenticated by pharmacognosist of IPGT and RA. The tuberous roots were made into slices and shade dried for 12 days and then pulverized to fine powder (mesh no. 80) and stored in an airtight container for experimental purposes.

Dose selection and schedule

The dose of *E. fusiformis* root powder for therapeutic purposes used by *Bhagats* of Dangs forest is about 1 g per day. The dose for experimental animals was calculated on the basis of body surface area ratio by referring to the standard table of Paget and Barnes (1969).[¹¹] On this basis, the rat dose was found to be 90 mg/kg. The experiment was carried out at two dose levels, namely; 90 and 180 mg/kg. The test drug was suspended in

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distilled water at a suitable concentration depending upon the body weight of animals, prior to administration.

Screening of diuretic activity

The diuretic activity was determined following the standard procedure of Gillard et al. (1971). The selected animals were divided into three groups, with each group comprising three male and three female rats. The first group was kept as control, whereas the second and third groups were administered with the test drug at a dose of 90 and 180 mg/kg, respectively to the overnight fasted rats. Normally, urine output in rats is very low (1–2 ml/rat/day). Hence, to get the measurable quantity of urine, rats of all the groups were administered with distilled water (2 ml/100 g) after 30 minutes of test drug administration. Then, the animals were placed individually in metabolic cages with netted floor and urine was collected in conical flasks placed below the polythene funnel of the metabolic cages. Extreme care was taken to avoid the contamination of urine with fecal matter. Urine was collected continuously for 5 hours after the drug administration and total urine volume was measured. Urinary Na+, K+ (cation) and Cl– (anion) excretion was also estimated by flame photometer and the amount of chloride was determined titrimetrically by silver nitrite solution (0.1 N), using one drop of 5% ferric alum solution as indicator. pH of urine was also measured using standard pH paper.

Statistical analysis

Results were presented as Mean±SEM. Student’s t test for unpaired data was used for analyzing the data generated during the study with the level of significance set at P<0.05.

Results

The effect of E. fusiformis root powder on urine volume and pH is shown in Table 1. The test drug produced significant increase in urine volume in a dose-dependent manner. Further, the test drug decreased the pH of urine in a dose-dependent manner. However, the observed decrease in urine pH was statistically nonsignificant in comparison to the control group.

The effects of single dose of E. fusiformis 90 and 180 mg/kg on electrolyte excretion in the 5-hour urine were estimated and are given in Table 2. The test drug significantly enhanced the excretion of urinary sodium and potassium at both the dose levels as compared to the control group.

Discussion

The test drug produced 68.30 and 85.33% increase in the urine output at TED and TED × 02 dose levels, respectively, which is dose dependent and statistically significant. This clearly shows that the test drug has very good diuretic activity. Further, it significantly enhanced sodium and potassium excretion in urine by several fold. However, chloride excretion was not affected to a significant extent. The observed pattern is similar to the pattern observed with thiazide diuretics in which increase in sodium, potassium excretion and urine formation is observed. Thiazides act by decreasing the re-absorption of sodium in the distal convoluted tubule. This occurs due to the inhibition of the Na+/Cl– co-transporter on the luminal membrane. There is increased loss of K+ ion due to exchange of K+ for Na+ in the collecting duct. It can be suggested that the test drug may also have similar type of mechanism of action to produce diuretic activity. Further, the major chemical components reported to be present in the tuberous roots of this plant are diterpene lactone caudicifolin, methyllellagic acid and euphol. They may be responsible for the observed diuretic activity.

Table 1: Effect of Euphorbia fusiformis root powder on urine volume and pH in hydrated rats

| Treatment          | Urine volume (ml) | % Change | pH     | % Change |
|--------------------|-------------------|----------|--------|----------|
| Control            | 07.13±0.77        | -        | 8.75±0.63 | -        |
| E. fusiformis (90 mg/kg, p.o.) | 12.00±1.89*     | 68.42    | 8.38±0.32 | 4.28     |
| E. fusiformis (180 mg/kg, p.o.) | 13.25±1.01**    | 85.96    | 8.00±0.50 | 8.57     |

The data are expressed as Mean±SEM. Significant differences in each group vs. the control are *P<0.05; **P<0.01, † Increase

Table 2: Effect of Euphorbia fusiformis root powder on urinary electrolyte concentrations

| Treatment          | Sodium (mEq/l) | % Change | Potassium (mEq/l) | % Change | Chloride (mEq/l) | % Change |
|--------------------|----------------|----------|-------------------|----------|------------------|----------|
| Control            | 12.745±1.60   | -        | 2.033±0.32        | -        | 1.21±0.435      | -        |
| E. fusiformis (90 mg/kg, p.o.) | 85.040±17.54** | 24.05    | 12.959±2.387**   | 1.96     |                  |          |
| E. fusiformis (180 mg/kg, p.o.) | 77.776±0.435*** | 27.67    | 20.845±1.996***   | 3.61     |                  |          |

The data are expressed as Mean±SEM. Significant differences in each group vs. the control are *P<0.01; † Increase

Conclusion

This study provides first scientific evidence in support of diuretic activity of E. fusiformis roots. The observed diuretic activity may be due to the individual or combined activity of bioactive constituents present in roots. Further pharmacodynamic investigations are required to find out the active constituents responsible for the observed diuretic effect and to understand the precise mechanism.

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हिन्दी सारांश

युफोर्बिया फुसीफोर्मिस का मूत्रल क्रिया पर अध्ययन

प्रस्तुत अध्ययन विस्तरार उद्देश्यों में युफोर्बिया फुसीफोर्मिस की जड़ के चुर्ण की मूत्रल क्रिया के प्रभाव के अध्ययन हेतु किया गया। चुर्ण के छिन्नां में युफोर्बिया फुसीफोर्मिस की जड़ के चुर्ण की मूत्रल क्रिया के प्रभाव के अध्ययन हेतु किया गया। चुर्ण के छिन्नां में युफोर्बिया फुसीफोर्मिस की जड़ के चुर्ण की मूत्रल क्रिया के प्रभाव के अध्ययन हेतु किया गया।