



Pharmacological Study

Diuretic activity of *Linaria ramosissima* (wall.) Janch. leaves in albino rats

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Abstract

Linaria ramosissima (Wall.) Janch., Scrophulariaceae, a folklore plant, has been claimed for its diuretic activities by traditional practitioners. The present study was undertaken to investigate the diuretic activity of *L. ramosissima* leaves in albino rats. Suspension of leaf powder in 2% gum acacia was administered to experimental rats orally at doses of 450 mg/kg. The diuretic effect was evaluated by measuring the urine volume, pH of urine, and urinary electrolyte excretion. Administration of the test drug increased the urine volume in a non-significant manner, while it enhanced the urinary excretion of sodium, chloride, and potassium significantly, in comparison to the control group. From the present study it can be concluded that the leaves of *L. ramosissima* have a significant diuretic activity.

Key words: Diuretic activity, electrolyte excretion, folklore plant, *Linaria ramosissima*

Introduction

Diuretics are drugs that increase the rate of urine flow and sodium excretion, and are used to adjust the volume and composition of body fluids in a variety of clinical situations. Drug-induced diuresis is beneficial in many life-threatening disease conditions such as congestive heart failure, nephritic syndrome, cirrhosis, renal failure, and hypertension.^[1] Most diuretic drugs have adverse effects on the quality of life including impotence, fatigue, and weakness. Naturally occurring diuretics include caffeine in coffee, tea, and cola, which inhibit Na⁺ reabsorption, and alcohol in beer, wine, and mixed drinks, which inhibits secretion of the anti-diuretic hormone.^[2,3] Although most of the diuretics have proved to be very effective in promoting sodium excretion, certain cause potassium loss and have prompted the search for potassium-sparing diuretics. Hence, a search for a new diuretic agent that retains therapeutic efficacy and yet is devoid of potassium loss is justified.^[4]

Linaria ramosissima (Wall.) Janch. [Syn. *Kickxia ramosissima* (Wall.) Janch.] belongs to the family Scrophulariaceae. In Gujarati, it is known as *Bhintgilodi* and

Kanoti. It is a perennial herb with numerous filiform branches, membranous leaves, and yellow flowers. It is found throughout India on walls, and rocky and stony places, ascending to 7,000 ft in the Himalayas. It is also found in the Saurashtra region of Gujarat. The plant is highly valued as a remedy for diabetes.^[5-7] According to Jaykrishna Indrajit, the roots and leaves are effective in snake-bite.^[8]

Folk people in Saurashtra regions use this plant to treat urinary stones.^[9] It has been also reported for its properties like *Mutrala* (diuretic), *Rechak* (purgative), *Tikta* (bitter), *Raktapittahara* (blood Disorders) and so on.^[10] However, till date, no pharmacological studies have been reported to prove its diuretic activity. Hence, in the present study the diuretic activity of the leaves of *L. ramosissima* was investigated.

Materials and Methods

Procurement and preparation of the test drug

The whole plant was collected from the surrounding areas of Jamnagar, Gujarat, especially from old abundant ruined walls of forts and buildings as well as rocky and stony places. It was

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Table 1: Effect on urine volume and pH

Groups	Volume of urine (ml/100 g)	pH
Water control	0.378±0.068	7.583±0.154
LR	0.463±0.091	7.667±0.105

Data: Mean±SEM, LR: *Linaria ramosissima* (test group)

Table 2: Effect on urinary electrolyte excretion

Groups	Urinary electrolyte excretion			
	Na ⁺ (Meq/L)	K ⁺ (Meq/L)	Na ⁺ /K ⁺ ratio	Total chloride (Meq/L)
Water control	076.69±5.59	150.20±09.40	0.510	211.56±17.17
LR	118.89±8.71**	270.29±08.85*	0.439	385.21±26.24***

Data: Mean±SEM; LR: *Linaria ramosissima* (test group); *P<0.05, **P<0.01, ***P<0.001 compared with water control (unpaired 't' test)

identified and authenticated by comparing it with different floras, and Reference Herbarium Specimen (No. 949 dated 16.10.65, Pharmacognosy Laboratory) and also a herbarium specimen (No. 6015) is kept in the Departmental Museum for future reference. The plant was thoroughly washed with tap water, the leaves were separated, shade dried, pulverized to fine powder (mesh No. 120#), and then stored in airtight glass containers, for experimental purposes.

Dose fixation and schedule: Dose fixation for the experimental animals was done on the basis of body surface area ratio, by referring to the standard table of Paget and Barnes.^[11] The adult human dose (5 g per day) was converted to animal dose. On this basis, the rat dose was found to be 90 mg/kg. The test drug was suspended in distilled water using 2% gum acacia and administered orally with the help of a gastric catheter sleeved to the syringe. The drugs were administered to overnight fasted animals.

Animals

Wistar strain albino rats of either sex weighing 220 to 260 g were obtained from the animal house attached to the Pharmacology Laboratory of the institute and maintained on 'Amrut' brand animal pellet feed from the Pranav Agro Industries, and tap water was given *ad-libitum*. The temperature and humidity was kept at optimum, and animals were exposed to natural day-night cycles. The experiments were carried out in conformity with the guidelines of the Institutional Animal Ethics Committee (IAEC) after obtaining its permission (Number: IAEC 07/2010/05 PhD).

Diuretic Activity

The selected animals were divided into two groups, each group comprising of three male and three female rats and activity was carried out.^[12] The first group was kept as control (Water control), whereas, the second was administered with a test drug in the dose of 450 mg/kg. The test drug and vehicles (distilled water) were administered to the respective groups of overnight fasted rats. As normal urine output in the rats was very low (1 to 2 ml/rat per day), to get the measurable quantity of urine, the rats of all the groups were administered with distilled water (5 ml/100 g) after 30 minutes of test drug administration. Then the animals were placed individually in metabolic cages with a 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. The urine was collected after drug administration up to the fifth hour. The urine volume was measured and analyzed for Na⁺, K⁺ (cations), and Cl⁻ (anions). The concentration of Na⁺ and K⁺ was analyzed with the help

of a flame photometer^[13] and the amount of chloride was determined titrimetrically by silver nitrite solution (0.1 N), using one drop of 5% ferric alum solution as an indicator.^[14] The pH of urine was also measured using standard pH paper.

Statistical analysis

The data is expressed as mean ± standard error of mean in each group. The data obtained was analyzed by using the unpaired student's *t* test, with the level of significance set at 0.05.

Results

The test drug increased the urine volume and urine pH to a non-significant extent in comparison to normal control rats [Table 1]. Administration of the test drug significantly enhanced urinary sodium and potassium excretion. Furthermore, it also significantly increased total chloride excretion from the urine [Table 2].

Discussion

The present study demonstrates that the leaves of *L. ramosissima* non-significantly enhance urine volume and significantly increase urinary electrolyte excretion. The observed pattern is similar to the pattern observed with thiazide diuretics, wherein, increase in sodium, potassium, and urine formation is observed.^[15] 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.^[16] It can be suggested that the test drug may also have a similar type of mechanism of action to produce diuretic activity. The major chemical components found positive in the plant are carbohydrates, steroids, saponins, flavonoids, alkaloids, tannins, phenolic compounds, and cardiac glycoside, by qualitative tests.^[17] Therefore, some of these components may have played role in the observed activity profile.

Conclusion

The leaf powder of *Linaria ramosissima* (Wall.) Janch. has a significant diuretic activity, which supports the folklore claim supporting its use as a diuretic in the management of urinary strangury and stones. However, further studies are required to explore its exact mechanism of action, as well as, to isolate the active principle responsible for the diuretic activity.

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हिन्दी सारांश

लाइनेरिया रेमोसिसीमा (कानोटी) औषधि वनस्पति के मूत्रल प्रभाव का मूल्यांकन

प्रीति एन. पंड्या, हेतल बी. अघेरा, बी.के. अशोक, रबिनारायण आचार्य

लाइनेरिया रेमोसिसीमा (कानोटी) औषधि वनस्पति प्रमेह, व्रण एवं ज्वर की चिकित्सा में उपयुक्त है एवं इसके मूत्रल, रेचक, तिक्त आदि गुणधर्म बताये गये हैं। प्रस्तुत अध्ययन में इस वनस्पति के पत्रों के मूत्रल कर्म का गुणात्मक परीक्षण किया गया है। परीक्षण हेतु वनस्पति पत्र चूर्ण को उपयोग में लाया गया है। इस शोधपत्र में परीक्षण तथा परिणामों का विस्तृत वर्णन किया गया है।