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Study on the diuretic activity of *Veerataru Kwatha* in albino rats

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Abstract

The purpose of the present study was to evaluate the diuretic activity of *Veerataru* [*Dichrostachys cinerea* (Linn.)] *Kwatha* in experimental animals by following the standard procedure. Randomly selected animals were divided into three groups of six animals each. The root of *Veerataru* was administered orally in the form of *Kwatha* at a dose of 5.4 and 10.8 ml/kg. Parameters like volume of urine, pH of urine and urinary electrolyte concentrations like sodium, potassium and chloride were studied. *Veerataru Kwatha* increased the urine output in a dose-dependent manner. However, it did not affect the urinary electrolyte concentrations. From the present study, it can be concluded that the root of *Veerataru* has diuretic property.

Key words: *Dichrostachys cinerea,* diuretic activity, *Veerataru Kwatha*

Introduction

Veerataru [*Dichrostachys cinerea* (Linn.)], belonging to the family Mimosaceae, is a deciduous thorny shrub or small rounded tree, found in tropical and subtropical conditions.[1] It was the first drug among the 19 drugs of *Veeratarvadi Gana* quoted by *Acharya* Sushruta.[2] This *Gana* is mainly indicated for *Mootrakruchcchra*, *Mootraghata*, etc. As per the Ayurvedic classical texts, *Veerataru* is effective in conditions like *Mootrakruchchhra*, *Mootraghata*, *Ashmari*, etc., where retention of urine is seen.[3] Traditionally also, the root of this plant has been used in the treatment of urinary calculi, strangury, renal troubles and diseases of the vagina.[4,5] Further, ethanolic extract of roots, fruits, leaves and seeds of this plant was reported to have antibacterial activity.[6-9] Also, the alcoholic extract of roots has shown marked nephroprotective activity against cisplatin-induced nephrotoxicity.[10] The classical Ayurvedic preparation of this plant called *Veerataru Kwatha*, prepared from the root of this plant, have shown excellent relief in patients of *Mootrakruchchhra* with symptoms of painful micturition and burning micturition.[11] Hence, the present study was carried out to assess the diuretic activity of *Veerataru* root in form of *Kwatha* (decoction) in experimental animals and also to provide experimental basis to the clinical findings.

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Materials and Methods

Animals

Wistar strain albino rats of either sex, weighing between 180 and 200 g, were selected from the animal house attached to IPGT and RA, Gujarat Ayurved University, Jamnagar. They were housed at 22±2°C with constant humidity 50–60%, on 12-hour natural day and night cycles. They were fed with diet Amrut brand rat pellet feed supplied by Pranav Agro Industries, Baroda, and tap water *ad libitum*. The experiments were carried out in accordance with the directions of the Institutional Animal Ethics Committee (IAEC).

Procurement and preparation of test drug

The root samples of the test drug were collected from *Raka Khatiya* forest area of Jamnagar district by careful botanical identifications referring various botanical floras and with the help of botanist of the institute. The root samples were dried in shade and converted to coarse powder form. From the powder samples, *Kwatha* (decoction) was prepared freshly by referring the classical method,[12] just prior to administration to the animals. In brief, 16 parts of water and one part of the drug were boiled on a low flame till one-eighth of it remained. This was filtered and allowed to cool before administering to the animals.

Dose selection and schedule

In the classical texts, dose of *Veerataru Kwatha* is mentioned as 60

ml/day for an adult. Considering this, the dose of the experimental animals was calculated by extrapolating the human dose to animals as 5.4 ml/kg based on the body surface area ratio by referring to the standard table of Paget and Barnes (1969).[13] The study was carried out at two dose levels, namely TED [therapeutically equivalent dose (5.4 ml/kg)] and TED×2 [double of therapeutically equivalent dose (10.8 ml/kg)]. The test drugs were administered orally with the help of a gastric catheter of suitable size sleeved onto a syringe nozzle at a constant volume to all the groups.

Experimental protocol

The diuretic activity was determined by following the procedure described by Gillard *et al.* (1971).[14] 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 *Veerataru Kwatha* at a dose of 5.4 and 10.8 ml/kg, respectively. The test drug and vehicles were administered to the overnight fasted rats of the respective groups. As the normal urine output in rats is very low (1–2 ml/rat/day), to get a measurable quantity of urine, the rats of all the groups were administered distilled water (2 ml/100 g) after 30 min 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 after drug administration at 1st, 2nd, 3rd, 4th and 5th hour. The urine volume was measured and analyzed for Na^+, K^+ (cations) and Cl^- (anions). The concentration of Na^+, K^+ was analyzed by flame photometer[15] 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.[16] 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 $P<0.05$. The level of significance was noted and interpreted accordingly.

Results

Test drug increased the urine volume in a dose-dependent manner. Especially at higher dose level, statistically significant increase in urine volume was observed. Administration of test drug at both the doses did not affect the urine pH to a significant extent in comparison to normal control rats [Table 1].

The effect of *Veerataru Kwatha* on urinary electrolyte concentration is shown in Table 2. Administration of *Veerataru Kwatha* in TED dose leads to statistically significant decrease in urine sodium excretion, whereas in TED × 2 dose, it enhanced the urinary sodium excretion, but in a statistically nonsignificant manner. *Veerataru Kwatha* did not affect the urine potassium and chloride excretion to a significant extent [Table 2].

Table 1: Effect of *Veerataru Kwatha* on urine volume and pH in hydrated rats

Groups	Volume of urine (ml/100g)	pH of urine
Control	0.407 ± 0.20	8.625 ± 0.13
Veerataru Kwatha (5.4 ml/kg)	0.436 ± 0.23	8.750 ± 0.25
Veerataru Kwatha (10.8 ml/kg)	1.177 ± 0.24*	8.625 ± 0.24

The test drug *Veerataru Kwatha* was administered by oral route to groups of rats ($n = 6$), 1 hour prior to the urine collection. The urine volume was measured for 5 hours. pH of urine was also measured using standard pH paper. The data are expressed as Mean ± SEM, Significant differences in each group vs. the control are *$P < 0.05$

Table 2: Effect of *Veerataru Kwatha* on urinary electrolyte concentration (5 hours)

Groups	Sodium (mEq/l)	Potassium (mEq/l)	Chloride (mEq/l)
Control	0.0178 ± 0.0006	0.1795 ± 0.134	0.0682 ± 0.00
Veerataru Kwatha (5.4 ml/kg)	0.0085 ± 0.008***	0.067 ± 0.025	0.0938 ± 0.016
Veerataru Kwatha (10.8 ml/kg)	0.0192 ± 0.005	0.0475 ± 0.007	0.1024 ± 0.014

The test drug *Veerataru Kwatha* was administered by oral route to groups of rats ($n = 6$), 1 hour prior to the urine collection. The concentrations of Na^+, K^+ were analyzed by flame photometer and the amount of chloride was determined titrimetrically. The data are expressed as Mean ± SEM, Significant differences in each group vs. the control are ***$P < 0.001$

Discussion

Results from the present study show that *Veerataru Kwatha* can function as an orally active diuretic agent. The observed dose-dependent activity suggests that the observed effect was intrinsic. There are two factors on which urine volume depends. One is the rate of glomerular filtration and other is the degree of tubular re-absorption. The observed effect may be attributed to mechanism like increasing the renal blood flow and the attendant increase in glomerular filtration rate. It is also possible that it has inhibitory effect on antidiuretic hormone (ADH) secretion as inhibition of ADH causes polyurea.[17] Another possible mechanism involved may be stimulation of release of endogenous natriuretic peptides, which promotes sodium and water secretion. Such a mode of action is unlikely as there was no significant increase in urinary Na^+ level although urine volume was raised. The test drug does not act as thiazides and related diuretics as these act by inhibiting the Na^+/Cl^- co-transporter in the distal convoluted tubules and increase Na+ and K+ loss,[18] whereas in this study, there was no significant alteration of urinary Na^+ and K^+ levels.

To conclude, the root of *Veerataru* has significant diuretic activity. The observed activity may be due to the individual or combined action of bioactive constituents present in it. Further phytochemical and pharmacodynamic studies are required to find the active constituent responsible for diuretic activity.

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हिन्दी सारांश

अल्बिनो चूहों में वीरतरु क्वाथ के मूत्रल प्रभाव का अध्ययन

भुपेश आर. पटेल, अशोक बी. के., बी. रवीशंकर

इस अध्ययन का मुख्य उदेश्य प्रायोगिक प्राणियों के द्वारा वीरतरु क्वाथ की मूत्रल क्रिया को जांचना है। प्रत्येक वर्ग में ६ प्राणी रहे। इस तरह से तीन वर्ग बनाये गये। प्रथम वर्ग को कन्ट्रोल वर्ग रखा गया। द्वितीय और तृतीय वर्ग में परीक्षणीय द्रव्य मूल को क्वाथ स्वरूप में ६.४ मि.ली. प्रति कि.ग्रा.और १०.८ मि.ली. प्रति कि.ग्रा. मात्रा क्रमशः मुख मार्ग से प्रयुक्त की गई। इसके साथ मूत्रका प्रमाण, पीएच और इलेक्ट्रोलाइट सान्द्रत्व जैसे सोडियम, पोटेसियम और क्लोराईड का अध्ययन किया गया। परिणाम स्वरूप यह देखा गया कि वीर तरु क्वाथ की मात्रा बढाने से मूत्र का प्रमाण भी बढता है। जबकि उसका इलेक्ट्रोलाइट सान्द्रता पर प्रभाव नहीं है। इस अध्ययन से यह निष्कर्ष निकलता है कि विरतरु मूल में मूत्रल कर्म की क्षमता है।