ORIGINAL ARTICLES

Acute Toxicity and Diuretic Studies of the Roots of *Asparagus racemosus* Willd in Rats

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ABSTRACT

Objective: Asparagus racemosus *Willd has been used as diuretic in Ayurveda but has not been validated by a suitable experimental model. Hence the present study was undertaken.*
Materials and Methods: *The study was carried out with an aqueous extract of the roots of* Asparagus racemosus *utilizing three doses viz 800 mg/kg, 1600 mg/kg and 3200 mg/kg for its diuretic activity in comparison with standard drug (furosemide) and control (normal saline) rats after doing acute toxicity study.*
Results: *Acute toxicity study showed no fatality even with the highest dose and the diuretic study revealed significant diuretic activity (*$p < 0.05$*) in the dose of 3200 mg/kg.*
Conclusion: Asparagus racemosus *showed diuretic activity at a 3200 mg/kg dose without acute toxicity.*

Keywords: *Asparagus racemosus*; Toxicity; Diuretic activity

Toxicidad Aguda y Estudios Diuréticos del *Espárrago Racemoso* Willd en Ratas

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RESUMEN

Objetivo: *El* espárrago racemoso Willd *ha sido usado como diurético en ayurveda pero no ha sido validado mediante un modelo experimental conveniente. De ahí la razón para emprender el presente estudio.*
Materiales y Métodos: *El estudio fue realizado con extracto acuoso de raíces de espárrago racemoso, utilizando tres dosis, a saber, 800 mg/kg, 1600 mg/kg y 3200 mg/kg para analizar su actividad diurética, comparándolo con el medicamento estándar (furosemida), y ratas de control (solución salina normal) después de hacer un estudio de toxicidad aguda.*
Resultados: *El estudio de toxicidad aguda no mostró fatalidad, incluso con la dosis más alta, y el estudio del diurético reveló una actividad diurética significativa (*$p < 0.05$*) con la dosis de 3200 mg/kg.*
Conclusión: *El* espárrago racemoso *mostró actividad diurética en una dosis de 3200 mg/kg sin toxicidad aguda.*

Palabras claves: *Espárrago racemoso, toxicidad, actividad diurética*

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INTRODUCTION

Asparagus racemosus Willd (family: Asparagaceae) commonly known as Shatavari in Hindi and Sheetaveerya in Sanskrit, is a perennial shrub, with a tuberous root, spinous stem and linear leaves with white flowers (1, 2). In traditional medicine, roots of this plant are considered highly mucilaginous, galactogogue, refrigerant, diuretic, nutritive, tonic, demulcent, aphrodisiac and antispasmodic (2). These

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root extracts have been evaluated in different scientific studies for antiulcer (3), anti-tussive (4), antidiarrhoeal (5), antioxidant (6) and antibacterial activities (7). As there was no scientific study regarding the diuretic activity of the aqueous extract of *Asparagus racemosus,* the present work was undertaken to evaluate the same in rats.

MATERIAL AND METHODS

Approval for the experiment was obtained from the Institutional animal ethics committee (IAEC), Kasturba Medical College, Manipal, vide letter No. IAEC/KMC 02/2006–2007.

Plant material

The roots of *Asparagus racemosus* Willd available locally were collected and identified properly by botanical and pharmacognostic characteristics in the Department of Botany, MGM College Udupi. The voucher specimen is preserved in our laboratory for future reference.

Method of extraction

The roots were cleaned, washed, dried in the shade and pulverized. The coarse powder was subjected to successive solvent extraction with water. A semi-solid extract was obtained after complete elimination of solvent under reduced pressure. The yield of the extract was 10%. The extract was stored in a desiccator and used for experiment after dissolving it in distilled water.

Animals

Inbred albino rats of the Wistar strain (uni-sex) aged around 2 to 3 months and weighing 150–200 g were used. They were housed at a temperature of 25 ± 2°C and relative humidity of 45–55%, in the animal house of Kasturba Medical College, Manipal. They were fed standard pellet diet (Hindustan Lever rat pellets) and water.

Acute toxicity study

Rats of either sex were divided into six groups of six each. Normal saline (5 ml) was orally administered to the control group. The other groups were administered 2000 mg, 4000 mg, 8000 mg, 16 000 mg and 32 000 mg/kg of aqueous extract of the roots of *Asparagus racemosus* orally. After administration of the extract, the rats in different groups were observed continuously for the first two hours for neurobehavioural alterations and intermittently for 24 hours to find out neurological changes, autonomic responses and mortality. Subsequently, the animals were observed daily for 14 days (8).

Diuretic study

The animals were fasted overnight prior to the experiment and then hydrated with normal saline and randomly divided in five groups of six rats each. The first two groups, being control and standard, received normal saline (5 ml) and furosemide [25 mg/kg] (9) as positive control respectively. The three other groups received three different doses (800 mg, 1600 mg and 3200 mg/kg) of extract with normal saline. The urine output at 24 hours was collected by housing each animal in a separate metabolic cage (Nalgene, USA) kept under laboratory conditions. The animals had free access to water but not to food during that time. The volume of urine was measured after 24 hours and analysed for sodium, potassium, chloride, bicarbonate, calcium, magnesium, phosphate, urea and uric acid contents. The whole procedure was repeated thrice after a wash-out period of 2 weeks each.

Statistical analysis

Statistical evaluation was done by using ANOVA in SPSS version10. Turkey test was used as a *post hoc* test.

RESULTS

Acute toxicity study

In the acute toxicity studies, the animals did not show any behavioural, autonomic or central nervous system changes. No death occurred at any of the doses. So the extract was found to be safe even at the maximum single dose of 32 000 mg/kg, orally. Based on the above findings, $1/10^{th}$ of the highest dose with two other doses less than the maximum single dose were taken for the study.

Diuretic study

The results of various parameters in the study are shown in Tables 1 and 2. The aqueous extract of *Asparagus racemosus* in the dose of 3200 mg/kg, given orally, revealed significant increase ($p < 0.05$) in urine output compared to control (Table 1). The urine output of the treated rat at the dose of 3200 mg/kg body weight seems to be closely related to the group receiving furosemide. There was significant ($p < 0.05$) increase in the excretion of potassium, phosphate and chloride

Table 1: Effect of aqueous extract of *Asparagus racemosus* on 24-hour urine output in different groups of rats.

Group	Treatment (oral dose)	Volume of urine collected for 24 h (ml) Mean ± SEM
I	Control (normal saline)	9.025 ± 0.57
II	Furosemide (25 mg/kg)	14.49 ± 0.56**
III	*A racemosus* (800 mg/kg)	8.098 ± 0.42
IV	*A racemosus* (1600 mg/kg)	10.15 ± 0.419
V	*A racemosus* (3200 mg/kg)	12.35 ± 0.298*

n = 6, *$p < 0.05$ *vs* control, ** $p < 0.001$ *vs* control

Table 2: Effect of aqueous extract of *Asparagus racemosus* on urine electrolyte in different groups (Mean ± SEM).

Group	Treatment (oral dose)	Sodium (mmol/L)	Potassium (mmol/L)	Chloride (mmol/L)	Phosphate (mmol/L)	Calcium (mg/dl)
I	Control (normal saline)	31.83 ± 3.63	45.68 ± 4.48	87 ± 4.60	40.65 ± 7.93	0.65 ± 2.00
II	Furosemide (5 mg/kg)	48.66 ± 5.33*	64.63 ± 3.42*	122.66 ± 8.22*	54.7 ± 5.78*	0.616 ± 0.1
III	*A racemosus* (800 mg/kg)	20.83 ± 5.73	46.75 ± 5.80	57.66 ± 9.51	12.18 ± 1.72*	0.60 ± 0.11
IV	*A racemosus* (1600 mg/kg)	32.33 ± 7.34	58.53 ± 7.45	89.33 ± 11.9	36.65 ± 5.72	0.35 ± 0.29
V	*A racemosus* (3200 mg/kg)	40.33 ± 4.11	73.03 ± 3.07*	113.83 ± 5.52*	59.63 ± 3.83*	0.38 ± 0.12

SEM = Standard Error of Mean, *statistical significance $p < 0.05$ in comparison to control; n = 6.

when compared to control in rats treated with a dose of 3200 mg/kg of the extract (Table 2). Phosphate excretion was found to be more than that of the furosemide treated group of rats. A significant ($p < 0.05$) decrease in phosphate excretion compared to control was seen in rats treated with a dose of 1600 mg/kg extract.

DISCUSSION

Diuretics are one of the important treatment modalities in the treatment of oedema or volume overload, particularly due to congestive heart failure, ascites, chronic renal failure and nephrotic syndrome (10). Even though there are a number of classes of diuretics, the ideal diuretic is yet to be found (11).

Many plants, conveniently available in India, are used in traditional medicine for diuretic action. Of the indigenous plants used, *Andrographis paniculata, Asparagus racemosus, Butea monosperma, Cassia auriculata* and others are mentioned.

In the present study, an aqueous extract of *Asparagus racemosus* that has not been studied so far, was evaluated for its diuretic potential in albino rats of Wistar strains. The pharmacological response was compared with that produced by furosemide, a widely used diuretic in clinical practice. The root of the plant was selected for the study as it is the root that is used in traditional medicine to induce diuresis. The oral route was chosen to be consistent with the use of these plants in traditional medicine (12).

In the present study, even though the rats showed a diuretic response to all doses of extract, the significant increase in urine output when compared to control was shown at the dosage of 3200 mg/kg (Table 1). The urinary excretion of potassium, phosphate and chloride was significant with the high dose of extract compared to control. Thus, this study shows that the traditional use of roots of *Asparagus racemosus* as a diuretic may be beneficial, although larger scale preclinical and clinical studies are required for confirmation of clinical efficacy.

The reasons for diuresis may be because of saponins like shatavarin I, II, III and IV[2] which are present in asparagus. Steroidal saponins and isoflavones (chemical constituents of Asparagus) could be responsible for diuretic activity (13).

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