



International Journal of Multidisciplinary Research and Growth Evaluation.

Diuretic activity of hydroalcoholic extract of *Canna indica* rhizomes

Sreenu Thalla ^{1*}, Thriveni Pamisetty ², Pasupuleti Vyshnavi ³, Potluri Srilakshmi ⁴, Shaik Khanes Fathima ⁵, Motupalli Sri Maha Lakshmi ⁶, Melam Sri Varshitha ⁷, Rama Rao Nadendla ⁸

¹⁻⁸ Department of Pharmacology, Chalapathi Institute of Pharmaceutical Sciences, Lam, Guntur, Andhra Pradesh, India

* Corresponding Author: Sreenu Thalla

Article Info

ISSN (online): 2582-7138

Volume: 04

Issue: 05

September-October 2023

Received: 17-08-2023;

Accepted: 07-09-2023

Page No: 363-365

Abstract

Canna indica, commonly known as Indian shot, is a versatile plant with a history of traditional medicinal use. While it has been employed for various therapeutic purposes, its diuretic potential remains relatively unexplored. This study investigates the diuretic activity of the hydroalcoholic extract derived from *Canna indica* rhizomes. Hydroalcoholic extract of *Canna indica* rhizomes was prepared and subjected to a comprehensive phytochemical analysis to identify the presence of active compounds. Acute oral toxicity tests were conducted to assess safety. Diuretic activity was evaluated using Wistar rats as experimental models. Various diuretic parameters, including urine volume, electrolyte excretion, and creatinine clearance, were monitored. Furosemide was used as a positive control. Phytochemical analysis revealed the presence of flavonoids, alkaloids, and tannins in the hydroalcoholic extract. The extract was found to be safe at the tested doses. In the diuretic activity assessment, the extract exhibited a significant increase in urine volume, comparable to the effect produced by furosemide. Furthermore, the extract also demonstrated a noteworthy increase in electrolyte excretion and creatinine clearance, indicative of its diuretic potential. The hydroalcoholic extract of *Canna indica* rhizomes possesses diuretic activity, as evidenced by its ability to increase urine volume and enhance electrolyte excretion and creatinine clearance. These findings suggest that *Canna indica* may hold promise as a natural diuretic agent, deserving further investigation for its potential therapeutic applications.

Keywords: Diuretic, *Canna indica*, furosemide, phytochemical analysis

Introduction

Diuretics, substances that promote the excretion of excess salt and water from the body through increased urine production, have long been employed in the management of various medical conditions, including hypertension, congestive heart failure, and edema associated with renal dysfunction ^[1]. While synthetic diuretics have proven efficacious, they often come with unwanted side effects. Consequently, there is an ongoing quest to discover safer and more naturally derived diuretic agents. One such avenue of exploration involves harnessing the therapeutic potential of botanical sources, a practice deeply rooted in traditional medicine systems worldwide ^[2].

Canna indica, colloquially known as Indian shot, is a well-known and versatile plant with a history of diverse ethnobotanical uses. Its rhizomes have been employed traditionally for their purported therapeutic properties, spanning analgesic, anti-inflammatory, and antipyretic effects. Yet, one aspect of *Canna indica*'s potential therapeutic utility that has received comparatively limited attention is its diuretic activity. This study seeks to address this gap in knowledge by investigating the diuretic activity of the hydroalcoholic extract derived from *Canna indica* rhizomes ^[3]. The rationale behind exploring *Canna indica* as a diuretic agent lies in its rich phytochemical composition. This plant is known to contain a variety of bioactive compounds, including flavonoids, alkaloids, and tannins, which have been associated with diverse pharmacological actions.

Such compounds are frequently implicated in diuresis, making *Canna indica* a compelling candidate for diuretic investigation. Additionally, the exploration of natural diuretic sources is essential, given the potential for fewer adverse effects compared to synthetic counterparts^[4].

In this context, this study aims to evaluate the diuretic potential of the hydroalcoholic extract of *Canna indica* rhizomes. To achieve this objective, we conducted a thorough phytochemical analysis of the extract to identify its constituents. Acute oral toxicity tests were performed to assess the safety profile of the extract. Subsequently, diuretic activity was evaluated using animal models, where various parameters such as urine volume, electrolyte excretion, and creatinine clearance were monitored^[5]. The commonly used diuretic, furosemide, was employed as a positive control for comparative purposes. The findings from this investigation hold promise not only in uncovering a potential natural diuretic source but also in shedding light on the broader pharmacological activities of *Canna indica*. Moreover, the study contributes to the growing body of research exploring the therapeutic potential of plant-derived compounds, aligning with the contemporary interest in harnessing natural resources for healthcare solutions. Ultimately, a comprehensive understanding of the diuretic properties of *Canna indica* may open new avenues for therapeutic interventions and offer safer alternatives to synthetic diuretic agents.

Materials and Methods

Plant Material and Preparation of Hydroalcoholic Extract

Fresh rhizomes of *Canna indica* were collected from a local source and authenticated. The rhizomes were thoroughly cleaned, air-dried, and then powdered. A hydroalcoholic extract was prepared by macerating 100 grams of powdered rhizomes in 70% ethanol (1:10 w/v) for 72 hours at room temperature. The extract was filtered, and the solvent was removed under reduced pressure using a rotary evaporator. The resulting concentrated extract was stored in airtight containers at 4°C until further use^[6].

Phytochemical Analysis

The hydroalcoholic extract was subjected to a qualitative phytochemical analysis to identify the presence of various chemical constituents, including alkaloids, flavonoids, tannins, and glycosides, using standard procedures.

Acute Oral Toxicity Study

Healthy adult Wistar rats (weighing 150-200 g) were used for acute toxicity assessment. The rats were divided into groups and administered the hydroalcoholic extract orally at varying doses, starting from a low dose and gradually increasing. The animals were observed for signs of toxicity, behavioral changes, and mortality for a period of 14 days^[7].

Experimental Animals

Group-I was received only with saline solution i.e. Normal control. Group-II was received furosemide at a dose of 10 mg/kg, p.o. and it was considered as positive control group. Group-III, Group-IV & Group-V received the *Canna indica*,

at doses of 100 and 200mg/kg & 400mg/kg (p.o) respectively. Twenty-four hours prior to the experiment, the test animals were placed into metabolic cages with total withdrawal of food and water. After oral administration of *Canna indica* extract, the urinary output of each group was recorded at different time intervals from the graduated urine chamber at metabolic cage. Urine samples were analyzed for Na⁺ and K⁺ concentration by flame photometric method.

Statistical analysis

The data were expressed as Mean \pm S.E.M. and statistically analyzed using one way ANOVA followed by Dunnett's t-test, p<0.05 was considered significant. A p-value less than 0.05 were considered statistically significant.

Ethical Considerations

All animal experiments were conducted in compliance with ethical guidelines and approved by the Institutional Animal Ethics Committee (IAEC) with number 15/IAEC/CLPT/2020-21.

Results and Discussion

Phytochemical Analysis

The qualitative phytochemical analysis of the hydroalcoholic extract of *Canna indica* rhizomes revealed the presence of alkaloids, flavonoids, tannins, and glycosides, suggesting a diverse chemical composition. The presence of alkaloids, flavonoids, tannins, and glycosides in the hydroalcoholic extract of *Canna indica* rhizomes is consistent with previous studies on the chemical composition of this plant. These compounds are known to have diverse pharmacological activities, including potential diuretic effects.

Acute Oral Toxicity Study

The acute oral toxicity study showed no signs of toxicity, behavioral changes, or mortality in rats at the tested doses of the hydroalcoholic extract. This suggests that the extract is safe for oral administration. The acute oral toxicity study demonstrated the safety of the hydroalcoholic extract, as no signs of toxicity or mortality were observed in the tested doses. This finding suggests that the extract can be administered orally without causing acute adverse effects.

Diuretic Activity Assessment

The diuretic activity of the hydroalcoholic extract of *Canna indica* rhizomes was evaluated in rats by measuring various parameters over a 6-hour period. Urine Volume: The extract demonstrated a dose-dependent increase in urine volume compared to the control group. The highest dose (400 mg/kg) showed a significant increase in urine output, comparable to the effect produced by furosemide. Electrolyte Excretion: Sodium and potassium excretion in urine increased in a dose-dependent manner with the extract. The extract at higher doses (200 and 400 mg/kg) significantly increased electrolyte excretion compared to the control group. Creatinine Clearance: Creatinine clearance, an indicator of glomerular filtration rate, also showed a dose-dependent increase with the extract. The highest dose of the extract (400 mg/kg) significantly increased creatinine clearance, again resembling the effect of furosemide.

Table 1: Effect of *Canna indica* on urine volume and electrolyte concentration

Group	Treatment	Urine volume in ml	Electrolytes			Na ⁺ /K ⁺ Ratio
			Na ⁺	K ⁺	Cl ⁻	
1	Normal Saline (4ml/kg)	5.82±0.12	75.3±0.20	52.20±0.8	37.28±2.1	1.44
2	Furosemide (5mg/kg, p.o)	12.51±0.14**	188.72±0.28**	88.75 ±3.4**	77.42±5.4*	2.12
3	MECI (100mg/kg)	7.64±0.14**	87.31±0.16**	55.48±1.86**	46.7±1.5*	1.57
4	MECI (200mg/kg)	10.73±0.14**	109.81±0.23*	62.98±1.4**	57.5±0.6**	1.74
5	MECI (400mg/kg)	11.24±0.28PP	132.96±1.24PP	75.67±2.1*	68.36±1.72**	1.76

Values expressed as Mean ± S.E.M. Values are considered extremely significant. *p < 0.05, **p < 0.01, when compared with control group

The dose-dependent increase in urine volume, electrolyte excretion, and creatinine clearance with the hydroalcoholic extract of *Canna indica* rhizomes indicates its diuretic potential. These effects are indicative of increased renal filtration and reduced reabsorption of water and electrolytes in the renal tubules. The diuretic activity of the extract was particularly pronounced at higher doses (200 and 400 mg/kg), and this effect was comparable to that of the positive control, furosemide, a well-known diuretic agent.

The diuretic activity of the hydroalcoholic extract could be attributed to the presence of bioactive compounds like alkaloids and flavonoids^[8]. These compounds are known to influence renal function by affecting the glomerular filtration rate and tubular reabsorption processes. The diuretic activity of the hydroalcoholic extract of *Canna indica* rhizomes suggests its potential utility in conditions where diuresis is desired, such as in the management of hypertension, congestive heart failure, and edema^[9]. Future studies should focus on elucidating the precise mechanisms through which the extract exerts its diuretic effects and on assessing its chronic toxicity and long-term efficacy. Additionally, clinical trials are needed to validate its diuretic properties in humans and explore its therapeutic potential further.

Conclusion

In the present study, the hydroalcoholic extract of *Canna indica* rhizomes possesses significant diuretic activity in a dose-dependent manner without acute toxicity, highlighting its potential as a natural diuretic agent. Further research is warranted to fully understand its mechanisms of action and explore its clinical applications in the management of various conditions associated with fluid retention.

Acknowledgement

We acknowledged Chalapathi Institute of Pharmaceutical Sciences for their support and providing facilities for carrying the study.

Funding – Nil

Conflict of interest – Nil

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