Diuretic Activity of Ethanolic Extract of *Bauhinia tomentosa* Linn Roots

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ABSTRACT

The present research examined the diuretic potential of the ethanolic derivatives of *Bauhinia tomentosa* Linn roots. The roots of this plant have been traditionally used for their diuretic effects, but scientific evidence supporting this claim is limited. The study utilized Wistar rats and evaluated urine volume, electrolyte excretion, and renal function to assess the diuretic functionality of the derivative. The findings demonstrated that the ethanolic extract considerably uprises urine output and improved the excretion of Na, K, and Ch compared to the control group. The diuretic effect was dose-dependent, with higher doses producing a greater effect. Furthermore, the diuretic activity of the derivative was comparable to that of the standard diuretic drug, furosemide. Statistical analysis confirmed the significance of the findings ($p < 0.001$). The phytochemical composition of the extract, which includes flavonoids, alkaloids, tannins, saponins, and phenolic compounds, may contribute to its diuretic properties. The study suggests that *Bauhinia tomentosa* Linn roots have potential as a natural diuretic agent, offering advantages over synthetic diuretics with fewer side effects. Further studies are needed to identify the active ingredient responsible for the observed diuretic effect and to elucidate the underlying mechanisms. The outcome is in line with the locally use of *Bauhinia tomentosa* Linn roots as a diuretic and warrant further investigation into their therapeutic applications.

Key Words: *Ethanolic extract of Bauhinia tomentosa Linn (EEBT) roots, Diuretic activity, Urine volume, Fluid overload, Synthetic drugs, Furosemide*

eIJPPR 2023; 13(2):25-29

HOW TO CITE THIS ARTICLE: Bhat R, Shanbhag P, Shabaraya AR. Diuretic Activity of Ethanolic Extract of *Bauhinia tomentosa* Linn Roots. Int J Pharm Phytopharmacol Res. 2023;13(2):25-9. https://doi.org/10.51847/Aw0gV7Mqbh

INTRODUCTION

Various civilizations have recognized and used medicinal plants' healing potential for ages [1]. In recent years, there has been a greater emphasis on investigating the pharmacological effects of traditional plant medicines as a source of new medicinal molecules [2]. *Bauhinia tomentosa* Linn, commonly referred to as "Yellow Bauhinia" is one such plant having a long history of usage in numerous systems of medicine [3].

Bauhinia tomentosa Linn belongs to the Fabaceae family and is indigenous to tropical and subtropical regions [4]. Different parts of this plant, including leaves, flowers, bark, and roots, have been traditionally employed for the management of several ailments, including diuretic effects [5]. Diuretics are substances that promote increased urine production, aiding in the elimination of excess fluids and waste products from the body. The putative diuretic properties of *Bauhinia tomentosa* Linn roots have drawn considerable attention in conventional medical practices [6]. Although there is anecdotal support for its diuretic effects, scientific validation and knowledge of the underlying mechanisms are lacking. The roots of *Bauhinia tomentosa* Linn contain a variety of bioactive substances, including flavonoids, alkaloids, tannins, saponins, and phenolic compounds, according to phytochemical studies [7]. These constituents are known to possess diverse pharmacological activities, including diuretic properties. Therefore, exploring the diuretic potential of the ethanolic extract of *Bauhinia tomentosa* Linn roots becomes imperative for better understanding its medicinal value and therapeutic applications.

Treatment for ailments like hypertension, edema, renal dysfunction, and congestive heart failure often involves the use of diuretic drugs [8]. Currently, available synthetic diuretics have several negative side effects, including electrolyte imbalances and renal impairment [9]. There is

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Received: 18 February 2023; **Revised:** 18 April 2023; **Accepted:** 19 April 2023

consequently an increasing interest in finding safer and more potent diuretic substances from natural sources, such as medicinal herbs [10]. This study seeks to examine the diuretic capacity of the ethanolic extract made from *Bauhinia tomentosa* Linn roots in light of the locally use of these roots as a diuretic agent and the paucity of scientific data to support this claim. Utilizing experimental animal models, the study measures the characteristics of urine volume, electrolyte excretion, and renal function to determine diuretic activity [11]. The findings of this research may support the traditional usage of *Bauhinia tomentosa* Linn roots as a diuretic and open the door to further investigation of their medicinal potential. Furthermore, discovery of the causative agent of the observed diuretic effect may lead to the development of new, less dangerous diuretics.

MATERIALS AND METHODS

The roots of *Bauhinia tomentosa Linn* were obtained from a local village in Mangalore and authenticated by botanist, Pilikula Nisargadhama, Vamanjoor, Mangalore. Its stored at the library of the dept for reference in the future. The current study was carried out at the Srinivas College of Pharmacy's Department of Pharmacology**.**

Plant extract

The roots of *Bauhinia tomentosa Linn* were sun-dried and roughly pulverized. A weighed amount (200 g) of powder was then subjected to continuous hot extraction with ethanol in a Soxhlet apparatus. The extract was filtered through a cotton plug, followed by Whatman filter paper (No. 1), and dried at 40-50°C to get a blackish-green semisolid material for final usage. The extract was stored in the refrigerator at 4 – 8 ^{0}C.

Animals

The following research used Wistar rats, which weigh between 150 and 200g for both sexes. Five groups of animals, each with six rats, were used. The animals were kept in a consistent 12-hour cycle of light and darkness and provided regular pelleted food and purified water as needed. All animals were kept in lab settings for 5 days before the experiment [12]. Prior to the experiment, the animals were denied food and drink for 18 hours. The ethical guidelines were followed during the execution of each experiment.

Drugs and chemicals

Furosemide 20 mg/kg body weight (Sanofi India Limited), EEBT 100, 200, and 400 mg/kg body weight, and distilled water.

Experimental design

Acute toxicity studies

Following the guidelines provided by the Organization for Economic Cooperation and Development (OECD) on testing the acute toxicity, an investigation was carried out. During the 24- to 72-hour observation periods, no adverse effects or death were seen in albino rats exposed to EEBT at doses up to 2 gm/kg, p.o. The rats were continuously examined for 5 hours throughout this time to check for any obvious behavioral, neurological, or autonomic toxic effects. After 24 to 72 hours, the animals were sacrificed [13].

Lipchitz method for diuretic activity

Wister rats were divided into 5 groups of n=6 each.
Group I – Received normal saline (25mL/kg) orally.
Group II – Received furosemide (20mg/kg) orally.
Group III – received 100 mg/kg EEBT root orally.
Group IV – received 200 mg/kg EEBT root orally.
Group V – received 400 mg/kg EEBT root orally.

Group 1 served as control (vehicle treatment) and group II served as standard (20 mg furosemide per kg body weight). Group III, Group IV and Group V were treated with ethanolic extract of Bauhinia tomentosa phosphorus root at 100 mg/kg, 200 mg/kg, 400 mg/kg body weight (orally). Treated. Immediately after dosing, rats/rat in each cage were placed in metabolic cages specifically designed to separate wine and faeces and maintained at room temperature of 25±0.50°C. The urine was gathered by using a cylinder for up to six hours. on the course of this, no food or water was made available to animals. Urine samples were stored in the refrigerator until Na+, K+, and Cl- levels were calculated. The amount of urine collected for each group was quantified. No preservatives were added to the urine samples during storage. By utilising 0.02N AgNO3 with 5% potassium chromate as an indicator, the amounts of urine Na+ and K+ were measured by flame photometry, and the quantity of Cl- was estimated titrimetrically.

Statistical analysis

By using the outcome parameters' Mean values and Standard Deviation, the impacts of EEBT were estimated. The analysis of variance (ANOVA) method was used to compare the outcomes of the investigated medicines. ANOVA was used to analyse the data, and Dunnett's test was then performed. The significance level was set at *p-0.05. Graph-pad Prism software was used for all of the statistical analysis.

RESULTS AND DISCUSSION

The findings from the assessment of the EEBT diuretic action were displayed in **Table 1**, **Figures 1 and 2**

According to the results, EEBT significantly increased urine output and increased salt, potassium, and chloride excretion when compared to control, indicating that it had a diuretic effect. It was found that the effect of EEBT was dose-dependent, meaning that among the three dosages examined, the higher dose generated a greater effect. The diuretic impact seen following treatment with EEBT was found to be considerable in terms of urine output, salt, potassium, and chloride concentrations when compared with the widely used diuretic medicine furosemide. Analyses of urine electrolyte concentrations showed that EEBT significantly raised the concentrations of the ions Na+, K+, and Cl-.

Table 1. Effects of oral administration of Ethanolic root extract of Mimosa pudica on urine volume and electrolyte excretion

Treatment	Dose (Oral)	Urine volume (ml)	Na+ (mEq/L)	K + (mEq/L)	Cl –(mEq/L)
Control	25 ml/kg	13.16±0.59	107.35±0.73	47.19±1.54	77.58±0.85
Standard	20 mg/kg	20.26±0.03***	188.49+2.45***	81.64±1.28***	127.41±1.74***
Test- 1	100 mg/kg	12.81±0.29***	129.40±2.80***	62.35±0.06***	91.41±0.99***
Test- 2	200 mg/kg	14.01±0.38***	164.99±2.00***	74.01±2.77***	100.06±2.25***
Test- 3	400 mg/kg	16.13±0.92***	179.17±0.69***	80.23±0.47***	112.96±1.05***

n=6, Values expressed as mean±SEM. Significance at p<0.001***. Compared with the control group (one-way ANOVA followed by Dunnett's 't'-test). BW: Body weight, EEBT: Ethanolic extract of *Bauhinia tomentosa* Linn root.

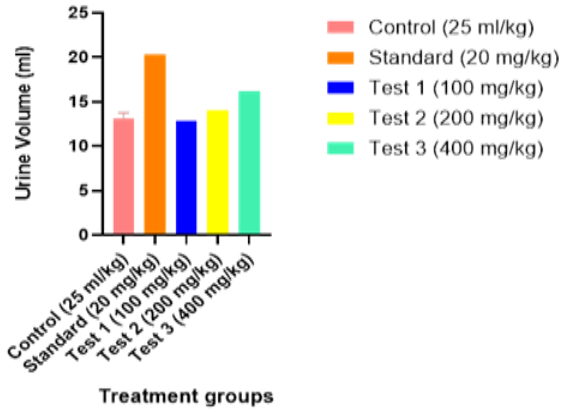

Figure 1. Comparative profile of volume of urine output after oral administration of 100, 200, 400mg/kg of EEBT.

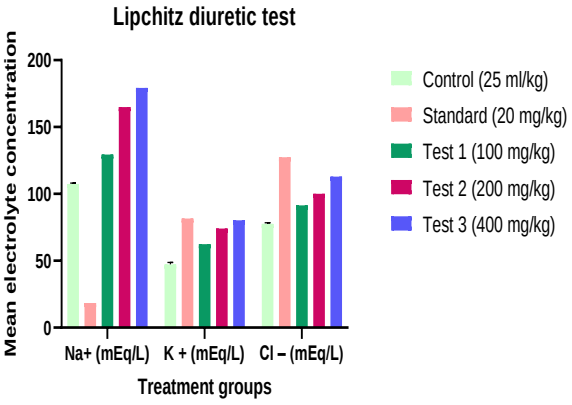

Figure 2. Comparative profile of concentrations of the ions Na+, K+, and Cl-. after oral administration 100, 200, 400mg/kg of EEBT.

Fluid overload can lead to complications like renal failure and hypertension [14]. Diuretic therapy helps in managing these conditions by reducing fluid volume and relieving the strain on the kidneys and cardiovascular system [15]. The most common reason for hospitalization for those over 65 is heart failure. Worldwide, more than 20 million people suffer from heart failure [16]. According to estimates, India has a prevalence of 1.3 to 4.6 million cases of heart failure and an annual incidence of 0.5 to 1.8 million [17]. Despite high rates of morbidity and mortality, little is known about the pathophysiologic processes of heart failure or how to treat it [18]. Even with the introduction of more modern and selective drugs, their adverse effect profiles are a drawback, and only a small percentage of cases exhibit resistance to standard therapy [19].

Diuretic agents have a critical function in the management of conditions such as hypertension, edema, renal dysfunction, and congestive heart failure [20]. Synthetic diuretics currently available in the market, including furosemide, are associated with various adverse effects, such as electrolyte imbalances and renal dysfunction. Depending on the class of diuretic, many routes are involved in the drug's activity. For example, loop diuretics like furosemide act by inhibiting the Na+-K+-2Cl- co-transporter in the thick ascending limb of the loop of Henle, leading to increased excretion of Na+, K+, and Cl-. This inhibitory effect disrupts the reabsorption of these ions, resulting in osmotic diuresis and subsequent water loss. Thiazide diuretics act on the distal convoluted tubule by inhibiting the Na+-Cl- co-transporter, while potassium-sparing diuretics act on the collecting ducts to promote Na+ excretion while reducing K+ excretion [21]. Therefore, there is a need to explore safer and more

effective diuretic agents from natural sources, such as medicinal plants.

The traditional use of *Bauhinia tomentosa* Linn roots as a diuretic agent is supported by the findings of this study. The increase in urine volume and electrolyte excretion indicates the potential of EEBT in promoting diuresis, which can aid in the elimination of excess fluid and waste products from the body. The exact mechanism of action of EEBT as a diuretic agent is not elucidated in this study. However, previous phytochemical investigations of *Bauhinia tomentosa* Linn roots have revealed the presence of various bioactive compounds, including flavonoids, alkaloids, tannins, saponins, and phenolic compounds. These constituents have been reported to possess diverse pharmacological activities, including diuretic properties. The combined action of these bioactive compounds in EEBT may contribute to its diuretic effect. The use of EEBT as a diuretic agent offers potential advantages over synthetic diuretics. Natural products derived from medicinal plants often exhibit a broad spectrum of pharmacological activities with fewer side effects compared to synthetic drugs. By validating the traditional use of *Bauhinia tomentosa* Linn roots and identifying the active constituents responsible for the diuretic activity, this study provides a basis for further exploration of its therapeutic potential.

CONCLUSION

The results of this study demonstrate the diuretic potential of the ethanolic extract of *Bauhinia tomentosa* Linn roots. The observed increase in urine volume and electrolyte excretion supports its traditional use as a diuretic agent. The dose-dependent effect and comparable activity to furosemide indicate the potential utility of *Bauhinia tomentosa* Linn roots in managing conditions associated with fluid overloads, such as edema, renal dysfunction, and hypertension. Further research is warranted to identify the active constituents and elucidate the mechanisms of action underlying the diuretic effect of *Bauhinia tomentosa* Linn roots.

Acknowledgments: I would like to thank the staff of the Department of Pharmacology, Srinivas College of Pharmacy for their support.

Conflict of interest: None

Financial support: None

Ethics statement: The experimental protocol and the number of animals used in this research study were approved by Institutional Animals Ethics Committee (IAEC) in its meeting held on 9th July 2022.

REFERENCES

[1] Petrovska B. Historical review of medicinal plants′ usage. Pharmacogn Rev. 2012;6(11):1.
[2] Yuan H, Ma Q, Ye L, Piao G. The Traditional Medicine and Modern Medicine from Natural Products. Molecules. 2016;21(5):559.
[3] Tanika T, Vaishnavi, Ravinder K, Shruti Sh, Rakesh T. A Review on Bauhinia Variegata and its Phytoconstituents. Ayushdhara. 2022;94-9.
[4] Al-Snafi AE. The pharmacological importance of Bauhinia variegata. Rev Int J Pharm Sci Res. 2013;4(12):160-4.
[5] Dutta KN, Chetia P, Lahkar S, Das S. Herbal plants used as diuretics: a comprehensive review. J Pharm Chem Biol Sci. 2014;2(1):27-32.
[6] Sathya B, Balamurugan K, Anbazhagan S, Jeganathan NS, Vimalson DC, Punitha E. Neuropharmacological Effect of Aqueous Extract of Bauhinia tomentosa L. Leaves in Experimental Animal Models. Int J Pharm Sci Rev Res. 2018;49(2):78-84.
[7] Dugasani S, Balijepalli MK, Tandra S, Pichika MR. Antimicrobial activity of Bauhinia tomentosa and Bauhinia vahlii roots. Pharmacogn Mag. 2010;6(23):204.
[8] Faris RF, Flather M, Purcell H, Poole-Wilson PA, Coats AJ. Diuretics for heart failure. Cochrane Database Syst Rev. 2012;(2).
[9] Shah PB, Soundararajan P, Sathiyasekaran BW, Hegde SC. Diuretics for people with chronic kidney disease. Cochrane Database Syst Rev. 2017;10.
[10] Karimi A, Majlesi M, Rafieian-Kopaei M. Herbal versus synthetic drugs; beliefs and facts. J Nephropharmacol. 2015;4(1):27.
[11] Al-Saikhan FI, Ansari MN. Evaluation of the diuretic and urinary electrolyte effects of methanolic extract of Peganum harmala L. in Wistar albino rats. Saudi J Biol Sci. 2016;23(6):749-53.
[12] Feige-Diller J, Krakenberg V, Bierbaum L, Seifert L, Palme R, Kaiser S, et al. The Effects of Different Feeding Routines on Welfare in Laboratory Mice. Front Vet Sci. 2020;6:479.
[13] Menzes C, Gupta K, Satyanarayana D, Jagadish Kamath V. Evaluation of Diuretic activity of Ficus glomerat ROXB in an experimental animal model. World J Pharm Pharm Sci. 2013;2(1):253-8.
[14] Khan YH, Sarriff A, Adnan AS, Khan AH, Mallhi TH. Chronic Kidney Disease, Fluid Overload, and Diuretics: A Complicated Triangle. Joles JA, editor. 2016;11(7):e0159335.
[15] Hansen L, Burks M, Kingman M, Stewart T. Volume Management in Pulmonary Arterial Hypertension

Patients: An Expert Pulmonary Hypertension Clinician Perspective. Pulm Ther. 2018;4(1):13-27.
[16] Savarese G, Lund LH. Global Public Health Burden of Heart Failure. Card Fail Rev. 2017;03(01):7.
[17] Martinez-Amezcua P, Haque W, Khera R, Kanaya AM, Sattar N, Lam CSP, et al. The Upcoming Epidemic of Heart Failure in South Asia. Circ Heart Fail. 2020;13(10).
[18] Schwinger RHG. Pathophysiology of heart failure. Cardiovasc Diagn Ther. 2021;11(1):263-76.
[19] Alomar MJ. Factors affecting the development of adverse drug reactions (Review article). Saudi Pharm J. 2014;22(2):83-94.
[20] Qavi AH, Kamal R, Schrier RW. Clinical Use of Diuretics in Heart Failure, Cirrhosis, and Nephrotic Syndrome. Int J Nephrol. 2015;2015:1-9.
[21] Oh SW, Han SY. Loop Diuretics in Clinical Practice. Electrolyte Blood Press. 2015;13(1):17.