International Journal of Pharmacy and Pharmaceutical Research (IJPPR)
Volume 30, Issue 9, September 2024 **ijppr.humanjournals.com** ISSN: 2349-7203

Herbal Medicines as Diuretics: A Review of The Scientific Evidence

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Received: 2024-09-07 Revised: 2024-09-15 Accepted: 2024-09-20

ABSTRACT

Abstract: In the Ayurveda system of ancient Indian traditional system of medicine, they called the diuretic substances as Muttra Virechanya Dravya. The significant source of diuretic substances are the medicinal herbs. These diuretic substances are very much use in ancient system of medicine. Many herbs are use as mono or poly herbal preparations to give diuretic effect. According to some studies there are more than 650 mono and polyherbal preparations from more than 75 plants. Diuretics normally causes increase the excretion of urine from our body this effect is used to treat many disorders like cardio vascular disease, edema, anxiety, diabetes mellitus, hypertension and liver degeneration disease. The objective of these study is to highlight the plant extract which promote diuretics. Many studies use flame photometer to estimate the Na^+ and K^+ level and Cl- by argenometric titration method. This study may help the researcher to select the medicinal plant for study on diuretics.

Keywords: Diuretic, Ayurveda, cardiovascular disorder, Medicinal Plants

INTRODUCTION

From ancient times human used many herbal and natural product base on folk medicines. A new worldwide trend has start to use these traditional plants medicine for the study to reveal their true health benefit by the scientist and health care professionals. This new trend has gained importance and popularity in the past few decades due to their safety, efficacy and cost effectiveness. There are 120 or more than plants are listed in Ayurveda which having diuretic qualities. Diuretic substance that increases the excretion of water from our body are very useful in many disorders like hypertension, cardiovascular disorder, premenstrual tension and nephritis etc. Now a days diuretics likes Mannitol, Thiazides, Furosemide and Ethacrynic acid are used but these synthetic diuretics inhibits potassium retention. This study reviewed the medicinal plants which show diuretic effects [1,2,3,4].

A. Coriander:

It is from the Umbelliferac family plant. Coriander is native to eastern Mediterranean where they were considered as field weed. Many countries farm this plant extensively including India, China, Russia and Bangladesh. It is use in cooking food. Some study explored the diuretic effect of coriander seed [5].

B. Funnel:

Funnel is a member of Apiacease family and grows in wilds of India and Europe. It's seed and roots may be responsible for its diuretic effect [5].

C. *Xanthium strumarium*

Xanthium strumarium, a prevalent weed discovered in India and categorized within the Compositae family, is utilized for medicinal purposes, particularly its roots and fruits.

Xanthium strumarium L. proliferates as a weed across wastelands. Locally referred to as Gokharu and Kutta zad, it is esteemed for its medicinal properties. Insights gleaned from conversations with local practitioners (hakims) underscore its multifaceted uses, wherein the entire plant serves as a blood purifier and a remedy for scabies. In Ayurveda, it is recognized as "Shankeshwara" and "Arishta," renowned for its anthelmintic, antipyretic, diuretic, cooling, laxative, alexiteric, tonic, digestive, and appetizing properties. Moreover, it is believed to enhance voice and complexion, aid in epilepsy and leucoderma, and serve as an antidote for insect bites, showcasing diuretic activity [(2)].

Diuretic Activity

P. Shravani et al. [6] investigated the diuretic effects of *Xanthium Strumarium* L. in albino rats. They administered the extract at doses of 250 and 500 mg/kg b.w., with Frusemide at 5 mg/kg b.w. serving as the standard. The graded doses of petroleum ether extract in normal saline exhibited a notable increase in diuresis, natriuresis, kaliuretic, and glomerular filtration rate. The extract led to increased urine output and higher excretion of Na+, K+, and Cl- compared to normal saline. Their findings suggested that the diuretic properties of the extract might be attributed to the presence of flavonoids, saponins, and organic acids. Additionally, they proposed that other secondary active metabolites could potentially contribute to the observed increase in water elimination.

D. *Samanea saman* (jacq) Merr

Samanea saman (Jacq) Merr is a towering umbraculiform tree, reaching heights of over 20 meters, boasting a stout trunk approximately 1.5 meters in diameter and a broad, expansive canopy that offers ample shade. Its bark is distinguished by a rough, deeply furrowed texture. Abundant alkaloids are purportedly found in the bark, stem, leaves, and seeds, while saponins and tannins are present in both leaves and stem. The trunk contains gum, and further constituents such as steroids, cardiac glycosides, and terpenoids have also been identified. This plant is utilized in the treatment of various ailments including acute bacillary dysentery, enteritis, diarrhoea, colds, sore throats, and headaches. Additionally, the decoction of its roots is employed in hot baths for stomach cancer. Alcoholic extracts derived from the leaves are utilized to address tuberculosis, while a decoction of the fruit serves as a sedative in Columbia [(2)].

Diuretic activity:

B. Komarapalayam et al. [7] conducted an evaluation on the diuretic activity of *Samanea saman* (Jacq) Merr bark in albino rats. They assessed the diuretic potential of the methanol extract of the bark using the in-vivo Lipschitz test model. Results indicated that the methanolic extract, administered at concentrations of 200 mg/kg and 400 mg/kg body weight, led to an increase in urine volume and electrolyte excretion compared to the control group. Furosemide, at a dose of 20 mg/kg b.w., served as the standard. The study found that the methanol extract of *Samanea saman* (Jacq) Merr, especially at higher doses, demonstrated diuretic activity comparable to that of the standard drug furosemide. Diuresis was accompanied by a significant increase in urine volume and excretion of urinary Na+, K+, and Cl^-.

E. *Morinda citrifolia* (Linn)

Morinda citrifolia Linn (Rubiaceae), commonly referred to as Noni or Indian Mulberry, is a globally cultivated small evergreen tree. Recognizable by its straight trunk, large bright green elliptical leaves, and tubular flowers, it bears ovoid yellow fruit. However, the mature fruit is distinguished by its unpleasant taste and odor [(2,8)].

Diuretic Activity

Preethi G. Pai et al. [9] They conducted a study on the diuretic activity of *Morinda citrifolia* Linn. The research involved saline-primed Wistar albino rats, with frusemide (10 mg/kg) serving as the standard drug. Two oral doses of the fruit juice, 5 mg/kg and 10 mg/kg, were administered. After 24 hours, urine volume and electrolyte (sodium, potassium, and chloride) excretion were measured, and the data were analysed using the Kruskal-Wallis and Mann-Whitney tests. The findings revealed that Noni fruit juice led to a statistically significant increase in urine volume in a dose-dependent manner, resulting in a diuretic index of 2.04 and 2.36 for the 5 ml/kg and 10 ml/kg dose ranges, respectively. Notably, there was a statistically significant decrease in sodium ion excretion. Although potassium excretion also decreased, the reduction was not statistically significant. These results suggest that the observed increase in urine formation may be attributed to an aquaretic action of Noni fruit rather than a natriuretic effect. The study underscores the need for further investigations involving larger doses and longer durations to fully elucidate the effects of Noni fruit on diuresis.

F. *Aerva lanata*[10]

The plant is characterized as an erect herbaceous weed with numerous branching stems. Its spikes, which vary in colour from white to pink, are clustered and typically measure between 1 and 1.5 inches in length. This species is widespread in regions including India, Sri Lanka, Arabia, Egypt, Ceylon, tropical Africa, Java, and the Philippines. In Sri Lanka, this plant holds traditional significance and is frequently recommended by Ayurvedic practitioners, either independently or in combination with other remedies, for addressing urinary infections. However, its utility extends beyond urinary infections, as it is believed to possess analgesic, anthelmintic, anti-inflammatory, anti-malarial, anti-venin, diuretic, and sedative properties.

Diuretic activity

Three trials were conducted in rats. Englert and Harnischfeger (1992) examined the diuretic effect of a mixture of leaves and stems from Orthosiphon in conscious, volume-loaded rats. Urine volume remained unchanged by this intervention, but urinary sodium increased approximately twofold (compared to placebo) at a dose of 750 mg/kg, as did urinary potassium (around twofold) and chloride (approximately threefold). However, statistical analysis was not provided, leading us to consider these effects as not significantly different, and consequently concluding that *Orthosiphon stamineus* had no discernible effect [10].

G. *Mangifera indica*

Mangifera indica, commonly known as mango, is a member of the Anacardiaceae family. Native to India, cultivated varieties of this species have been introduced to various warm regions worldwide. Remarkably, it stands as the tallest fruit tree globally, reaching heights of up to 100 feet, with trunk circumferences typically ranging from 12 to 14 feet, although occasionally exceeding 20 feet [3].

Shree Devi [11] conducted a study employing rats to investigate the diuretic effects of *Mangifera indica* bark extract. The study utilized ethanol, ethyl acetate, and a water extract of Mangifera indica to assess their diuretic efficacy. Oral administration of 250 mg of the extract per kilogram of body weight was carried out. The findings from the diuretic investigation revealed that the aqueous extract exhibited a higher Na+/K+ ratio compared to the ethanol and ethyl acetate extracts. Notably, the aqueous extracts demonstrated the most potent diuretic effect when compared to other extracts.

H. *Achyranthes aspera*:

Ayurvedic practitioners have historically employed Achyranthes aspera Linn (Amaranthaceae), also known as Apamarga, as a medicinal herb to address various ailments. Native Americans have similarly utilized the plant for its diverse therapeutic properties, including its roles as a diuretic, spermicidal agent, cardiovascular tonic, nephroprotective agent, antiparasitic agent, hypoglycaemic agent, analgesic, and antipyretic [5].

In a study, the diuretic efficacy of Achyranthes aspera whole plant methanolic extract was investigated. Lipschitz et al., utilizing furosemide as a reference medication, developed a methodology to assess the diuretic impact. While the diuretic effect observed in the treated rats exceeded that of the control group, it was not as robust as that of furosemide. Nonetheless, both the treatment and control groups exhibited a significant increase in renal clearance of sodium, potassium, and chloride ions [5].

I. *Bixa orellana*:

In the West Indies, tropical Asia, and Africa, the *Bixa Orellana* shrub or small tree is commonly cultivated for its seeds or as an ornamental plant. It is affectionately referred to as the "lipstick tree" due to its historical use by Native Americans for making body paint, particularly for the lips. Bixa leaf extracts exhibit potent antibacterial properties, notably against *Bacillus pumilus* and other Gram-positive pathogens. Additionally, Bixa leaves have been utilized in the treatment of leishmaniasis and malaria. To investigate its potential diuretic activity, dried leaf powder underwent several soxhlet extractions using petroleum ether, methanol, and water. Subsequently, these extracts were evaluated for diuretic activity in Wistar rats using a standardized protocol. The study revealed that the methanolic extract of *Bixa orellana* leaves exhibited robust diuretic effects, enhancing both urine production and the excretion of sodium, potassium, and chloride ions [5,12].

J. *Lepidium sativum* [3,13,14]

Lepidium sativum, commonly known as garden cress, is part of the Brassicaceae family. Both the seeds and leaves of this plant contain volatile oils. Garden cress seeds are recognized for their diverse medicinal properties, including being bitter, thermogenic, depurative, rubefacient, galactogogue, tonic, aphrodisiac, ophthalmic, antiscorbutic, antihistaminic, and diuretic. They have been

traditionally utilized in treating various ailments such as asthma, coughs with expectoration, poultices for sprains, leprosy, skin diseases, dysentery, diarrhoea, splenomegaly, dyspepsia, lumbago, leucorrhoea, scurvy, and seminal weakness. Studies have indicated that garden cress seeds can alleviate asthma symptoms and improve lung function in individuals suffering from asthma. The plant is abundant in chemical constituents such as flavonoids, coumarins, glycosides, glucosinolates, glucotropaeolin, triterpenes, sterols, and alkaloids. Research has shown that both aqueous and methanolic extracts of L. sativum significantly increase urine volume. Furthermore, these extracts enhance sodium excretion, while the aqueous extract also increases potassium excretion. The diuretic effect of these extracts is comparable to that of hydrochlorothiazide, a reference drug, with the additional benefit of potassium conservation observed with the methanolic extract.

K. *Taraxacum officinale* [3,15]

Taraxacum officinale, commonly known as the common dandelion, is a flowering herbaceous perennial plant belonging to the Asteraceae family. Dandelion is not only a widely recognized food source but also holds medicinal significance. Its leaves are commonly used in salads and teas, while the roots are occasionally utilized as a coffee substitute. For centuries, dandelion leaves and roots have been employed in the treatment of liver, gallbladder, kidney, and joint issues. Traditionally, dandelion has been considered an alternative remedy for conditions like eczema and cancer [3].

Experimental research on mice has shown that high doses of an aqueous extract of dandelion leaf (2 g per kg body weight) display diuretic activity similar to that of furosemide. Additionally, dandelion is recognized as a rich source of potassium. Some researchers speculate that it may effectively replenish potassium lost through diuresis [15].

L. *Holarrhena antidysenterica* [2,16]

Holarrhena antidysenterica, belonging to the family Apocyanaceae, is commonly known as bitter oleander and locally referred to as Kurchi. It is a small deciduous tree primarily found in the Himalayan and sub-Himalayan regions. Traditionally, *Holarrhena antidysenterica* has been utilized in various disorders such as colic, diarrhoea, dysentery, and fever. Additionally, it is employed as a carminative, astringent, lithotripsic, tonic, aphrodisiac, cardio suppressant, diuretic, and antihypertensive agent [2].

Anwarul-Hassan Gilani et al. conducted a study on the crude extract of *Holarrhena antidysenterica* seeds and its fractions (n-hexane, n-butanol, and aqueous) to evaluate their diuretic effect in Wistar rats. Hydrochlorothiazide at a dose of 10 mg/kg b.w. served as the standard. The crude aqueous ethanolic extract exhibited a dose-dependent increase in urine output at doses of 30 and 100 mg/kg, indicating its diuretic effect. Furthermore, the crude extract elevated urine levels of Na+ and K+, as well as urine volume, pH value, and electrolyte levels, corroborating its diuretic effects. However, none of the fractions showed a diuretic effect as strong as that of the original crude extract. The hexane extract showed no diuretic effect, while the butanol extract exhibited a mild diuretic effect at 30 mg/kg. On the other hand, the aqueous extract induced a significant increase in urine output only at 100 mg/kg, suggesting that the diuretic activity is distributed among fractions in an order of increasing polarity of the solvent. The study concluded that the diuretic activity of *Holarrhena antidysenterica* may be mediated through its saluretic effect, which supports its traditional medicinal use as a diuretic [16].

M. *Mimosa pudica* [5,17]

Mimosa pudica, also known as the sensitive plant or the sleeping plant, is a creeping annual or perennial herb prized for its unique compound leaves. These leaves exhibit a fascinating response: when disturbed or touched, they droop and fold inward, providing protection to the plant's young from potential attackers before re-emerging shortly thereafter. The species is native to Central and South America and thrives primarily in shaded areas, often beneath trees or bushes [5].

A study was conducted to evaluate the diuretic properties of *Mimosa pudica* Linn. Aqueous extract in albino rats. The Lipchitz test was employed to analyze the leaves, and aqueous extracts of M. pudica leaves were administered to three test groups at doses of 100, 200, and 400 mg/kg, respectively. The control group received 0.9% NaCl, while the standard group received furosemide. Urine biochemistry was analyzed using calorimetry. The results indicated that at a dose of 100 mg/kg p.o., the aqueous extract of M. pudica leaves significantly increased electrolyte excretion. However, further increasing the dose of the test drug did not lead to a proportional increase in its diuretic activity [17].

N. Euphorbia thymifolia [2,18]

Euphorbia thymifolia Linn, a member of the Euphorbiaceae family, holds significance as a versatile plant in the desert and arid regions of the Indian subcontinent. It plays a crucial role in providing vegetative cover in dry, hot, and sandy desert areas where few

other plants thrive. *Euphorbia thymifolia* is renowned for its resilience and adaptability, making it an invaluable species in such challenging environments [(2)].

Diuretic activity

Sandeep R. Kane et al. [(18)] conducted a study to investigate the diuretic activity of the crude ethanolic extract and fractions of *Euphorbia Thymifolia* Linn in albino rats, comparing them with the standard drug Furosemide (10mg/kg, p.o.). The extracts were administered at doses of 200 and 400mg/kg b.w. The study found that the extract exhibited significant diuretic activity in a dose-dependent manner. Additionally, fractions of the extract potentiated the diuretic activity. These effects are likely attributed to the phytoconstituents present in the ethanolic extract of *Euphorbia Thymifolia* Linn. At the higher dose tested (400 mg/kg p.o.), it increased urine output and electrolyte concentration, with the diethyl ether fraction being the most effective.

O. *Erythrina indica lam.* [(2,19)]

Erythrina indica Lam., commonly known as the Indian coral tree, is a medium-sized deciduous tree characterized by its spiny nature. It typically grows to a height of 6-9 meters, with young stems and branches adorned with thickly armed stout conical spines measuring up to 8mm in length. The leaves of *Erythrina indica* are trifoliate and alternate, displaying a bright emerald green colour. They are borne on long petioles measuring 6-15cm in length, with the rachis ranging from 5-30cm long. The leaflets are prickly, smooth, and shiny, broader than long, typically measuring 8-20 by 5-15cm in size, and are ovate to acuminate with an obtusely pointed end [(2)].

Diuretic activity

Erythrina indica Lam. is utilized in traditional medicine as a diuretic. M. Jesupillai et al. they conducted an evaluation of the diuretic activity of ethanol, chloroform, and ethyl acetate extracts of the leaves of *Erythrina indica* Lam. in albino rats. The results were compared with furosemide, a standard diuretic, administered at 20 mg/kg body weight. Their findings revealed that all extracts exhibited significant diuretic activity at the dose of 250 mg/kg. This was evidenced by an increase in the total urine volume and the urine concentration of Na+, K+, and Cl- [(19)].

CONCLUSION :

The objective of the current review is to provide an overview of the existing information on the utilization of herbal drugs as diuretics. Diuretics are commonly employed as the initial treatment for patients with hypertension in clinical practice. Herbal medicines are highly sought after in both industrialized and developing countries due to their broad biological and therapeutic actions, enhanced safety margins, and lower costs, making them a primary choice for healthcare. This review encompasses information on the botanical characteristics of plants, aiding in their identification, as well as their documented behaviours and ethnobotanical uses. However, there is a limited number of studies available, necessitating further research to validate the purported actions. Such evidence is crucial for scientifically substantiating the folkloric usage of traditional medicines and may contribute to the development of novel drugs, treatments, and treatment recommendations. The investigation underscores the presence of numerous plants in nature with potent diuretic properties. Unlike allopathic pharmaceuticals, herbal medicines generally lack toxicities or side effects. The primary aim of this review is to provide a comprehensive overview of the knowledge pertaining to the use of herbal medications as diuretics.

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How to cite this article:
Salam Bhupendra Singh et al. Ijppr.Human, 2024; Vol. 30 (9): 254-259.

Conflict of Interest Statement: All authors have nothing else to disclose.

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