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A Thorough Review of *Mutral* Herbs

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Abstract

In the present era, the cases of renal diseases are speedily growing and relapses of these diseases are also very frequent. Diuretics in contemporary science, play a major role in the treatment of renal anomalies, but they have side effects too. So, to combat the situation, Ayurvedic *Mutral* drugs are gaining wide acceptance as they are safe and effective. In Ayurveda, great importance has been given to *Mutra* and *Mutravaha srotas* in maintaining the health of an individual. This can be illustrated by the fact that to deal with urinary disorders, Acharya Charak has specifically mentioned the *Mutravirechaniya Mahakashaya* and Acharya Sushruta and Acharya Vagbhata have mentioned *Veertarvadigana* and *Trinapanchmoolagana*. The herbs of the above-mentioned *Kashaya* and *Gana* are used to treat various renal ailments like burning micturition, scanty urine, calculi, etc. Apart from this, they also help to re-establish the normal physiological function of the affected renal tissues and organs. Hence, due to these attributes, they are the components of a wide number of Ayurvedic *Mutral* formulations. The current review is undertaken for screening the therapeutic action on the renal system of a total twelve herbs, taken from *Mutravirechaniya Mahakashaya*, *Veertarvadigana* and *Trinapanchmoola gana*. Various research studies concerning property of increasing urinary output (*Mutral*) of such plants are compiled here. These drugs are mostly *sheet virya* and *snigdha guna*, so increase the watery content of urine, thereby increasing its amount and flow.

Keywords: *Mutravirechaniya Mahakashaya, Mutral, Trinapanchmoola gana, Veertarvadigana*, Diuretic.

INTRODUCTION

At present, urinary ailments are becoming quite common, annually affecting over 150 million individuals globally [1]. As per a comparative clinical study assessing kidney and urinary system diseases, it was found that these diseases contribute to approximately 8,30,000 deaths and 18,467,000 cases of illness yearly. This places these conditions at the 12th rank among the leading causes of death and the 17th rank for causing dysfunction [2]. In Ayurveda, Acharyas have given broad importance to *Mutra* and *Mutragat vikaras.* Various Acharyas have mentioned the importance of *Mutra* in their respective texts. Acharya Sushruta has opined "*Dosha dhathu mala mulam hi shareeram*" i.e. *Dosha, Dhathu* and *Mala* are the basic fundamentals of the *Shareera* (Body) [3]. Mala here signifies *Trimala* i.e. *Purish, Mutra* and *Sweda*. Acharya Sushruta has also specified that the *Samyak visarjan* of *mala* is one of the characteristics of *Swastha* (healthy) [4]. *Mutra* being one among the *Mala*, wide importance has been given to understanding its physiology and function in the body. Acharya Vagbhatta has included *Mutravega* among the thirteen *Adharaniya Vegas* [5]. Acharya further added that it plays a major role in *Kledavahana* and hence helps in eliminating the waste metabolites from the body [6]. Along with these, *Basti* i.e. the *moola* of the *Mutra* is placed in one of the *Trimarma* [7]. Hence, considering the importance of *Mutra*, Acharya Charaka and Acharya Vagbhatt have mentioned *Mutravirechaniya Mahakashaya*, which is used primarily to increase urine output along with dealing with other renal ailments. *Mahakashaya* is a group of ten drugs that are used individually or in combination to perform specific function. The plants in *Mutravirechaniya Mahakashaya* are *Vrukshadani, Shvadanshtra, Vasuka, Vashira, Pashanabheda, Darbha, Kusha, Kasha, Gundra* and

itkatamula [8]. Five of these ten plants namely *Vasuka, Vashira, Darbha, Kusha and Kasha* are also the contents of *Trinapanchmoola Gana* [9]. Moreover, Acharya Sushruta has specified *Veertarvadigana* for increasing urine output and managing renal anomalies. This *Gana* comprises of almost similar above-mentioned drugs like *Vasuka, Vashira, Kusha, Kasha, Gundra, Pashanbheda, Gokshura* and added *Shar* and *Sahchar* [10]. In the Modern System of medicine, diuretic drugs are used to enhance urine output. These drugs primarily cause a net loss of Na^+ and increase the excretion of water in urine [11]. These are widely prescribed but they have side effects too. So, the above-stated Ayurvedic *Mutral* drugs are a better substitute for modern diuretics. Various research studies conducted on these herbs have proven that they are effective, safe and have fewer side effects as compared to modern diuretics. Thus, in this review, an attempt has been made to compile all the related studies of these herbs and to understand the mechanism of *Mutral* (diuretic) action of these herbs in both concepts, the ancient as well as contemporary.

Mutra Nirman as Per Ayurveda

Following the digestion of *Aahara*, the digested *Aahara* is divided into two components i.e. the *Saara* and the *Kitta*. The liquid portion of the *Kitta* is transported from the *Pakvashaya* to the *Vasti* via *sookshma srotas*. Upon reaching the *Vasti*, it is expelled as *Mutra* through the *Mutravaha srotas*. In this process of micturition, *Apana vayu* plays a significant role [12].

Modern Concept of Urine Formation [13]

The process of urine formation begins with Glomerular filtration and extends to Tubular secretion in a prodigal way. At the glomerulus, all the soluble components of the blood, except for plasma proteins and lipids, are filtered.

Three stages are involved in the Formation of urine:

1. Glomerular Filtration
2. Tubular reabsorption
3. Tubular Secretion.

1. Glomerular Filtration

In Glomerular Capillaries, the blood is filtered based on the pressure difference between the blood entering into the glomerulus and the filtrate in the glomerular capsule. This process retains the blood cells and protein, and only allowing the passage of the remaining material for further stages**.** The rate at which filtrate is produced by both kidneys per minute is termed as the Glomerular Filtration Rate (GFR), typically measuring about 125 ml/min, resulting in approximately 180 liters of filtrate daily. Almost all of this filtrate is reabsorbed, with less than 1% i.e. 1 to 1.5 liters being excreted as urine.

2. Tubular Reabsorption

This process facilitates in the reabsorption of glomerular filtrate as it passes through the different parts of nephrons, including the Proximal Convoluted Tubule (PCT), Loop of Henle, Distal Convoluted Tubule (DCT) and the collecting tubule. This stage is vital for maintaining the body's fluid-electrolyte balance and pH level. The PCT efficiently reabsorbs water, glucose, amino acids, vitamins, hormones, etc., while active transport mechanism handles substances like sodium, potassium, calcium, phosphate and chloride. Various processes such as Na^+/H^+ exchange, direct entry of Na^+, transport of Na^+ and K^+ along with glucose, amino acids, phosphates facilitate reabsorption in the PCT. Moving through the Loop of Henle, water, sodium and chloride are predominantly reabsorbed through osmosis. Only a fraction (15-20%) of the filtrate reaches the DCT, where further absorption occurs. However, the reabsorption of nitrogenous waste products like urea and uric acid is quite limited.

3. Tubular Secretion

It the peritubular capillaries surrounding the renal tubules, active elimination of waste products like creatinine, excess H^+ and excess K^+ ions occur. The excess K^+ ions are released in the tubules while Na^+ ions are absorbed in exchange to maintain the normal body physiology. The secretion of Hydrogen ions (H^+) into the tubules plays a significant role in regulating the normal blood pH. The filtered substance in the tubules is ultimately termed as Urine.

Diuretic

The word "Diuretic" is derived from the Greek words *Di* (dilute) and *uretics* (urine) [14]. A diuretic is any substance that causes a net loss of Na^+, increases urine output and thereby increases water excretion [15]. The diuretics act primarily by reducing Sodium chloride reabsorption through tubules. Just a 1% decrease in the tubular reabsorption of sodium leads to more than double urine output. The other mechanism of diuretic is by osmosis [16]. Diuretics of the modern system of medicine can be correlated with *Mutra Virechaniya Dravya* or *Mutral Dravya* in Ayurveda.

Mutra virechaniya Dravya

"*Yat dravyam mutrasya atipravartanam karoti tat mutravirechaneeyam."* [17].

This means the herbs which increase the urinary output are known as *Mutravirechaniya dravyas.* Examples are *Vrukshadani, Shvadanshtra, Vasuka, Vashira, Pashanabheda, Darbha, Kusha, Kasha, Gundra, itkatamula,* etc. As per Acharya Charaka, the *Panchbhautik* composition of *Mutra* primarily comprises *Jala Mahabhoot*. [18]

MATERIAL AND METHODS

Table 1: *Mutral* Drugs [19]

Drugs	Botanical Name	Family	Part used
Vrukshadani (Vandaak)	*Dendrophthoe falcata* Linn.	Loranthaceae	Whole plant
Shwadanstra	*Tribulus terrestris* Linn.	Zygophyllaceae	Fruit & root
Vasuka (Punarnava)	*Boerhavia diffusa* Linn.	Nyctaginaceae	Root, seed, whole plant
Vashira	*Achyranthes aspera* Linn.	Amaranthaceae	Root, seed, leaves, whole plant
Pashanbheda	*Bergenia ligulata* Wall.	Saxifragaceae	Root
Darbha	*Imperata cylinderica* Beauv.	Gramineae	Root
Kusha	*Desmostachya bipinnata* Stapf.	Gramineae	Root
Kasha	*Saccharum spontaneum* Linn.	Gramineae	Root
Gundra	*Typha angustata* Bory	Typhaceae	Rhizome, root
Itkatmula	*Saccharum officinarum* Linn.	Gramineae	Root
Shar	*Saccharum munja* Roxb.	Gramineae	Root
Sahchar	*Barleria prionitis* Linn.	Acanthaceae	Whole plant, specially leaves

Table 2: *Rasa Panchaka* of *Mutral* drugs

Drugs	*Rasa*	*Guna*	*Virya*	*Vipaka*	*Doshaghnata*	*Karma*
Vrukshadani (Vandaak)	*Kashaya, Tikta, Madhur*	*Laghu, Ruksha*	*Sheet*	*Katu*	*Kapha Pittashamak*	*Mutral, Mutrakrichahara*
Shwadanstra	*Madhur*	*Guru, Snigdha*	*Sheet*	*Madhur*	*Vatapittashamak*	*Mutral, Mutrakrichahara*
Vasuka (Punarnava)	*Kashaya, Katu*	*Guru*	*Sheet*	*Katu*	*PittaKaphashamak*	*Mutrakrichahara, Mutral, Vastishothshamak*
Vashira	*Katu, Tikta*	*Laghu, Ruksha, Tikshna*	*Ushna*	*Katu*	*KaphaVatashamak*	*Mutral, Mutraamlatanashak*
Pashanbheda	*Kashaya, Tikta*	*Laghu, Snigdha, Tikshna*	*Sheet*	*Katu*	*Tridoshshamak*	*Mutral, Mutrakrichahara*
Darbha	*Madhur, Kashaya*	*Laghu, Snigdha*	*Sheet*	*Madhur*	*Tridoshshamak*	*Mutral, Mutrakrichahara*
Kusha	*Madhur, Kashaya*	*Laghu, Snigdha*	*Sheet*	*Madhur*	*Tridoshshamak*	*Mutral, Mutrakrichahara*
Kasha	*Madhur, Kashaya*	*Laghu, Snigdha*	*Sheet*	*Madhur*	*VataPittashamak*	*Mutral, Mutrakrichahara,*
Gundra	*Kashaya,Madhur*	*Snigdha*	*Sheet* [20]	-	*Pittanashak*	*Mutral, Mutrakrichahara,*
Itkatmula	*Madhur*	*Guru, Snigdha*	*Sheet*	*Madhur*	*VataPittashamak, Kaphavardhak*	*Mutral, Mutrakrichahara, Vrikkaroga*
Shar	*Madhur, Tikta*	*Laghu, Snigdha*	*Sheet*	*Madhur*	*Tridosh shamak*	*Mutral, Mutrakrichahara*
Sahchar	*Tikta, Madhur*	*Laghu*	*Ushna*	*Katu*	*Kaphavatashamak*	*Mutral*

***Vrukshadani* (*Dendrophthoe Falcata* Linn.)**

A research study was conducted to compared the diuretic effect of *Vrukshadani's* active ingredient in aqueous form at a dosage of 4 g/kg orally with furosemide (4 mg/kg) and hydrochlorothiazide (10 mg/kg). The result found a significant increase in urine output and elimination of excess salts [21]. Another study aimed to demonstrate the diuretic activity of the petroleum ether extract from leaves of *Dendrophthoe falcata* in Wistar rats, administered at doses of 250mg/kg and 500mg/kg showed a dose-dependent increase in urine output [22].

***Shwadanstra* (*Tribulus Terrestris* Linn.)**

In an study, the aqueous extract obtained from the fruits and leaves of *Tribulus Terrestris* demonstrated positive diuretic effect at 5g/Kg dosage, surpassing the effect of the standard drug Furosemide. This was also accompanied by elevated levels of Na^+, K^+ and Cl^+ in the urine [23]. In another study, *In-vivo* research was conducted to examine the diuretic potential of various extracts including aqueous, methanolic, *Kwatha*-low strength, *Kwatha*-high strength and *Ghana* powder of *Tribulus terrestris* fruits. The high-strength *Kwatha* demonstrated the most potent diuretic effect, almost comparable to that of the standard drug furosemide. Additionally, it also showed potassium-sparing effect [24]. These extracts markedly increase urine output

while decreasing electrolyte levels. Furthermore, a significant decrease in the sodium level and serum potassium level was also seen throughout the study period [25]. Another study, in albino rats, confirmed the diuretic property of the aqueous extract of the *Tribulus terrestris* by increasing its sodium and chloride concentration in the urine. These findings also suggest its potential use in the treatment of kidney disorders [26]. Similarly, a study on the watery extract of *Gokshura*, conducted both in rats and dogs, revealed a diuretic activity equivalent to that of urea.

***Vasuk* or *Punarnava* (*Boerhavia Diffusa* Linn.)**

An *in-vivo* study was conducted to evaluate the effect of *Convolvulus pluricaulis* and *Boerhavia diffusa* on diuretic activity. The finding revealed a notable diuretic activity in both the extracts. Out of which the root extract showed more increase in urine output (90.3%) than leave extract (67.22%) [27]. In a different study**,** isolated alkaloid Punarnavine and water-soluble base choline from *Boerhavia diffusa* roots were studied for diuresis property. The result showed a significant diuresis at a dose of 5 mg/100 g [28]. *Boerhavia diffusa* was identified as a diuretic acting on the glomeruli of the kidney and also protecting the kidney from being damaged [29]. With special reference to nephrotic syndrome, the *Boerhaavia diffusa* extract is evaluated as having a diuretic effect [30]. A noticeable diuretic effect was also found in the glucosidic compound extracted from the *Boerhavia diffusa* [31].

***Vashira* (*Achyranthes Aspera* Linn.)**

An *in-vivo* diuretic study of crude aqueous extract of *Achyranthes aspera* in albino rats and mice, displayed noteworthy diuretic ($p < 0.001$), natriuretic ($p < 0.001$) and kaliuretic ($p < 0.001$) properties. The diuretic activity increased proportionately with the dosage, reaching its peak at 50 mg/Kg. Additionally, male rats showed an enhanced diuretic effect when administered with the methanolic extract of *Achyranthes aspera* [32]. Another investigation by Gupta S etal showcased the significant diuretic effect of saponin extracted from seed of *Achyranthes aspera* [33]. In the oral administration of achyranthine at a dose of 5mg/ kg in rats resulted effective diuresis effect [34].

***Pashanbheda* (*Bergenia Ligulata* Wall.)**

In a study examining the diuretic property, the effect of the alcoholic extract of *Bergenia ligulata* was contrasted with the standard drug, furosemide. The research manifested a positive diuretic effect attributed to the presence of alkaloids like flavonoids and saponins [35]. Another investigation revealed that rats exhibited increased urine production with low dose (0.5 mg/kg) of *B. ligulata* extract while higher dose (100 mg/kg) resulted in a reduction in urine output [36].

***Darbha* (*Imperata Cylinderica* Beauv.)**

The research conducted on albino rats regarding *Imperata cylindrica* demonstrated noteworthy diuretic, natriuretic and Kaluretic actions [37]. In a comparative clinical diuretic study of 14 days carried out in healthy volunteers was performed between *Darbha Choorna* and *Kusha Choorna*. The result revealed that both the drugs led an increase in urine volume, with *Darbha Choorna* showed a slightly more pronounced effect than *Kusha Choorna*. Additionally, these medicines not only elevated the urinary output but also reduced the presence of pus cells that were found, before the participants started taking the *Choorna* [38].

***Kusha* (*Desmostachya Bipinnata* Stapf.)**

The hydroalcoholic extract showed significant diuretic activity, demonstrating a significant increase in urinary output at a dosage of 500 mg/kg when compared to the standard furosemide ($P< 0.01$). Additionally, this extract proved effective in enhancing the concentrations of urinary electrolytes (Na+, K+, and Cl-) [39]. In Indian traditional medicine, it is employed as a diuretic and is also utilised for addressing issues like burning sensation and excessive perspiration [40].

***Kasha* (*Saccharum Spontaneum* Linn.)**

Bhav Prakash Nighantu has described it as a *Mutrajanan* (diuretic) [41].

***Gundra* (*Typha Angustata* Bory)**

The use of *Gundra* as *Mutrajanak* is well documented in Ayurvedic texts [42]. Bhav Prakash has mentioned its therapeutic application in *Mutrakrichha* and for *Shodhan of Mutra* [20].

***Itkatmula* (*Saccharum Officinarum* Linn.)**

The ethanol extract (50%) of fresh leaves given intragastrically to rats at a dose of 40 ml/kg, showed active diuretic activity, while its decoction did not [43, 44].

***Shar* (*Saccharum Munja* Roxb.)**

It is used in urinary calculi due to its *Shita Virya* and *mutrajanan* properties [45]. The leaves possess lithotriptic action [46, 47].

***Sahchar* (*Barleria Prionitis* Linn.)**

The aqueous extract of flower, administered at a dose of 200 mg/kg, demonstrated significant diuresis, leading to a 24-hour urine volume of 12.58±0.80. This volume was statistically comparable with the diuretic effect of furosemide at 20 mg/kg (12.58±0.80), where the 24-hour urine volume was also 12.58±0.80. Furthermore, the aqueous root extract from the roots also enhanced the excretion of sodium [48].

DISCUSSION

The Ancient Acharyas placed significant emphasis on the role of *Mutra* and *Mutravaha Srotas* in maintaining the homeostasis of health. For this purpose, Acharya Charak classified three distinct groups as *Mutravirechaniya*, *Mutravirajniya* and *Mutrasangrahniya Mahakashaya*. Each group comprises

ten plants aimed at addressing various *Mutra* related ailments. The *Mutravirechaniya* group is intended to increase the urine output, the *Mutravirajniya* group helps restore normal *varna* (colour) to urine and the *Mutasangrahniya* group aids in controlling excessive urine production. This article specially focusses on the *Mutral* (diuretic) property, so elaborating only the contents of *Mutravirechaniya Mahakashaya.* Likewise, Acharya Sushruta outlined a specific group called *Veertarvadi Gana* for managing urinary disorders like *Mutrakrichha, Mutraghat* and *Ashmari.* Additionally, Acharya Vagbhata mentioned *Trina Panchmoola Gana* for the same purpose. The *Mutravirechaniya Mahakashaya* consists of ten ingredients namely *Vrukshadani, Shvadanshtra, Vasuka (Punarnava), Vashira, Pashanabheda, Darbha, Kusha, Kasha, Gundra* and *Itkatamula*. The *Veertarvadi Gana* incorporates these ingredients along with some additional herbs i.e. *Shar* and *Sahchar***.** In Ayurveda, the principle of *Samanya* asserts that substances with similar attributes to a particular *Dhatu* or *Guna* can enhance those specific *Dhatu* or *Guna* in the body [49]. So, as per the principle, as the *Panchbhautik* composition of *Mutra* primarily comprises of *Jala Mahabhoot* and *Snigdha* and *Sheet Guna*, herbs with similar qualities such as *Sheet Virya* and *Snigdha Guna,* are believed to increase urine secretion, making them classified as *Mutral.* Accordingly, plants like *Vrukshadani, Shwadanstra, Vasuka, Pashanbheda, Darbha, Kusha, Kasha, Gundra, Itkatmula, Ikshu* and *Shar* demonstrated their *Mutral* property. Further, it is important to highlight that among the mentioned herbs, *Pashanbheda* is considered controversial while *Gundra* is rarely found [50].

As per the contemporary science, the process of urine formation involves the elimination of surplus of K^+ and H^+ ions while simultaneously absorbing Na^+ ions. Diuretic drugs function by different mechanisms. Primarily, inducing a net loss of Na^+ ions, resulting in an increased water excretion in urine. Another mechanism involves an osmotic process, where osmotic agents increase the osmotic pressure in the PCT and Loop of Henle. This, in turn, reduces water absorption and increases its elimination through urine. In the above-stated studies, it is seen that *Vrukshadani* showed an elevation in urine output due to the presence of tannins and flavonoids. Additionally, it's composition includes sugar, which due to its osmotic activity, opposes the reabsorption of water from the glomerular filtrate. Hence produces diuresis [51]. *Gokshura* demonstrated comparable diuretic effect as standard drug. It was noted to contain significant amounts of potassium and nitrate ions, indicating its substantial role in diuresis [52]. *Punarnava* serves as an effective diuretic by expediting the kidney's filtration process, facilitating the elimination of excess fluids and waste products [53]. This is attributed to the high potassium content in the water-soluble fraction of its root and leaves. This fraction induces urine secretion through the exchange of potassium ions with the Sodium ions, a process akin to normal urine secretion [54]. The diuretic activity is further influenced by the presence of β-ecdysone alkaloid, specially extracted from the root of *Boerhavia diffusa*. *[Suri]* Additionally, *Punarnava* also demonstrates efficacy in addressing damaged nephrons, caused by high blood sugar levels. Apart from glycosides, specific alkaloids like Punernavoside, present in Punarnava (*Boerhavia diffusa* Linn.) and Purin alkaloids like Caffeine, Theobromine, Theophylline found in substances like Coffee, Cocoa, Tea, etc. are recognised for their diuretic property [55]. *Vashira* and *Pahanbheda* demonstrated attributed to the presence of saponin and flavonoids. Several other drugs like *Gundra, Itkatmula, Shar*, etc. are mentioned in various Ayurvedic texts like Bhav Prakash for their *Mutrajanan* (diuretic) Property. Many plants belonging to the families like Fabaceae, Liliaceae, Solanaceae, and similar groups contain spironolactone, a diuretic steroid. *Kushmanda* (*Benincasa hispida*) is acknowledged for its *bastishuddikara* and the *srishta mutrakaraka* properties, with its mannitol content (act as osmotic agent) believed to contribute to these functions [56].

CONCLUSION

The present article presented a compilation of plants with diuretic effect. Numerous experimental and clinical studies included in this compilation have substantiated their efficacy. These plants exhibited diuretic activity both, when used individually and as a content of polyherbal formulations. As per the Ayurvedic Pharmacology, most of these contents possess *Sheeta Virya* and *Snigdha Guna*, resulting in an increased water content in urine. From a modern scientific perspective, these herbs act as diuretic by reducing the absorption of Na^+ ions or by functioning as osmotic agents. Both these attributes, contribute to an increased excretion of water through urine. In summary, all these herbs function as diuretic.

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