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Therapeutic efficacy of medicinal plants in combating urinary tract infections: A comprehensive systematic review

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Abstract

Urinary tract infection (UTI) is a very common infection of human body a collective term that describes any infection involving any part of the urinary tract, namely the kidneys, ureters, bladder and urethra. The urinary tract can be divided into the upper (kidneys and ureters) and lower tract (bladder and urethra).

UTI can involve any part of your urinary system, including the urethra, ureters, bladder and kidneys. Symptoms typically include needing to urinate often, having pain when urinating and feeling pain in your side or lower back.

The urinary tract infection is the first most common infection even it comes in list of common infection after respiratory infection. We may easily found that urinary tract infection always connects with the nosocomial infection which is very common in hospital and somehow it may be the cause of death of a patient in a very large scale.

The urinary tract infection may become a common infection during Hospital stay, due to less immunity of the Patient and in high risk patients, especially with long stay of the patient, poor hygiene of the patients and negligence of the hand hygiene may increase the chances of UTI in hospitalized patients. The inappropriate treatment of a patient like without urine culture and sensitivity test the Physician gives experimental treatment of a patient with incorrect antibiotics creates a condition of “super bugs.

Plant medicines have been used for many thousands of years in many different cultures and in many countries. Today medicinal plants have become a growing alternative for establishing a healthy body environment. They play an important role for the treatment of different types of diseases and disorders since ancient times.

Including urinary tract infections. They can affect the urinary tract infections as disinfectants, analgesics, diuretics or narcotics. Some have been shown to have antimicrobial effects against *Escherichia coli* and other organisms that cause Urinary tract infections (UTIs). Medicinal plants can be very effective in programs for resolving UTIs.

Keywords: Urinary tract infection, urethra, medicinal plant, *Escherichia coli* spp.

Introduction

Plant medicines have been used for many thousands of years in many different cultures. Today medicinal plants have become a growing alternative for establishing a healthy body environment. They play an important role for the treatment of different types of diseases and disorders since antiquity including urinary tract infections [1].

Frequent use of antibiotics may create severe issue like multiple drug resistance microorganisms and it alter the flora of microorganisms, through it our good microbial flora can alter for months it may lead to serious health issues, a herb is a good source of treatment if they prepare under correct scientific preparation and with right proportion.

Infections of the urinary tract are the second most common type of infection in the body. *Escherichia coli* causes about 80% of urinary tract infections in adults. Other bacteria that causes urinary tract infections include *Staphylococcus saprophyticus*, *Chlamydia trachomatis* and *Mycoplasma hominis*.

If the infection stays in urethra without travelling into the bladder, it is called urethritis and is usually confined to burning while urinating [2, 3].

Plants Medicines for UTI

It is well known that our plants have hidden properties to cure our body because of their Medicinal properties, Plants have in used for long back in our Ayurveda which is very old and known to treat many diseases in many different cultures.

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Today medicinal plants have become a growing alternative for establishing a healthy body environment. They play an important role for the treatment of different types of diseases and disorders since long back including urinary tract infections

A. Historical or traditional use Cranberry

(*Vaccinium macrocarpon*) has long been recommended by herbalists as well as doctors to help prevent UTIs [4].

Cranberry (*Vaccinium macrocarpon*) Research has suggested that cranberry may be active against UTIs because it prevents *E. coli* spp., the bacteria that causes most urinary tract infections, from attaching the walls of the bladder [5, 6]. Cranberry is not, however, a substitute of antibiotics in the treatment of acute UTIs. Moreover, in children, whose UTIs are due to neurogenic bladder, cranberry juice supplementation did not reduce the rate of infection [7]. Consumption of cranberry juice cocktail may offer protection against both sensitive and resistant strains of P-fimbriated *E.coli*. [8].

Chamomile flower (*Matricaria recutita*)

It contains aromatic compounds that increase the production of digestive fluids, reduce muscles spasms and pains, reduce inflammation and are antiseptic. These compounds have a sedative and relaxing effect and are helpful in treating UTIs [9].

Juniper berry (*Juniperus communis*)

It contains bitter compounds that increase the flow of urine. It also increases production of digestive fluids that assist in absorption as well as relieves pain. The berry is often used as an antiseptic, diuretic, and stimulant. It is extremely useful with chronic cystitis but best when not used when there is acute inflammation because it may result in irritation of bladder. It contains aromatic compounds that increase the flow of urine. Generally, these plants are taken as tea [10].

Uva Ursi (*Arctostaphylosuva-ursi*)

An extract of uvaursi is used in Europe and in traditional herbal medicine in North America, as treatment for UTIs [11]. This herb is approved in Germany for treatment of bladder infections [12].

It is effective against *E. coli* in the bladder. Uvaursi is a strong, non-irritating diuretic and urinary antiseptic for bladder and kidney infections. When combined with marshmallow it helps to eliminate stones from the kidney and bladder.

It strengthens and tones the urinary passages and is effective to treat blood in the urine. Its diuretic properties are at the most effective if the herb is infused into cool water. Hot water alters its diuretic properties [13]. Uvaursi is good to use if there is an irritable bladder or an atonic body bladder. It is also good to use when there is bacterial vaginosis and if there is ulcerative cystitis. It may cause the urine to become brownish-green and it works best with alkaline urine [14].

Goldenseal (*Hydrastis canadensis*)

Goldenseal is reputed to help treat many types of infections. The bioactive compound that may act similarly to proanthocyanidins in inhibiting bacteria from adhering to the walls of the bladder is present in the goldenseal [15], as well as Oregon grape and other plants.

Plantain (*Plantago lanceolata*)

Because of the anti-inflammatory effects of plantain, it may be beneficial in some people with UTIs. However, human trials have not been done to confirm this possibility or to confirm the traditional belief that plantain is diuretic [16].

Oregon grape (*Berberis aquifolium*)

Berberine present in Oregon grape may help in the treatment of UTIs. These herbs have not however, been studied for the treatment of UTIs in humans [17].

Chamomile flower (*Matricaria recutita*)

It contains aromatic compounds that increase the production of digestive fluids, reduce muscles spasms and pains, reduce inflammation and are antiseptic.

These compounds have a sedative and relaxing effect and is helpful in treating UTIs [18].








Chebolic myrobalan (*Terminalia chebula* Retz.)





Chebolic myrobalan exhibited antimicrobial potential against multi-drug resistant uropathogenic *E. coli* and the phenolic compounds present in it mainly responsible for this activity [19, 20].

Diureticslike *Solidago* spp (goldenrod) herb, *Levisticum officinale* (lovage) root, *Petroselinum crispus* (parsley) fruit, and *Urticadioica* (stinging nettle) increase urine volume in both healthy and people with urinary disorders that help in flushing out the probable threats. People, who consume antiseptic and anti-adhesive herbs like *Arctostaphylosuva-ursi* (uvaursi), *Juniperus* spp (Juniper) leaf, and fruit of *Vaccinium macrocarpon* (cranberry) excrete antimicrobial compounds, which may directly kill microbes or interfere with their adhesion to epithelial cells, thereby protecting against acute and chronic UTI [21].

The roots of *Mahonia aquifolium*

(Pursh) Nutt. (Oregon grape), (Berberidaceae) and *Hydrastis canadensis* L. (Goldenseal), (Ranunculaceae) are rich in berberine. Berberine is an important drug against many bacteria and combat infections by preventing the bacteria (*E. coli* and *Proteus* species) from adhering to the host cell [22]. Diuretic botanicals like *Asparagus officinalis* L. (asparagus), *Betula* spp. (birch) *Elymus repens* (L.) Gould (synonym: *Agropyron repens*) (couch grass), *Solidago virgaurea* L. (goldenrod), and *Equisetum arvense* L. (horsetail) work against UTI by increasing urinary volume and supposedly flushing bacteria out of the urinary tract. Ayurvedic herbs like *Tribulus Terrestris* L., *Boerhavia diffusa* L., *Tinospora cordifolia* (Willd.) Miers, and *Santalum album* L. are used since time immemorial for UTI in India [23].

S. No	Picture of the Herbs	Name of herb
1.		Cranberry
2		Chamomile Flowers
3.		Juniper berry
4.		Golden seal
5.		Uvaursi
6.		Plantain
7.		Oregon grape

8.		Chebuliemyrobalan
9.		Solidagospp.
10.		The root of Mahoniaaquifolium
11.		<i>Asparagus officinalis L</i>

The herbs and their effect

S. No	Name of Herb	Effects of herb
1	Cranberry	It prevents <i>E. coli</i> , <i>Spp</i> the bacteria that causes most urinary tract infections, from attaching the walls of the bladder, Consumption of cranberry juice cocktail may offer protection against both sensitive and resistant strains of P-fimbriated <i>E coli</i> . <i>Spp</i> .
2	Chamomile flower	It reduce muscles spasms and pains, These compounds have a sedative and relaxing effect and is helpful in treating UTIs.
3	Juniper berry	The berry is often used as an antiseptic, diuretic, and stimulant.
4	Uva-Ursi	It is effective against <i>E. coli</i> in the bladder, Uva-ursi is a strong, non-irritating diuretic and urinary antiseptic for bladder and kidney infections.
5	Goldenseal	It inhibits bacteria from adhering to the walls of the bladder is present in the goldenseal.
6	Plantain	It may be beneficial in some people with UTIs.
7	Oregon grape	Oregon grape may help in the treatment of UTIs.
8	Chebolic myrobalan	Chebolic myrobalan exhibited antimicrobial potential against multi-drug resistant uropathogenic <i>E. coli</i>
9	Chamomile flower	It reduces muscles spasms and pains, reduce inflammation and are antiseptic.
10	Diuretics like <i>Solidago spp</i>	It increase urine volume in both healthy and people with urinary disorders that help in flushing out the probable threats.
11	The roots of <i>Mahonia aquifolium</i>	It is an important drug against many bacteria and combat infections by preventing the bacteria (<i>E. coli</i> and <i>Proteus</i> species) from adhering to the host cell.
12	Horseradish (<i>Cochlearia armoracia</i>)	Was considered to be a diuretic and used by herbalists to treat kidney stones and edema.

Conclusion

Common reasons of UTI is vary it shows that people get UTI through many reasons like in Pregnancy UTI is common, Catheter induced UTI, Recurrent urinary tract infections and in condition of Diabetes, in babies due to nappy and unhygienic toilets, in Hospital Patient get it through hospital staff un hygiene hands practice or by unsterile handling of Foley catheter it may be the cause of UTI due to different reasons, rest of it we may get UTI at any stage and in any

condition our general awareness may keep us away from it if, we could understand the different causes of UTI and its mechanisms [24].

Antibiotics are frequently used to treat and prevent acute and recurrent UTI, but their repeated use can result in dysbiosis of vaginal and intestinal normal flora, as well as antibiotic resistance due to the high mutation ability and horizontal gene transfer capability of different pathogens.

Moreover, different mechanisms are used by uropathogens for

survival in the bladder under stresses such as starvation and immune responses. Uropathogens undergo morphological changes, invade uroepithelial cells, and form biofilms to persist and cause recurrent infections. Extracellular DNA, exopolysaccharides, pili, flagella, and other adhesive fibers create a niche for a bacterial community that is secluded from antimicrobial agents, immune responses, and other stresses. Thus, it is high time to seek alternative methods for the prevention and treatment of UTIs.

Like Horseradish (*Cochlearia armoracia*) was considered to be a diuretic and used by herbalists to treat kidney stones and edema [25].

Modern research has suggested that cranberry may prevent UTIs. In a double blind trial elderly women who drank 300 ml of cranberry juice per day had a decrease in the amount of bacteria in their urine [26].

In another study elderly residents of a nursing home consumed either 120 ml of cranberry juice or 6 capsules containing concentrated cranberry daily for 13 months. During this time the number of UTIs decreased by 25% (27). A small double-blind trial with younger women ages 18-45 years with a history of recurring urinary tract infections found that daily treatment with an encapsulated cranberry concentrate (400 mg twice per day) for three months significantly reduced the recurrence of UTIs compared to women taking a placebo [28].

Other preliminary trials in humans suggests cranberry may help people with urostomies and enterocystoplasties to keep their urine clear of mucus buildup and possibly reduce the risk of UTIs [29].

Garlic (Therapeutic efficacy of medicinal) Pure garlic has been named as the “Heavy Weight” of all herbal remedies because it has such inheriting strong antibacterial properties and is useful in treating different types of diseases including UTIs [30].

The current review article demonstrated that urologic herbs exhibited different types of phytoconstituents and are useful in the cure of urinary tract infections and could be a prospective source for the development of drugs against UTIs. But still little information is available to highlight the effectiveness of these herbs in children and elderly men and women. Whether these are acceptable for long periods of time is not clear. In addition, it is not clear what is the optimum dosage level and method of administration (e.g. juice or tablet etc.).

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