
Traditional plants that are utilized to treat urinary tract infections: A review

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REVIEW

Traditional Plants that are Utilized to Treat Urinary Tract Infections: A Review

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Abstract

Among the most serious problems affecting public health is urinary tract infection (UTI). There are several parts of the urinary tract affected by this type of inflammation and affects women more frequently than men. As the antibacterial resistance problem is growing in urological medicine, there is a increasing and a continuing requirement to add anti-microbial medication which could be from medicinal herbs in regulatory UTIs.

Since the beginning of civilization, medicinal plants have been an integral element of human society in the fight against diseases. For the aim of reducing costs, increasing the effectiveness of treatment and eliminating the side effects of UTI patients, medicinal plants have gained wide popularity and great interest. Medicinal plants have been known as a rich source of therapeutic agents.

A number of different plants show promise the ability to treat of a various urologic disorders. As the current review illustrates, a number of traditional medicinal plants are evaluated to prevent or treat UTIs, and modern scientific investigations on these important herbs and some isolated chemical compounds.

Keywords: UTI, Medical plants, Medical herbs, Uropathogens

1. Introduction

Urinary tract infection (UTIs) is one of the most common diseases in humans, this requires rapid and continuous treatment [1]. Urinary tract infection is also the most widely used antibiotics, which leads to the high financial costs for health care organizations if the treatment is not applied immediately and effectively [2]. Infection with this disease includes the parts of the body when urine passes before leaves the body like kidneys, ureters, bladder or urethra. If the infection is not treated effectively, This leads to the success of complications several times in kidney failure.

UTIs affect both males and females, but it's been more likely to occur in females than males during all stages of life as a result of the differences in lifestyle, reproductive and urogenital anatomy and physiology. Urinary tract infection accounts for about 25%

of bacterial infections in women of all infections [3]. Reports have stated that at least 50% of women have at minimum one infection during their throughout their lifespan [4]. The more risk factors for UTI in female are the anatomy, age, sexual activity, and menopause. Urinary tract abnormalities, obstruction, and catheterization operations also consider dangerous factors that cause this disease [5].

Pregnant women, which have UTI may cause high blood pressure and premature delivery. Women who use contraceptives are more likely to get UTIs because of immune destruction in these women. Pregnant women can transmit the infection for infants and children. According to studies indicate that postmenopausal women are more prone to develop UTI as a result of estrogen deficiency, increased *Escherichia coli* and decrease of *Lactobacilli* ssp. in the vaginal flora [3].

Urethral catheter is associated with UTI, and the probability of infection rises with the duration of the

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infection. *Catheter-Associated Urinary Tract Infections* (CAUTI) affects both men and women, with long-term urinary catheterization almost ever result in urine containing bacteria. Daily catheterization may elevate the chance to acquire of typical CAUTI to 3–7% [6].

Repeated urinary tract infections (RUTIs) are those that have occurred three times in the previous year or twice in the previous six months. 20–30% of women who have experienced one form of UTI may experience a regular UTI, and about 25% of them will progress to recurring instances [7].

2. Types and clinical finding of UTI

UTI is classified into two types, complicated and uncomplicated. The pathogenesis of these types are complex and influenced by many host biological, behavioral factors and properties of the infecting uropathogens [8]. Complicated type happen in people have disorders or abnormalities in every segment of the urinary tract, more likely to develop a complicated type of infection, which is more severe and difficult to cure [9].

The most prevalent type of UTI is an uncomplicated one, which develops when there are no obvious symptoms or abnormalities in the urinary tract [10]. Clinical indications of UTI involve a Strong and persistent urges to urinate, frequent urination, and a short urine volume. Another symptoms including hazy urine, red or bright pink colored, women's pelvic pain, nauseousness, and vomiting may be linked features [11].

2.1. The etiology of UTI

The microorganisms that mainly account for UTI are the Gram-negative enteric bacteria, especially *E. coli*. Uropathogenic *E. coli* (UPEC) is the primary bacteria recovered from people with urinary infections (75–90% of isolates), other Gram negative and positive bacteria like *Proteus mirabilis*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Staphylococcus saprophyticus* and *Enterococcus faecalis* are the causative agents of for the other infections [12].

A bacterial pathogen capable prevents urine from passing the urinary system and preserve it by forming pentagonal adhesions with glycolipids and glycoproteins on the epithelial tissue of the urinary tract. In most cases, the bacteria that cause UTIs work to control the periphery of the urethra, and thus the infection develop. Natural bacteria can prevent pathogenic bacteria from colonizing, it is

also possible for the defense mechanisms in the bladder to eliminate disease colonies, as well as the urinary catheter can also control the spread of disease.

2.2. Therapy of UTI

Antibiotics are the are the effective t treatment for both acute and chronic UTIs. But the wide use of antibiotics give the resistant bacterial pathogens and lead to the extent of antibiotic resistance [13]. It is predicted that antibiotic resistance will continue to increase. There are need to consider alternatives to antibiotics.

2.3. Chemical constituents and mechanism of action of medical herbs

Medicinal plants are a wealthy origin of bioactive component, such as flavonoids, alkaloids glycosides and phenols that have several health properties [1] (Bahmani et al.,2015). Use of phytochemicals in the prevention or treatment of many diseases like urinary infections is a very old tradition [14].

The investigations of non-chemical treatment of UTI have directed to the stages of the pathogenesis, including: colonization, adherence of microbes to the receptors on epithelial cell and invading [6]. So far, there is no integrated study on how medicinal herbs work to cure a UTI, but researches have revealed that medicinal herbs possess secondary compounds that inhibit the pathogens of this disease: inhibiting the obsession of bacteria in the urinary tract and stopped it from growing (like antibiotics, act as diuretics in which help flush out the bladder, heal the bladder wall, decrease pain and inflammation, antioxidants and immunomodulators.

These various properties in medicinal plants are because of the presence of different secondary metabolites such as alkaloids, flavonoids, glycosides, phenols, saponins, steroids, sterols, tannins, terpenoids, hydrocarbons, phlobatannins and many others phytochemicals directly related to plants' antimicrobial properties [15].

The antibacterial effect of many plant extracts was reported using different techniques such as agar well diffusion, disk diffusion and minimum inhibitory concentration (MIC) of the raw herbal extracts, but researches on the specific activity of the phytochemicals against bacteria are limited [16]. The resistance problem that occurs due to the use of synthetic medicines can be reduced by using medicinal plants which contain phytochemicals that are accountable for their useful actions and the synergistic activity of medicinal plants [3].

Table 1. Some of herbal medicines used for urinary tract infections.

	Botanical name	Common/local names	Parts used	Method of use	Active phytochemicals	Mechanism of action	References
1	<i>Vaccinium macrocarpon</i>	cranberry	fruit	Dried fruits, juice, tablets or cranberry capsules	proanthocyanidin such as anthocyanidin, catechin, flavanols, quercetin, and phenolic compounds	may be act against UTIs because it prevents bacteria <i>E. coli</i> , that cause UTI, from attaching the walls of the bladder	[5,17]
2	<i>V. oxycoccus</i>	Cranberry	Fruit and leaf	Raw fruit, encapsulated extracts,	Flavonoids, anthocyanidin, peonidin and quercetin, and proanthocyanins	preventing the adhesion of type 1 and p-fimbriae strains (particularly from <i>E. coli</i>) to the urothelium	[18,19]
3	<i>Vaccinium myrtillus</i>	Blueberry	fruit and leaves	preserves, jams, and juices,	flavonols (quercetin, catechins), but anthocyanins make by far the largest	antimicrobial effects against human pathogens	[5,20]
4	<i>V. corymbosum</i>	Blue swamp, blue berry,	Leaf and fruit	Raw fruit, juice, syrups, herbal teas	Citric and malic acids, alkaloids, and petunidol	antimicrobial effects against human pathogens	[18]
5	<i>Vaccinium angustifolium</i>	blueberry	Fruit and leaves	juice cocktail Concentrated cranberry extract in the form of tablets and capsules	Tannins	Inhibit <i>E. coli</i> because of its ability to adhere walls of the bladder	[17]
6	<i>Arctostaphylos A. uva-ursi</i>	UvaUrsi, kinnikinnick,	Leaf	use as tea	Ursolic acid, gallic acid, and flavonoids	Antimicrobials (including urinary antiseptics) Diuretics, it facilitates the removal of kidney and bladder stones	[18,17]
7	<i>Cinnamomum verum</i>	Cinnamon, true cinnamon tree	Bark and leaf	Spice, or decoction of bark and leaves	Camphor, cinnamaldehyde, and proanthocyanidins	Proven to completely suppress UTIs causing bacteria and fungus	[3]

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Table 1. (continued)

	Botanical name	Common/local names	Parts used	Method of use	Active phytochemicals	Mechanism of action	References
8	<i>Juniperus communis</i>	Juniper	Fruits, berries, and leaves	Fruits, bark, and leaves	Terpinen- 4-ol, a volatile oil. Mono terpene, Berberine. The volatile oils of juniper contain nephrotoxic complexes, especially hydrocarbon terpenoids	Used as an diuretic, antiseptic, stimulant. It is used with chronic cystitis but not used with acute inflammation	[5,17]
9	<i>Rosmarinus officinalis</i>	Rosemary	Aerial part	Extract or juice	rosmarinic acid, carnosol and carnosic acid,	diuretic Antibacterial activity	[21,22]
10	<i>Thymus vulgaris</i> L	Thyme	Flowers, leaves, and oil Aerial part	Tea, beverage,	Monoterpenes, carvacrol, thymol monoterpene hydrocarbons γ -terpinene and p-cymene	Antiseptic and antimicrobial properties, diuretic	[22-24]
11	<i>Origanum majorana</i>	Marjoram	Aerial part	Juice infusion	monoterpene alcohol, terpinene-4-ol carvacrol and thymol are p-cymene and α -terpinene	Antibacterial activity	[22,25]
12	<i>Ammi visnaga</i>	Khella Baldi or toothpick weed	fruit	fruit decoction powdered	polyphenolic compounds including flavonoids, as well as γ -pyrones, represented mainly by khellin and visnagin	Diuretic, antimicrobial effect	[26]
13	<i>Zea mays</i> L.	Corn silk, maize	collection of the stigmas from the female flowers	Extract(Tea)	tannins terpenoids, alkaloids and flavonoids change in urinary PH, and prevention of growth and adhesion of pathogens is very important	anti-inflammatory diuretic Antispasmodics For bladder involvement	[17,27,28]

14	<i>Petroselinum crispum</i> var. <i>crispum</i>	Parsley, French persillade	Aerial part	Essential oils, raw leaf can be crushed, infusion of leaves, seed, and roots	Carotenoids, Ascorbic acid, Flavonoids, Apiole, terpenoids, Coumarin, phenyl propanoid-s, tocopherol, and furanocoumarins	Antispasmodic, anti-inflammatory diuretic	[29,30]
15	<i>Agathosma betulina</i> (previously <i>Barosma betulina</i>)	Buchu, bucco	Leaf and stalk	Drink as tea, maceration of leaves Volatile oils, Flavonoids	Limonene and Diosphenol and are the most imperative in UTIs	Antimicrobials (including urinary antiseptics) and diuretic Its volatile oil induce urination and is secreted practically by the kidneys	[17,18]
16	<i>Hybanthus enneaspermus</i>	Spade flower	Leaf	Infusion of leaves	Flavonoids, Phenols, Terpenoids, and Alkaloids	antimicrobial activity	[3,5,31]
17	<i>Equisetum arvense</i>	horsetail Dome asb	Aerial part	Boiled	Alkaloids, phytosterols, tannins, triterpenes, and phenolics, Phenolic compounds, act as antibacterial activities	Diuretics Antispasmodics For bladder involvement	[5,17]
18	<i>Hydrastis canadensis</i>	Goldenseal, orange root, yellow plant	Leaf	Infusion of leaves, food supplement	Berberine, (alkaloid) hydrastine, saponin, and flavonoid	Antimicrobials, inhibiting bacteria by adhering to the walls of the bladder present in the goldenseal	[17,32]
19	<i>Zingibar officinale</i>	Ginger	Roots	Fresh ginger, dried root	Zingiberene, Zingiberol, dihydroparadol, and gingerols	Anti-inflammatory	[3,5]
20	<i>Plantago lanceolata</i>	Plantain	Leaf	dried leaf, dry extract, liquid extract, soft extract, herbal substance, and syrup	Mixture of mucilage, organic acids, polysaccharides, and flavonoids.	Diuretics	[5,33]
21	<i>Allium sativum</i>	Garlic Lehsan	Garlic bulbs and cloves	Raw garlic used as infusion, soaking, food additive, essential oil	volatile oil, allicin, alliin, acrolein, disulphide and diallyl-trisulfide	Antimicrobials (including urinary antiseptics)	[3,17]

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Table 1. (continued)

	Botanical name	Common/local names	Parts used	Method of use	Active phytochemicals	Mechanism of action	References
22	<i>Cochlearia Armoraciaria</i>	Horseradish	Root	Capsule, juice	isothiocyanates Volatile oils	Act as anti bacteria that cause UTIs Diuretic and used by herbalists to treat kidney stones and edema Diuretic	[5,17]
23	<i>Coriandrum sativum</i>	Coriander, Chinese parsley,	Leaf and seed	Food flavors, seeds essential oil	Carvone, geraniol, limonene, camphor, and alkanals		[18,34,35]
24	<i>Terminalia chebula</i>	black or chebulic myrobalan,	Fruit and roots	Dried fruit as powder, decoction of roots	Chebulin, Tannin, Fatty acids and Betulinic acid	Act as antimicrobial potential against multidrug resistant uropathogenic <i>E. coli</i>	[4,8] [3,17],
25	<i>Cucumis sativus</i> L	Sasa	Seed	Seeds can be grinded with salts	Glycosides, Tannin, sterol, Terpens.	Diuretic	[36,37]
26	<i>Camellia sinensis</i>	Green tea, tea shrub Green Tea	Leaf	Dry leaves, aqueous extract	Phenols, glycosides, alkaloids, and polyphenols	antimicrobial effects	[38,39]
27	<i>Apium graveolens</i> L.	Celery, <i>Apium</i>	Seeds, and aerial parts	Seed essential oil,	Succinic acid, iso fraxidin, lunularin, and eugenic acid.	Antispasmodic	[3,30]
28	<i>Trachyspermum copticum</i>	Ajowan, bishop's Weed	Leaf and fruit	Essential oil of fruits, infusion of leaves	Terpinene, p-cymene, xylene, palmitic acid and thymol	Antimicrobial effects	[3,8]
29	<i>Taraxacum officinale</i>	Dandelion	Leaves and flowers	Soup or salads contain raw or cooked leaves, and maceration of leaves	Inulin, Phenolic acids, Taraxacin, Sesquiterpene, and catotenoids	Diuretics	[18]
30	<i>Arctium lappa</i>	Greater burdock, <i>lappa</i> ,	Roots and seeds	Infusion of seeds and roots	Caffeoylquinic acid, Caffeic acid, and Rhamnosid	Act as antibacterial and antifungal and act against UTIs	[3,17]
31	<i>Mentha piperita</i>	Peppermint	Leaf	Infusion of leaves flavoring element	Menthol, Menthone, limonene, and pulegone	diuretic effects, anti-inflammatory	[3,40]
32	<i>Ocimum sanctum</i>	Holy basil, tulsi	leaves, stems, flowers, roots, and seeds	Infusion, of any part of plant	Polyphenol, Flavonoids, Flavonols, Betasitosterol, luteolin, and apigenin	Antimicrobial activity	[4,8]

33	<i>Moringa oleifera</i>	Moringa	Leaf, flowers, and fruits	Raw, dried fruits, leaves as tea	Thiocarbamate Kaempferol, acetylated, and Spirochin	Diuretic, improved renal function	[4,41]
34	<i>Phyllanthus amarus</i>	Sleeping plant Jangli Amla	whole plant	Decoction of the whole plant, juice	Tannins, flavonoids, terpenoids, corilagin, niranthin	anti-inflammatory and antimicrobial properties	[3,42]
35	<i>Boerhavia diffusa</i>	Punarnava, red spiderling, bishkrapra	Leaves and roots	Leaves as vegetarian dish	Lignin, arachidic acid, lignin, glycosides and boeravinone B	antimicrobial activity	[4,43]
36	<i>Tribulus terrestris</i>	Kharkhasak, Gokhru. Goat's head, bullhead,	Roots, leaves, and fruits	Infusion of dried roots and leaves powder	Saponins, kaempferol, hecogenin, neohecogenin glucoside, and cinnamic amide	Antimicrobial activity	[3,44]
37	<i>Azadirachta indica A. Juss</i>	Neem	Fruits, leaves, and bark	Infusion, of leaves, oil of fruits	phenols, cardiac glycosides, and tannins	anti-inflammatory, and antimicrobial properties	[4,45]
38	<i>Berberis aquifolium</i>	Oregon grape	Root	Tea	Berberine	kills microorganisms, that cause urinary tract infections	[5] [17],
39	<i>Sassafras albidum</i>	Sassafras	Inner bark of the root	beverage or tea	Volatile oil	Diuretics, Antiseptic	[17]
40	<i>Urtica dioica</i>	nettle	root	extracts	Lignans Poly saccharides and lectins	Antimicrobial activity Mild diuretic	[5,41]
41	<i>Galium aparine L.</i>	Cleavers, goose-grass, catchweed, stickyweed	Stems, leaves, and fruit	leaves and stems as food flavors, fruit as coffee, soaking of leaves	Glycosides, Iridoid alkaloids, and Citric acid	Anti-inflammatory Diuretics	[7,18]
42	<i>Levisticum officinale</i>	lovage	Root	Tea	Terpenoids and coumarins	diuretic.	[41]
43	<i>Clitoria ternatea</i>	Darwin pea, butterfly pea	Root, bark, seed	Root can be used in food	but lacks the anti-inflammatory and has a milder spasmolytic effect Phenols, Flavonoids, and Saponins	Antimicrobial activity	[46,47]

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Table 1. (continued)

	Botanical name	Common/local names	Parts used	Method of use	Active phytochemicals	Mechanism of action	References
44	<i>Zizyphus oenoplia</i> (L.) Mill.	Boroi	Roots	decoction	alkaloid, flavonoids, phenolic content and terpenoid, cyclopeptide alkaloids such as Ziziphine	antimicrobial activities, diuretic	[48,49]
45	<i>Zizyphus jujuba</i>	Takkul	Fruit	the fruit is taken	Alkaloids, glycosides, Terpens	Antimicrobial activity	[3,50]
46	<i>Abutilon indicum</i>	Paatri	Roots, leaf	leaves and roots orally	Alkaloids, Terpens, Phenols, Glycosides	Antimicrobial activity diuretic	[51,52]
47	<i>Andrographis paniculata</i>	Kalmegh	Leaf	Fresh leaves	Alkaloids, Anthracene, Phenols, Tannins	antimicrobial effect	[53,54]
48	<i>Juniperus osteosperma</i>	Utah juniper	leaves, bark, and fruits	fruits and decoction of leaves and bark	Phenolics, alpha-pinene, Terpenoids, Cadinene,	Antimicrobial activity Diuretic activity	[5,18]
49	<i>Acacia nilotica</i> Delile	Babool	Leaves, Gum, Bark	Gum Paste, Powder of Bark	Flavonoids, Glycosides, Saponins	Antimicrobial activity	[3,55]
50	<i>Vigna mungo</i>	Mung	Seeds	Seeds are taken	Flavonoids, Alkaloids, Phenols, Tannins	anti-inflammatory	[56]
51	<i>Syzygium cumini</i> (L.)	Jamun, black plum, plum,	Fruits and Bark	Infusion, and salads of fruits	Steroids, Flavonoids, Alkaloids, and terpenoids	Diuretic	[3,57]
52	<i>Emblica officinalis</i>	Amla, Indian gooseberry,	Fruits	Raw and fruits, powder	Alkaloids, Tannins, Phenolic, chebulinic acid, and trigallayl	Antimicrobial activity	[58,59]
53	<i>Prunella Vulgaris</i>	Self- heal	Leaves, Stems	Salads	Steroids, lapel, cyanidin, delphinidin,	antimicrobial activity	[3,60]
54	<i>Cichorium intybus</i> L.	Chicory, blue daisy, dandelion, blueweed	Leaf and root	Tea of the leaves and roots	Flavonoids, Terpenoids, Tannins, Saponins,	Antimicrobial activity	[4,61]
55	<i>Bidens pilosa</i> L.	Black-jack, friends' peg	Whole herb	Tea of the whole herb	Cardiac glycosides Alkaloids, Flavonoids, Steroids, Anthraquinones, Tannins, Glycosides, Saponins	Antimicrobial activity	[4,62]

56	<i>Brassica nigra</i>	Source	Seeds	Seeds are grinded to take	Flavonoids, alkaloids, sterols, tannins, Alkaloids, Flavonoids, Carbohydrates, sterols	Antimicrobial activity	[63]
57	<i>Pimpinella anisum</i>	Mithazira	Seeds	Seeds as taken	Tannins, Alkaloids, Phenols, Flavonoids, Saponins	Antimicrobial activity	[3,64]
58	<i>Malva sylvestris</i> L	Mallow	Leaf, fruit, and seeds	Leaf used as salad, seeds as decoction		Antimicrobial activity	[4,65]

2.4. Medical herbs used for UTI

The major herbs that used therapeutic of UTI with the main phytochemical components that responsible for their effects, their common name, parts used, method of use and mechanism of action is recorded in Table 1.

3. Conclusion

Urinary tract infections are a prevalent phenomenon that impacts patients, the increasing incidence of bacterial resistance among urinary pathogens, caused by the overuse of antibiotics in humans are a significant danger to the public health. Therefore, the investigators focus to identify new herbal treatments for UTIs. Medicinal plants used to treat urinary tract infection pathogens are very active. They possess antibacterial properties, applied locally and was found to possess good healing property. In addition, its easy access and have less toxicity. It was found that may be all the plant parts or extracts used in treatment of urinary tract.

In this review, its illustrated a number of plants to be useful in urinary infections; but many other plants need to be exploited for their pharmacological actions. Also, its study of the activity of the medicinal plants obtained in this study and their activity provides a good source for new drugs in modern medicine.

Conflicts of interest

None declared.

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