



# Herbal Solutions for Urinary Tract Infections: A Literature Review

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## Abstract

If treatment is not received, Urinary Tract Infections (UTIs), which are frequent microbial illnesses affecting the urinary system, can lead to discomfort and problems. Because they have antibacterial qualities and can potentially reduce UTI symptoms, natural treatments have been used. Supplements or juice made from cranberries are one popular natural treatment. Proanthocyanidins, which are found in cranberries, have the potential to inhibit bacteria, especially *E. coli*, from adhering to the lining of the urinary tract, hence decreasing the risk of infection. Its efficacy is still up for discussion, though, and certain drinks' high sugar content may make UTI symptoms worse. D-mannose, a kind of sugar included in fruits like peaches and cranberries, is another commonly utilised treatment. D-mannose inhibits germs from sticking to the walls of the urinary system, in a manner akin to that of cranberries. It's believed to be effective against *E. coli*, a common UTI-causing bacterium, but it's ideal dosage and long-term effects require further research. Probiotics are thought to be helpful for UTIs, particularly those that contain lactobacilli strains. They may lessen the chance of infection by assisting in the maintenance of a balanced population of bacteria in the urinary tract and gut. There is, however, little data to support their direct influence on UTI treatment. Herbal treatments with possible antibacterial effects, such as buchu, goldenseal, and bearberry (*uva-ursi*), have been used historically. These herbs have ingredients that may aid in the battle against germs in the urinary system, but further research is needed to determine how safe and effective they are. Increasing water consumption is a simple yet effective treatment. Drinking enough water dilutes urine, which lowers the quantity of bacteria that could lead to an illness, and aids in the removal of bacteria from the urinary system. Even while these natural treatments seem promising for treating UTIs, it is important to see a doctor before using them, particularly if you think the illness may be serious. Certain medical issues may prevent the use of natural therapies, or they may interact negatively with medicines. When used as the only treatment for acute UTIs, they are frequently less successful than when used as preventative measures or in conjunction with traditional medicines. The main line of treatment for severe or persistent UTIs is still medical intervention with antibiotics to avoid complications and recurrent infections.

**Keywords:** Antimicrobial, Herbal Remedies, Hydration, Probiotics

## 1. Introduction

Using the power of different substances found in plants, fruits, and supplements, natural therapies offer an exciting way to manage urinary tract infections. These treatments have drawn interest because they may be able to reduce symptoms and perhaps prevent infections from happening again. This introduction will look at the range of natural therapies that are beneficial to urinary tract health and are recognised for

their antibacterial qualities. If left untreated, infections related to the urinary system which are typically due to bacterial overgrowth in the urinary system, can cause discomfort, pain, and problems<sup>1</sup>. Although natural medicines have become complementary or alternative treatments, antibiotics are still the standard of care. These treatments frequently seek to either strengthen the immune system, prevent bacteria from adhering to the walls of the urinary tract, or foster an environment that is unfavourable to bacterial growth.

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A popular natural medicine, cranberry contains chemicals that may prevent germs, from adhering to the lining of the urinary tract. Similar to D-mannose, another promising chemical that can be found in several fruits, it works by stopping the adherence of bacteria<sup>2</sup>. Probiotics, which are good bacteria found in foods or supplements that have undergone fermentation, help keep the gut and urinary tract's bacterial balance in a healthy state, which may lower the risk of infections. Herbal medicines with antibacterial qualities have been utilised historically, such as buchu, bearberry, and goldenseal<sup>3</sup>. These herbs are thought to have components that fight germs in the urinary system, but further research is needed to confirm how effective they are. Furthermore, maintaining proper hydration is essential to managing UTIs. Drinking more water helps the urinary tract rid itself of pathogens, dilutes urine, and lowers the amount of the concentration of potentially harmful bacteria<sup>4</sup>. Although natural therapies have potential, it's crucial to use caution when using them. It is essential to speak with medical specialists before using, particularly for those who have underlying medical issues or severe illnesses. Natural treatments may have various effects on different people or interact differently with pharmaceuticals<sup>5</sup>. People can choose wisely whether to include these treatments in their UTI management plans by being aware of their possible advantages and disadvantages<sup>6</sup>.

UTIs are a common bacterial illness that affects the urinary system that is frequently unfavourable. UTIs can arise in any region of the urinary system. This spread of disease is usually caused by bacteria, most frequently *Escherichia coli* (*E. coli*). Many symptoms, including a persistent need to urinate, burning when urinating, murky or strong-smelling urine, and pelvic pain, are indicative of UTIs<sup>7</sup>. A UTI can strike anyone, but women are more vulnerable to the infection because of their shorter urethras, which provide bacteria with greater access to the bladder. UTI susceptibility can be increased by several factors, including sexual activity, certain medical diseases, urinary tract abnormalities, low hydration, and poor hygiene practices<sup>8</sup>. However, interest in other methods, such as natural therapies and preventive measures, has increased due to the rise in antibiotic resistance and worries about their abuse. For prompt intervention and efficient care, which lowers the risk of complications and recurrent infections, it is

essential to comprehend the signs, causes, and available therapies for UTIs<sup>9</sup>.

## 2. Pathophysiology

Ways for pathogens to enter the urinary system:

### 2.1 Ascending Infections

Follows an upward trend. Women's UTIs are caused by faecal flora uropathogens. They infiltrate the vaginal introitus and displace various species that are naturally present. One of the most important early stages in the resulting repetitive UTIs appears to be the colonisation of the vaginal introitus by *E. coli*. The urethra serves as the principal route for most uropathogens to enter the bladder<sup>10</sup>.

### 2.2 Hematogenous Spread

Women experience urinary tract infections at a higher rate than men do. Blood is the cause of hematogenous kidney spread. *Staphylococcus aureus* is the primary reason of bacteraemia. Men are not as likely to experience bloodborne infections of the renal parenchyma as they are ascending route infections. The Gram-positive bacterium *S. aureus*, which also causes endocarditis and bacteremia, is commonly responsible for kidney abscesses in individuals<sup>11</sup>.

### 2.3 Lymphatogenous Spread

Via colon and rectal lymphatic veins infection enters the male's bladder and prostate; periuterine lymphatics in women's urine tracts<sup>12</sup>.

## 3. Antibiotics Used in the Treatment of Urinary Tract Infections

The suggestions state that the treatment of UTIs with empirical antibiotics is common. The purpose of antimicrobial therapy is to destroy the pathogenic microorganisms. The type of infection, its severity, the prevalent bacteria in the location, and patterns of antibiotic resistance all influence the antibiotic that is selected. Trimethoprim, Sulfamethoxazole, Nitrofurantoin, Ciprofloxacin, Levofloxacin, Cephalexin, Ceftriaxone, Azithromycin, Doxycycline, and other antibiotics are frequently used to treat urine related infections<sup>13</sup>.

## 4. Herbal Medicines as Possibilities

Scientific suggestions on the "safety and effectiveness of natural drugs" were announced by the World Health Organisation in 1993<sup>14</sup>. They made it proper that a drug's historical use was a trustworthy predictor of its safety in the absence of any contradictory scientific facts<sup>15</sup>. One important source of novel antibiotic development has been the extensive use of herbal treatments in traditional medicine.

## 5. Herbal Remedies

Utilizing herbal diuretics and antibacterial agents is among the best ways that nature has to offer to keep the urinary system healthy. A few crucial plants that treat UTI, their benefits and preparations are shown in Table 1<sup>16</sup>.

### 5.1 Cranberry (*Vaccinium macrocarpon* or *Vaccinium oxycoccos*)

Because concentrated cranberry extract in cranberry juice keeps germs away from adhering to the surface of the urinary tract, it is a popular home treatment for UTIs. It therefore lowers the likelihood of developing UTIs again. It contains a flavonoid called

proanthocyanidin-A, which has an antibacterial action. It strengthens the immune system, eases the discomfort associated with urinating, helps control the PH of urine, and activates macrophages to aid in the healing of wounds and the reduction of inflammation<sup>16</sup>. The likelihood of asymptomatic bacteriuria is decreased. These products are recommended by the Canadian Society of Obstetricians and Gynaecologists as a prophylactic against recurrent UTIs<sup>17</sup>.

### 5.2 Blueberry (*Vaccinium angustifolium*)

Blueberries are useful in the treatment of UTIs due to their anti-bacterial properties. For instant effects, have blueberry juice early in the morning. Blueberry juice has a high proanthocyanidin and vitamin C content. An increase in fluidity helps to get rid of bacteria<sup>18</sup>. It strengthens immunity and prevents the formation of bacteria that cause urinary tract infections. Many secondary metabolites found in plants, which include flavonoids, alkaloids, terpenoids, and tannins, have been shown to have antibacterial properties *in vitro*. These substances have the potential to treat microbial diseases in a way that is safe, efficient, and less expensive than traditional antibiotics<sup>19</sup>.

**Table 1.** Various herbs with their actions and preparations.

Herb	Benefits/Actions	Preparations
Cranberry ( <i>Vaccinium macrocarpon</i> )	Contains compounds that may prevent bacteria from adhering to the urinary tract walls, potentially reducing UTI risk.	Fresh berries, juice, capsules, tablets, extracts
Dandelion ( <i>Taraxacum officinale</i> )	Mild diuretic properties help to increase urine flow and flush out toxins. May have anti-inflammatory effects.	Fresh leaves, tea, tincture
Uva ursi ( <i>Arctostaphylos uva-ursi</i> )	Contains arbutin, a compound that may have antimicrobial properties, potentially helpful in UTIs.	Tea, tincture, capsules
Goldenseal ( <i>Hydrastis canadensis</i> )	Contains berberine, which has demonstrated antimicrobial activity. Supports immune function.	Tincture, capsules, powder
Buchu ( <i>Agathosma betulina</i> )	Traditionally used as a urinary tract disinfectant and diuretic. It may help alleviate urinary discomfort.	Tea, tincture
Horsetail ( <i>Equisetum arvense</i> )	Has diuretic properties, helps increase urine production, potentially aiding in flushing out bacteria	Tea, capsules, tincture
Garlic ( <i>Allium sativum</i> )	Contains allicin, which exhibits antimicrobial properties. May help fight infections.	Raw, capsules, extract
Parsley ( <i>Petroselinum crispum</i> )	Diuretic properties increase urine output. Contains antioxidants that may support urinary tract health.	Fresh leaves, tea, tincture
Marshmallow root ( <i>Althaea officinalis</i> )	Has soothing and anti-inflammatory properties, potentially helpful in easing urinary discomfort	Tea, capsules, tincture

### 5.3 Horseradish (*Cochlearia armoracia*)

Volatile oil in horseradish gets rid of microbes that might cause infections of the urinary tract. Horseradish extract can help people with UTI<sup>20</sup>.

### 5.4 Tea Tree Oil (*Melaleuca alternifolia*)

Its antibacterial qualities allow it to combat the germs that cause bladder infections. Apply 10 drops of tea tree oil instead of swallowing. After being submerged in bath water, they can clean the urethra aperture. Along with sandalwood oil, tea tree oil on applied to the abdomen and the surrounding space around the bladder. This is a very accurate way of treating painful urinary tract infections. For perfect effects, use 3-4 times every day<sup>21</sup>.

### 5.5 Buchu (*Agathosma betulina*)

Natural drugs have very long used preparations for more release of urine and urinary tract cleaners<sup>22</sup>. Its volatile oil, which the kidneys essentially eliminate, stimulates urine. If you have acidic urine, a bladder infection, or a constant need to urinate but don't feel better afterwards, use it<sup>23</sup>.

### 5.6 Uva Ursi (*Arctostaphylos uva-ursi*)

It helps treat UTIs because of a variety of chemicals and antiseptic properties. There is a high concentration of tannins. Those with renal or liver disease, expectant mothers, nursing moms, and children should not use uva ursi. This plant can result in dark or green urine, nausea, ear ringing, indigestion, cancer, or even death when taken in high amounts over an extended period of time<sup>24</sup>.

### 5.7 Grapefruit (*Citrus paradisi*)

Pulp and seed of grapes were used to make grape seed extract or GSE. It has been discovered to possess natural antiviral, antifungal, and antibacterial qualities. Prescription antibacterial drugs and grapefruit extract from seeds have similar antibacterial components. Through a range of mechanisms, it affects the development of organisms<sup>25</sup>. Strong components in urine inhibit the growth of dangerous bacteria such as *Pseudomonas aeruginosa*, *Klebsiella scies*, and *S. aureus*. The extract has been shown to eradicate harmful bacteria in 15 minutes when it comes into touch with a diluted solution. Two zinc, berberine, and grapefruit

seed extract capsules should be taken every two hours throughout the day, or until the disease completely resolves<sup>26</sup>.

### 5.8 Echinacea (*Echinacea purpurea*)

It is said to be a strong herb that has numerous beneficial health effects. For over 400 years, Native Americans have been using echinacea as an herbal antibiotic. Echinacea boosts immunity, which helps fight illness. Echinacea is currently regulated by the German government as an approved remedy for UTIs. It comes in the form of tea, tincture, or tablet extract and contains a wide range of plant chemicals. To improve immunity and expedite the healing process, a variety of medicines are utilised, such as infusions, extracts, tinctures, and poultices<sup>27</sup>.

### 5.9 Garlic (*Allium sativum*)

Because it can increase immunity and reduce inflammation, garlic is well known for its antimicrobial qualities. It consists of sulphur. Allicin is an excellent source of the potent antioxidant glutathione and helps with detoxification<sup>28</sup>. Garlic extract is a treatment for recurrent UTIs. Additionally, reviews indicate that using it lessens impulses to urinate frequency of urine and pain in the pubic area<sup>29</sup>.

### 5.10 Oregano (*Origanum vulgare*)

Carvacrol is a strong, unpredictable oil. An antibiotic found in oregano oil combats Salmonella and *E. coli*<sup>30</sup>. Strains of bacteria including *P. aeruginosa* and *E. coli* are inhibited from multiplying due to the antibiotic properties of oregano essential oil. *E. coli* is a prevalent cause of UTIs that is resistant to therapy; this is the aim of its antibacterial action. It also fights infections caused by streptococci. As "reverse antimicrobial treatments improving recovery process in" one study<sup>31</sup>. oregano oil was described.

### 5.11 Chamomile Flower (*Matricaria recutita*)

Its fragrant chemicals offer antimicrobial qualities, lessen inflammation, ease muscle discomfort and spasms, and improve the passage of digestive fluids. These substances have a relaxing and soothing effect in addition to being useful in the treatment of urinary tract infections<sup>32</sup>.



### 5.12 Moringa (*Moringa oleifera*)

Moringaceae is the name of its family. Sohanjna is the one being utilised besides there is a reduction in fever and antimicrobial properties. It includes amino acids, acetylated carbamate, spirochin, tocopherol, kaempferol, and thiocarbamate glycoside<sup>33</sup>.

### 5.13 Ginger (*Zingiber officinale*)

Moringaceae is the name of its family. Sohanjna is the one being utilised. It includes amino acids, acetylated carbamate, spirochin, tocopherol, kaempferol, and thiocarbamate glycoside<sup>34</sup>.

### 5.14 Spade Flower (*Hybanthus enneaspermus*)

It is a member of the Violaceae family. It is referred to as spade bloom. It has antimicrobial, antidiabetic, and antioxidant properties. Its herbal properties are attributed to the presence of flavonoids<sup>35</sup>.

### 5.15 Hareer (*Terminalia chebula*)

It belongs to the Combretaceae family. Hareer, or har, is the colloquial phrase. It shows antibacterial and hypolipidemic. Fatty acids, gallic acid, betulinic acid, tannic acid, beta-sitosterol, and chebulin are among its constituents<sup>36</sup>.

### 5.16 Tulsi (*Ocimum sanctum*)

The Lamiaceae family is involved. It's a well-liked name. It has antibacterial, anti-inflammatory, analgesic, and antipyretic properties. Among its components are flavones, carnosic acid, betasitosterol, apigenin, rosmarinic acid, eugenol, vicenin, orintin, and polyphenol<sup>37</sup>.

### 5.17 Celery Seeds (*Apium graveolens*)

It belongs to the family Apiaceae. It's known as celery seed in most places. It contains diuretic, antioxidant, and anti-inflammatory qualities. beta-sitosterol, succinic acid, oplopandiol, falcariindiol, and lunularin B<sup>38</sup>.

### 5.18 Barberry (*Berberies vulgaris*)

Barberries contain berberine, which shows amazing anti-infection qualities. Studies reveal that it eliminates bacteria that cause urinary tract infections, such as streptococci and *E. coli*. The body's detoxification and

elimination mechanisms function more effectively because of the bitter chemicals found in dandelion root (*Taraxacum officinalis*). These substances facilitate the production of bile and other digestive enzymes and healthy liver function. It has a laxative effect and facilitates urination<sup>39</sup>.

### 5.19 Oregon Grape (*Berberis aquifolium*)

It is one possible remedy for UTIs. None of these herbs, nonetheless, are effective in treating UTIs in people.

### 5.20 Plantain (*Plantago lanceolata*)

Plantains may help people with urinary tract infections because of their anti-inflammatory properties. Nevertheless, there are no clinical studies to support this idea or the widely held belief that plantains contain diuretic qualities.

### 5.21 Goldenseal (*Hydratis canadensis*)

Many different infections react differently effectively to goldenseal treatment. Bioactive materials found in plants like Oregon grape and goldenseal may work similarly to proanthocyanidins in preventing the adherence of bacteria to bladder walls.

### 5.22 Juniper Berry (*Juniperus communis*)

Its bitter components facilitate easier urination. Moreover, it accelerates the secretion of digestive juices that reduce pain and help in absorption. It is used as a stimulant, diuretic, and antibacterial. It is highly advantageous for chronic cystitis; it is good to avoid using it for acute inflammation as it may irritate the bladder. Its aromatic components promote increased urination. These herbs are typically used as tea.

### 5.23 Burdock (*Arctium lappa*)

It belongs to the Asteraceae family. It has diuretic and antibacterial qualities. Also includes caffeineoylquinic acid and cynarin, and There are luteolin, rhamnoside, caffeic acid, quercetin, quercitrin, and other lignins, flavonoids, arctigenin, and arctiin<sup>40</sup>.

## 6. Some Urologic Herbs' Chemical Compositions Beneficial against UTIs

A lot of illnesses related to the urinary system are cured with the tannin found in blueberry leaves. Buchu

leaves contain 1.0–3.5% flavonoids and volatile oils. Buchu's antibacterial properties against the urinary tract are believed to originate from its volatile oils. About 5–6% of the total alkaloids found in goldenseal roots and rhizomes are berberine, which has a broad range of antibiotic properties against pathogenic microorganisms such as *Entamoeba histolytica*, *Salmonella typhi*, *E. coli*, and *Chlamydia*. Research has demonstrated that the volatile oil present in horseradish has a positive effect on getting rid of germs that could lead to UTIs. There may be diuretic effects from horsetail. influence on the outcome of flavonoid and saponin content. Terpinen-4-ol in juniper can increase urine volume without lowering electrolytes like potassium. The active ingredients that help in treating infections related to the urinary system are most likely polysaccharides and lectins.

Berberine, found in Oregon grapes, decreases the risk of infection, especially urinary tract infections, by preventing bacteria from adhering to human cells. A plantain's primary chemical constituents are tannins, mucilage, iridoids, and glycosides, particularly aucubin. When combined, these components may give plantains some modest antibacterial and anti-inflammatory effects. The oil that can heal UTIs is its volatile oil. Up to 85% of the terpenoid in this erratic oil is saffron<sup>41</sup>.

## 7. Discussion

Various parts of the urinary tract system could harbour the bacteria that cause urinary tract infections. The infection listed by doctors in poor nations is UTI. Diabetes, renal failure, long-term corticosteroid therapy, and the use of immune-suppressive medications for autoimmune illnesses are long-term factors that increase the risk of UTI. The main problem is urinary obstruction brought on by prostatic hypertrophy, tumours, bladder catheterization, and pregnancy<sup>42</sup>.

*Klebsiella* species, *E. coli*, and *E. faecalis* are the main offenders. UTIs are caused by uncommon bacteria found in subtropical regions, including *Proteus*, *Staphylococcus*, and *Pseudomonas variola*. Natural medication is inexpensive, safe, and simple to take. The main benefit of these herbal medicines is that they do not cause bacterial resistance. These natural therapies can help with the resistance issue that results from using standard treatments. No reports of

microbial susceptibility to herbal medicine have been produced to date, perhaps due to the diverse array of phytochemical components found in medicinal plants, which are primarily responsible for both their positive and synergistic effects. The phytochemicals used to treat urinary tract infections were the only topic of this review. Research is currently being done to pinpoint the precise processes via which the phytochemicals in these herbs affect UTIs. To fully understand these phytochemical modes of action, more investigation is required. To determine which phytoconstituents are responsible for treating UTIs, more research is required. Thus, you must carry out additional research on genetics and develop techniques to ascertain how phytoconstituents work to eradicate harmful microorganisms<sup>43</sup>.

## 8. Conclusion

Among the most prevalent illnesses in both industrialized and developing nations, urinary tract infections are more common in women than in men. Depending on the extremity of the infection, different drugs are used to treat UTIs. However, the bacteria linked to UTIs are becoming more tough for medical experts to treat as a result of antibiotic treatment resistance. One kind of alternative therapy that has been proven to be one of the most effective therapeutic approaches and is regarded as a godsend for treating UTIs is herbal medicine. Modern methods like RNA sequencing, which studies bacteria directly to identify urinary tract infections, and appropriate evidence of barcoding technology's use to identify medicinal plants and their bioactive components which bolster those plants' antibacterial qualities need, nevertheless, to receive greater attention.

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