

# ANTIBACTERIAL ATTRIBUTES OF ARCTOSTAPHYLOS UVAURSI ON URINARY TRACT INFECTION

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**Abstract:** Urinary tract infection is one of the most habitual bacterial infections in the general population, with an estimated overall incidence rate of 18 per 1000 person per year. Urinary tract infection (UTI) is an infection that commences in the urinary tract system. The human urinary tract comprises of kidneys, ureters, bladder and urethra. Habitually the microorganisms are responsible for the urinary tract infection especially of bacteria. In the treatment of infections in urinary system, numerous herbs and plants are being exerted throughout the world as exotic plants. Amongst them Bearberry (*Arctostaphylos uva ursi*) which is a pervasive procumbent shrub located throughout North America, Asia and Europe. It has the potential effect in treating urinary tract infection. The herb contains abundant bioactive compounds such as arbutin, methylarbutin, tannins, ursolic acid, gallic acid, syringic acid as well as flavanoids. Some studies reveal that *Arctostaphylos uva ursi* folium has the tendency to inhibit proliferation of some bacteria. The fruits of bearberries are almost tasteless albeit containing a high concentration of active ingredients. This review article encompasses the antibacterial features of *Arctostaphylos uva ursi* that have been clinically proven to prevent urinary tract infection.

**Key words:** *Arctostaphylos uva ursi*, bearberry, urinary tract infection, antibacterial features

## I. INTRODUCTION

Urinary tract infection (UTI) is an infection that commences in the urinary system. It is the second most common after respiratory infection. Urinary tract infection could occur in kidneys, ureters, bladder and urethra of the urinary system. (Geetha, R.V. et al., 2010) Urinary tract infection is one of the most habitual bacterial infections in the general population, with an estimated overall incidence rate of 18 per 1000 person per year (Edmond Pucal., 2014) Urinary tract infection is a common contagion among population, but the incidence is relatively high among women due to their physiology and remarkably higher among the pregnant women (Ranganathan Vasudevan., 2014) Uncircumcised male infants less than 3 months of age and females less than 12 months of age had the highest baseline prevalence of urinary tract infections, a study says. (Nader Shaikh et al., 2008) Though bacteria are the major causative factor of Urinary Tract Infection, fungi, virus and parasites can also play a role.

Infection of the bladder causing cystitis is the most common Urinary tract infection but infection can also occur in other parts of the urinary tract, which might cause pyelonephritis, urethritis and prostatitis. (Neil S Sheerin., 2011) In the treatment of the infections that occurs in the urinary system, numerous herbs and plants are being exerted throughout the world. Amongst them Bearberry (*Arctostaphylos uvaursi*) which is a pervasive procumbent shrub located throughout North America, Asia and Europe. It has the potentiality to treat the urinary tract infections. The leaf extract of *Arctostaphylos uva-ursi* (bearberry) has been approved for use for urinary tract inflammation by the German Federal Institute for Drugs and Medical Devices. The herb is reported to have diuretic, urinary antiseptic, astringent and anti-inflammatory properties. The antioxidant potential of bearberry leaves has been studied by numerous chemical analysis including reducing power assay, radical scavenging activity using 2,2-diphenyl-1-picrylhydrazyl (DPPH) and scavenging hydroxyl radicals (HO). The main constituents of bearberry leaves are the glycosides arbutin (5%–15%), methylarbutin (up to 4%), and small quantities of the free aglycones. Other elements may include ursolic acid, tannic acid and gallic acid. The extract components include flavonoids, iridoids, hydroquinone glycosides (mainly arbutin), tannins and terpenoids. (Trill J et al., 2017) The fruits of bearberries are almost tasteless albeit containing a high concentration of active ingredients. (Nurul Aini Mohd Azman et al., 2016)

## II. ETIOLOGY AND RISK FACTORS OF URINARY TRACT INFECTION

In Majority of the people possessing urinary tract infections, the infection starts when there is absence of structural or functional abnormality within the urinary tract. Typically, the urinary tract is hygiene and the infection emerge only when bacterial severity overcomes normal host defence mechanisms. (Neil S Sheerin., 2011)

*E. coli* is the most common causative pathogen involved in urinary tract infection betwixt the numerous microorganisms. Approximately 80% of all occurrences of infection are due to this organism. Other notable pathogens are *Staphylococcus saprophyticus*,

*Klebsiella pneumoniae*, and *Proteus mirabilis*, which each cause approximately 4% of all incidents of acute cystitis. (Saskatoon SK et al., 2017)

Associations of urinary tract infection with the following have been established

- Age,
- Pregnancy,
- Sexual intercourse,
- Use of diaphragm and a spermicide,
- Delayed post-coital micturition and
- Menopause. (Najar MS et al., 2009)

Other risk factors may include, any interruption or impedance of the usual flow of urine (about 50 cc per hour in normal adults) is a risk factor. Kidney stones, urethral strictures, enlarged prostate, or any anatomical abnormalities in the urinary tract increases infection risk. Women are far more susceptible than men to Urinary tract infection because their urethra is short and its exit (or entry for pathogens) is close to the anus and vagina, which in turn the sources for pathogens. (Geetha, R.V. et al., 2010)

### 2.1. Indicators of Urinary Tract Infection

The indicators associated with cystitis are usually

- Pain on urination (dysuria),
- Urgency (inability to delay urination),
- Frequency (urinating small volumes more often) and
- Suprapubic pain.
- Urinary frequency accompanied by symptoms of thirst and unexplained weight loss can indicate diabetes.

The patient is also likely to be systemically unwell, with fever and rigors when bacteremia is associated with the infection. Such features are more evident in upper urinary tract infections, in which case they are associated with loin pain and vomiting. However, none of these features is merely indicative of urinary tract disorders - and similar presentations can be seen in other urinary tract disorders such as urethritis, calculi and herpetic lesions. (Balakrishnan I., 2010)

Some may also experience the following symptoms

- Some men experience fullness in the rectum.
- Despite the urge to urinate, only a small amount of urine is passed
- Milky, cloudy or reddish urine
- Foul-smelling urine
- A fever, which may mean that the infection has reached the kidneys
- Pain in the back or side below the ribs
- Nausea and/or vomiting (Geetha, R.V. et al., 2010)

### III. ARCTOSTAPHYLOS UVA-URSI –BIRD’S EYE VIEW

Traditionally, plants have served a basis for evolution of novel drugs, thereby contributing to human health and well-being. A variety of plant-based polyphenols serve as dietary constituents as well as active components in number of herbal and traditional medicines. In excess of 5000 plant polyphenols have been identified, and several of them exhibit a wide spectrum of biological effects, including anti-inflammatory, antimicrobial, and anti-carcinogenic properties. (Mary Anne Roshni Amalaradjou et al., 2011)

Bearberry is an evergreen shrub. The leaves are oval, up to 3 cm long, leathery. The flowers are gathered in small clusters. The fruit is a red berry. This plant grows in dry and rocky habitats at high mountains up to 2400 meters above sea level. (Dragana M. Vucic., 2013) The leaves and preparations made from Bearberry (*Arctostaphylos uva-ursi* L., fam. Ericaceae), are being used in traditional and modern medicine for treating urinary tract infections, while the leaves exhibit strong antibacterial, anti-inflammatory, antioxidant and diuretic effects.

The herb is packed of many bioactive compounds such as arbutin, methylarbutin, tannins, ursolic acid, gallic acid, syringic acid and also some flavonoids. Antibacterial activity, total phenolic content and flavonoid concentrations of extracts from the leaves of *Arctostaphylos uvaursi* L. were performed by many. The most active plant extracts were aqueous and ethanol extracts. In which the ethanol extract has the highest amount of the total phenolic content (300.23 mg GA/g) and concentration of flavonoids (73.46 mg RU/g). (Dragana M et al., 2013)

And also, an ethanolic extract of bearberry (*Arctostaphylos uvaursi*) leaves has been found to have potent antioxidant activity in model and meat systems and therefore demonstrated a potential for use as a natural antioxidant in non-nitrite processed meats. (Gary A. Dykesa et al., 2002)

### 3.1. Antibacterial Effect of *Arctostaphylos Uva Ursi*

In nature the *Arctostaphylos uva ursi* possessing antibacterial properties. The antimicrobial activity of *uva ursi* was attributed to its power to change microbial cell surface characteristics. When grow the clinical isolates of *E. coli* in the presence of *uva ursi* extracts, it has the ability to increasing the microbial cell surface hydrophobicity, thus in turn decreasing their ability to cling to host cells. Additionally, *uva ursi* has diuretic and anti-inflammatory effects that indirectly aid in antimicrobial potentiality to control Urinary tract infections. (Mary Anne Roshni Amalaradjou et al., 2011)

Antibacterial effects of the herbs are exhibited by the existence of hydroquinone, originated from arbutin. The examination has been carried out by the analysis of the arbutin metabolites, from the leaves of bearberry. Antibacterial effect of arbutin evaluated on *Pseudomonas aeruginosa*, *Ureaplasma urealyticum* and *Mycoplasma hominis* and also on *Listeria monocytogenes*. It has established the claim of a strong antibacterial activity of arbutin. However, the aqueous extract has shown strong antibacterial activity. (Dragana M et al., 2013)

The antimicrobial activity of an antioxidant ethanolic extract of bearberry (*Arctostaphylos uvaursi*) leaves, alone and also in combination with nisin (antibacterial peptide), was determined against 25 food-related bacteria by the spot-on-lawn and the micro-dilution methods. The combination of nisin and the bearberry extract slow down the growth of some bacteria, most notably *Brochothrix thermosphacta*, as compared to nisin alone. Sub-lethal injury was induced in two types of bacteria (*Bacillus cereus* and *Broch. thermosphacta*) by the bearberry extract.

The growth kinetics of four bacteria picked out from the 25 were determined in the presence of nisin and bearberry extract by monitoring absorbance at 550 nm, while the degree of sub-lethal injury of these bacteria was determined with bearberry extract alone by plating on agar with and without 4% NaCl. (Gary A. Dykesa. et al., 2002)

### 3.2. Role of *Arctostaphylos Uva-Ursi* in Urinary Tract Infection

The key component present in *uva ursi* is arbutin, which is the hydroquinone derivative. It will have antimicrobial and astringent properties when the stomach absorbs it and changes it into a substance with disinfectant. Arbutin fights with infection, soothes irritation and reduce inflammation during urination. (Geetha R.V. et al., 2010)

The active antimicrobial ingredient in bearberry is an aglycone hydroquinone which is released in alkaline urine. The study connected with human subject shows that who consumed a dried leaf extract of *uva ursi* showed that 64.8% of arbutin consumed in tablet form and 66.7% of arbutin ingested in aqueous solution were released in the urine. This significant level of the fruit extract in urine was attributed to its antimicrobial effect.

The one more clinical study conducted with human subjects in which urine from patients given extracts of *uva ursi* or isolated arbutin was evaluate. The urine from the treatment group demonstrated significant antimicrobial activity against *E. coli*, *P. mirabilis*, *P. aeruginosa*, *S. aureus* and 70 other urinary bacteria. The same study also demonstrated that the crude extract of *uva ursi* was more effective against bacteria than arbutin by itself. (Mary Anne Roshni Amalaradjou et al., 2011)

As well as the herb, has been reported to be effective against *E. coli*. The antimicrobial effect appears to be in part due to the capacity of aqueous *uva ursi* extracts to change microbial cell surface characteristics. In a study of 40 *E. coli* strains isolated from urine of patients with pyelonephritis, *uva ursi* significantly increased the hydrophobicity of the microbial cell surface, decreasing the ability of bacteria to adhere to the host.

In addition to this the *Uva ursi* appears to have diuretic and anti-inflammatory effects. In a clinical double-blind study of 57 women tested the herb's effectiveness for prevention of Urinary tract infections. Half were given *uva ursi*, while the other half took a placebo for one year. At the end of the study, five of the placebo group and none in the *uva ursi* group had gotten bladder infections.

Dosage is 250 to 500 mg of extract (standardized to contain 20% arbutin) three times daily. *Uva ursi* works most efficiently in alkaline urine, so it is best not used with supplements that might acidify the urine, such as cranberries or vitamin C. Due to the herb stimulates uterine contractions, the herb is limited during pregnancy. Overdoses may cause nausea, vomiting, ringing of the ears and convulsions. (Geetha, R.V. et al., 2010)

## IV. CONCLUSION

When the foods are taken as herbs, it has a positive impact on the human health. And it is also similar in treating urinary tract infections. The herb discussed above plays major role in treating the infections takes place in urinary tract system. It is believed to fight against the bacteria, thereby effective in the management of infections. The bioactive components present in the leaves of *Arctostaphylos uva ursi* are being actively involved in dealing the infections of urinary system. The herb can be taken in any form like extracts, powders, pellets, juices etc. If the leaves and fruits of the bearberry consumed on regular basis it could prevent numerous bacterial infections including urinary tract infections. Further research can be carried on isolation of nutraceutical component from *Arctostaphylos uva ursi*, which could be served as an alternative medicine for pharmaceutical product.

## REFERENCES

- [1] Ahmad-Reza Gohari and Soodabeh Saeidnia. 2014. The role of herbal medicines in treatment of urinary tract diseases. *Journal of Nephro pharmacology*. 3(1): 13–14.
- [2] Balakrishnan, I. 2010. Dealing with urinary tract infections. *The pharmaceutical journal*. volume 287:687 - 690

- [3] Dragana M. Vucic, Miroslav R. Petkovic, Branka B. Rodic-Grabovac, Sava M. Vasic, Ljiljana R. and Comic. 2013 In vitro efficacy of extracts of arctostaphylos uva-ursi L. On clinical isolated escherichia coli and enterococcus faecalis strains. Kragujevac Journal of Science, 107-112.
- [4] Edmond Pucal. Urinary Tract Infection in Adults. 2014. Clinical Microbiology: Open Access. 3(6):1000e120.
- [5] Gary A. Dykes, Ryszard Amarowicz and Ronald B. Pegg. 2002. Enhancement of nisin antibacterial activity by a bearberry (Arctostaphylos uva-ursi) leaf extract. Elsevier Journal, 20 (2):211-216.
- [6] Geetha, R.V. Anitha roy and Lakshmi, T. 2010. Nature's Weapon against Urinary Tract Infections. International Journal of Drug Development & Research, 3(3):85-99.
- [7] Kucheria, R. Dasgupta, P. Sacks, S H. Khan, M S and Sheerin, N S. 2005. Urinary tract infections: new insights into a common problem. Post graduate medical journal, 81(952):83-86.
- [8] Mary Anne Roshni Amalaradjou and Kumar Venkitanarayanan. 2011. Natural Approaches for Controlling Urinary Tract Infections. Intech Open Science, ISBN 978-953-307-757-4:227-244.
- [9] Nader Shaikh, Natalia E. Morone James E, Bost, and Max H. Farrell. 2008. Prevalence of Urinary Tract Infection in Childhood. The Pediatric Infectious Disease Journal, 27(4):302-308.
- [10] Najar, MS. Saldanha, CL and Banday, KA. 2009. Approach to urinary tract infections. Indian Journal of Nephrology, 19(4):129-139.
- [11] Neil S Sheerin. 2011. Urinary tract infection. The American journal of Medicine. 39(7):384-389.
- [12] Nurul Aini Mohd Azman, Maria Gabriela Gallego, Francisco Segovia, Sureena Abdullah, Shalyda Md Shaarani and María Pilar Almajano Pablos. 2016. Study of the Properties of Bearberry Leaf Extract as a Natural Antioxidant in Model Foods. MDPI Journal, 5(2):11.
- [13] Ranganathan Vasudevan. 2014. Urinary Tract Infection: An Overview of the Infection and the Associated Risk Factors. Journal of Microbiology & Experimentation, 1(2):1-15.
- [14] Saskatoon, SK and St. Lambert, QC. 2017. No. 250-Recurrent Urinary Tract Infection. Journal of Obstetrics and Gynaecology, 39(10):422-431.
- [15] Trill, J. Simpson, C. Webley, F. Radford, M. Stanton, L. Maishman, T. Galanopoulou, A. Flower, A. Eyles, C. Willcox, M. Hay, A. Griffiths, G. Little, P. Lewith and Moore, M. 2017. Uva-ursi extract and ibuprofen as alternative treatments of adult female urinary tract infection (ATAFUTI): Study protocol for a randomised controlled trial, 18(1):421.

