Summary

This study aimed to provide a bacteriological profile of uropathogens in the Kumaun region. The microorganism that we investigated were bacteria isolated from urine of urinary tract infected (UTI) patients. UTI is an extremely common medical problem, and is defined as bacteriuria i.e., the multiplication of bacteria in urine within the renal tract and the presence of 100000 (10^5) or more per ml in the mid-stream sample of the urine. UTI is the second most common cause of visits to doctors (after respiratory disease) and is the third most common cause of hospitalizations in India.

A bacterial UTI is the most common kind of infection affecting the Urinary Tract. The urinary tract consists of the kidney, ureters, bladder, and urethra and is characterized as being either upper or lower based primarily on the anatomic location of the infection. The lower urinary tract encompasses the bladder and urethra whereas; the upper urinary tract encompasses the ureters and kidneys.

The UTI can be caused by bacteria and, rarely by virus, fungus and mycobacterium tuberculosis. The culprit is frequently *E.coli* but sometime *S. saprophyticus* or especially in hospital-acquired infection, *Klebsiella species, Proteus mirabilis, Pseudomonas aeruginosa or Enterococcus faecalis*. Candida infection may occur in diabetic and immunocompromised patients.

Microorganisms causing UTI vary in their susceptibility to antimicrobials from place to place and time to time. So identification of the etiological agent and selection of an effective antibiotic agent to the organism in question is very important for effective treatment of bacterial UTIs. Although the spectrum of agents causing UTIs is relatively constant, their antibiotic susceptibility patterns are different in different geographical locations. At present, antibiotics are used for the treatment of several infections. Although antibiotic therapies have been effective, increasingly multiple antibiotics resistance is a major concern and has necessitated urgent research for new antimicrobial compounds. To ensure appropriate therapy, a deeper understanding of the organisms that cause UTI and their antibiotic susceptibility is mandatory.

In recent years, widespread use of antibiotics is blamed for the rise of antibiotic resistant urinary tract pathogens all over the world. As this is a serious threat to global public help, unprecendted steps are being taken. This study aimed to understand possibility of finding new therapeutic agents with novel modes of action from natural
resources from medicinal plants. Among these medicinal plants, *Aloe vera* or *Aloe barbadensis* family is of particular interest due to its age-old reputation as a curative agent and its widespread use in alternate medicine such as Ayurveda. The plant has many common names in India; it is often referred to as *Ghrat Kumari*. Aloes have long been used all over the world for their various medicinal properties.

This research aimed to conduct a systematic bacteriological examination of urine samples along with their antibiogram to understand the trend of antibiogram of uropathogens in the Kumaun region and to provide evidence for the antibacterial effectiveness of *aloe vera* gel and whole leaf extract in in-vitro condition. After analysis of the results following observations were made -

- Out of the 371 patients, 158 (42.58%) were males and 213(57.41%) were females with an overall male female ratio of 0.74:1.

- *E.coli* was the dominant bacteria among all the UTI patients followed by *Enterococcus sp.* (13.48%), *Klebsiella sp.* (6.19%), *Cons* (3.23%), *Proteus mirabilis* (2.69%), *Mrcons* (2.42%), *Citrobacter sp.* (2.15%), *Staphylococcus aureus* (2.15%), *Pseudomonas sp.* (2.15%), *Acinetobacter sp.* (1.34%), *Mrsa* (.53%) and *Alcalegenes f.* (.26%).

- A high percentage of isolates showed resistance to sulfa drugs such as Cotrimoxazole that is line with previous finds. The commonly used antibiotics such as Nitrofurantoin, Ampicillin/sulbactum and Co-trimoxazole were poorly effective against majority of the organisms isolated in this study.

- Methanolic extract showed better antibacterial activity than aqueous extract. Among the gram negative bacteria, high antibacterial activity was observed with whole leaf methanolic extract against *Proteus sp.* (ZOI 9.333±0.333 in 25 mg/ml extract) while among the Gram’s positive bacteria highest antibacterial activity was observed against *S. aureus* (ZOI 8.333±0.333 mm in 25 mg/ml extract) Gel methanolic extract showed significant antibacterial activity against *Proteus sp.* (ZOI 8.333±0.333 mm in 25 mg/ ml) and *S.aureus* (ZOI 8.333±0.333 mm in 25 mg/ml extract).

- Whole leaf methanolic 80% extract of *Aloe vera* showed better MIC than whole leaf aqueous extract. 80% methanolic whole leaf extract of *A. vera* showed better
MIC (2,000 mg/ml) against Proteus sp. respectively followed by (3 mg/ml) against S.aureus.

The methanolic extract of Aloe vera was more effective than the aqueous extract. This can be explained as most of the antibacterial constituents of Aloe vera are non-polar and can be extracted only in organic solvent medium. When dissolved in organic solvent, these substances show their maximum activity in vitro against proteus spp., S.aureus, Alcaligenes f., Pseudomonas spp., Citrobacter spp., Acinetobacter spp., Enterococcus spp.

Apart from increasing drug resistance, there is also increasing evidence that antibiotic therapies can show a number of side effects so use of natural resources as a therapeutic agent in a place of antibiotic will be beneficial. Aloe vera is an herb which has been reported to have antimicrobial activity with negligible side effects.

Acemannan, anthraquinone (emodin and barbaloin) are the major constituent of Aloe vera. Emodin and Barbaloin is the main representative of anthraquinone. Emodin and Barbaloin showed strong affinity for phospholipids membrane and were effective in weakening hydrophobic interaction between hydrocarbon chains of phospholipid bilayer and thereby cause membrane disruption. Acemannan is a major carbohydrate fraction of aloe vera having immunomodulatory activity on dendritic cells. The adjuvant activity of acemannan is due to its capacity to promote differentiation of immature dendritic cells.

Acemannan also increase monocyte activity cytotoxicity, stimulates killer T-cells and enhances macrophage activity. Acemannan enhances macrophage release of interleukin-1 (IL-1), interleukin -6 (IL-6), tumor necrosis factor alpha, and interferon gamma (INF-g) in vivo. Acemannan does not show significant activity in vitro but these two components (anthraquinone and acemannan) together are more effective in vivo, these constituents act in combination with some other factors and become more effective against bacterial infection. All these factors make aloe vera more beneficial over antibiotics. Therefore it can be said that Aloe vera can be one of the remedy to the increasing problem of multiple antibiotic resistance to bacteria.

Still more and better data are needed to define the effectiveness of this popular herbal remedy more precisely.