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Study the effect of some medicinal plant extracts on microorganisms isolated from urinary tract infections and compare them with antibiotics

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Abstract

Resistance to both new and old medications is increasing as a result of the numerous defense mechanisms that bacterial pathogens have developed against antimicrobial medicines. Numerous medicinal plants must be screened for antibacterial activity due to the issue of antibiotic resistance in pathogenic microbes.

These days, plant extract therapy is an alternative to antibiotic therapy because of the rise in antibiotic resistance, the exorbitant cost of some medications, and the adverse effects they can have on patients.

Pomegranate and lime fruit extracts have antibacterial qualities. According to this study, pomegranate fruit extract affects *Staphylococcus aureus*, and lime fruit extract may be more successful than other antibiotics used to treat some urinary tract pathogens (*Escherichia coli*, *Staphylococcus aureus*, and *Proteus*).

The overall goal of this study is to use pomegranate and lime fruit extracts to effectively find novel antibacterial agents.

Keywords: Antibacterial activity, plant extracts, pomegranate extract, lime extract, antibiotic resistance, *Staphylococcus aureus*, *Escherichia coli*

Introduction

One of the major frequent infectious disorders is urinary tract infection (UTI), which is characterized by symptoms and the presence of bacteria in the urine. One of the most common bacterial illnesses in both men and women is a UTI ^[1, 2].

A combination of clinical symptoms and the presence of bacteria in the urine are what constitute a urinary tract infection, according to the National Institute for Health and Clinical Excellence's (NICE) guidelines ^[5]. Frequency, dysuria, pyuria, abdoeminal discomfort, baeck pain, fever, or urgency are typical clinical signs of a UTI ^[6, 8]. However, none of these signs by themselves are effective in diagnosing a communicative patient with a UTI ^[7, 8].

Feeling grateful The prevalence of urinary tract infections across different demographics will aid in determining the appropriate work-up and level of suspicion for these infections ^[8]. Because the exact diagnosis of UTI depends on both the existence of symptoms and a positive urine culture, it is challenging to determine the precise incidence of UTI because of underreporting ^[27]. The likelihood of a UTI throughout childhood is 2% for boys and 8% for girls ^[11].

Important factors involved in the pathophysiology of UTIs include male circumcision status, peri-urethral flora, micturition problems, bowel disorders, local factors, and hygienic practices. Both bacterial and host variables, such as bacterial adherence and motility, as well as the host's immune response and genetic factors, affect the pathogenicity of bacteria in UTIs ^[12].

The majority of UTIs are caused by gram-negative aerobic bacteria called Enterobacteriaceae, which are found in the gastrointestinal tract. These bacteria include *Escherichia coli* (70–95%), *Klebsiella* 1-2%, *Proteus* species 1-2%, *Staphylococcus* 5–10%, *Enterobacter*, *Citrobacter*, and *Serratia* species ^[1, 3]. For appropriate treatment selection based on culture and sensitivity, doctors also need to be aware of local patterns of microbial susceptibility in UTIs; however, the extent of a population's exposure to a particular antibiotic may influence these variations ^[4].

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Since ancient times, plants have been a major source of medicinal substances that have helped to preserve human health. Eighty percent of people worldwide use plant extracts or their active ingredients as folk medicine in traditional remedies, according to the World Health Organization. Natural products are the source of more than half of all contemporary clinical medications [13].

phytochemicals with anti-microbial and anti-oxidant properties, including vitamins A, C, E, and K; carotenoids; terpenoids; flavonoids; polyphenols; alkaloids; tannins; saponins; pigments; enzymes; and minerals [14].

Therefore, screening for antimicrobials in plant extracts and phytochemicals serves as a foundation for the development of antimicrobial medications. The introduction of new and advanced methodologies has drawn the attention of plant scientists to phyto-chemical investigations. These methods significantly contributed to the hunt for raw material sources for the pharmaceutical industry [15].

Materials & Methods

Bacterial isolates

In microbiology labs, various clinical microbial isolates (including Gram-positive and Gram-negative bacteria) were

extracted and identified using the Api system and conventional biochemical testing [16]. They were then grown in pure cultures. Among these bacteria were *Escherichia coli*, *Staphylococcus aureus*, and *Portus* species.

Antibiotic Sensitivity Test

The antimicrobial susceptibility tests were conducted using Muller-Hinton agar and various commercially available single antimicrobial discs in accordance with Kirby-Bauer (discs diffusion) procedures. The National Committee for Clinical Laboratory Standards (NCCLS) recommendations were followed in reading the results [26].

Using an interpretation chart from the National Committee for Clinical Laboratory Standards, subcommittee on antimicrobial susceptibility testing, the diameters of inhibition zones for each individual antimicrobial agent were converted to terms of sensitive, intermediate, and resistant categories [18].

Source of plant extract

Citrus limon and *Punica granatum* were the plant plants employed in this investigation. These plants were gathered from a nearby marketplace.

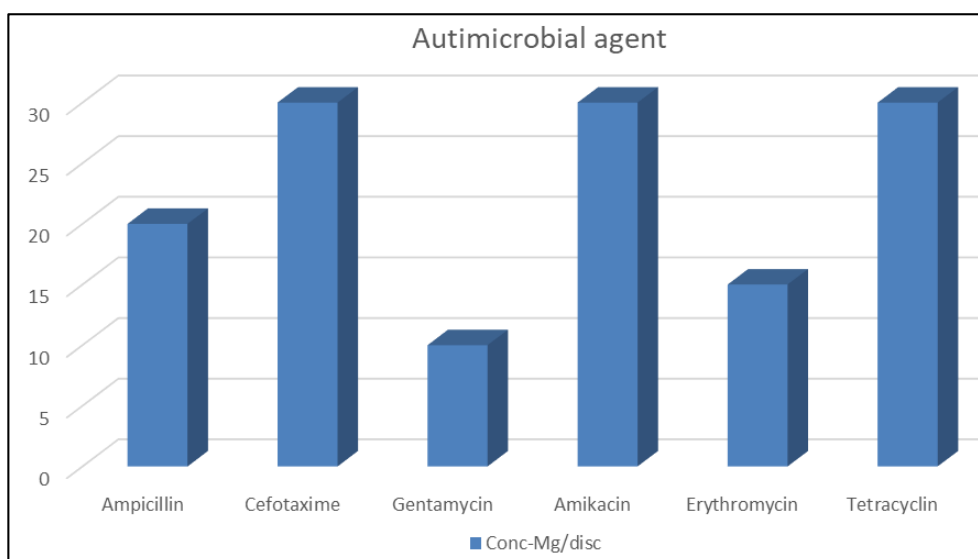


Fig 1: Anti-microbial agents used and their concentrations per disc

Preparation of plant extract

Sterile distilled water was used to collocate and wash the fruit (*Punica granatum* and *Citrus limon*). To extract the crude extract, the samples were crushed into pieces and squeezed. Filter paper and sterilized containers were used to filter the crude extracts [19]. *Citrus limon* and *Punica granatum*, were employed in the juice at concentrations of 100%, 50%, and 25%.

Determination of anti-bacterial activity

The Kirby and Bauer methods of sensitivity determination were used to conduct the sensitivity studies. Mueller Hinton agar sterile Petri dishes were prepared in accordance with manufacturing specifications.

The antibacterial activity was screened using the wells diffusions method. Using Mueller Hinton Agar (MHA), which was obtained from Hi-Media, India, an in-vitro antibacterial treatment was conducted. 15 milliliters of molten media were poured into sterile Petri dishes to prepare the MHA plates. After letting the plates solidify for

ten minutes, the 0.1% inoculum suspension was uniformly swabbed, and the inoculums were left to dry for five minutes. Using a sterile corked borer, wells (6 mm) are aseptically punched on the agar, leaving at least 30 mm between adjacent wells. The plant extract was then introduced into the wells in fixed volumes. After that, the plates were incubated for 24 hours at 37 °C [16]. The antibacterial activity was evaluated by measuring the diameter of the inhibition zone formed around the discs.

Results and Discussion

Antibiotic sensitivity

The results of the sensitivity test have shown that AK (30) was the most effective antibiotic on *Escherichia coli* (17 mm) and the other have less effective antibiotic on *Escherichia coli*. The CTX and SAM were the most effective on *Staphylococcus aureus* (27, 25 mm), and The CTX and TE were the most effective antibiotic on *Proteus* spp. (35, 31 mm) respectively, SAM, GM and AK were have effective on *Proteus* spp. at (25 mm) [10].

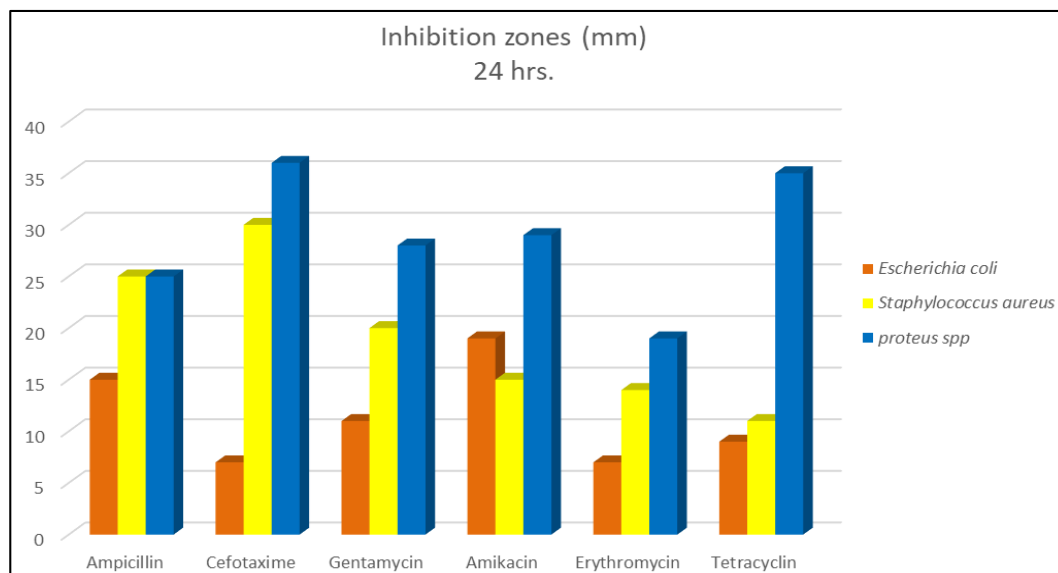


Fig 2: Show anti-biotics susceptibility results (zone of inhibition in mm) against *E. coli*

Antibacterial of biological extracts

Results shown in table (2) indicate that the *Citrus limon* have inhibition against *E. coli* in the concentration 100% and low inhibition in concentration (50%) and the other concentration have no inhibition, in additions the *Punica granatum* have no inhibition too. According to NCCLS cheat ^[12], the results referred to sensitivity of *Proteus* and *E. coli* for carrot, and resistant to *Staph. aureus* and the *Citrus limon* have inhibition against *Staphylococcus aureus* in the

concentration 100% and low inhibition in concentration (50%), (25%) and *Punica granatum* (100%), (50%) and *Staphylococcus aureus* resistant to other concentration and *Daucus carota* juice ^[17].

Results show that the *Citrus limon* juice have effective on *Proteus* spp at concentration (100%), (50%), (25%) and the *Daucus carota* (100%), (50%), and the *Proteus* spp are resistant *Punica granatum* juice at all concentration.

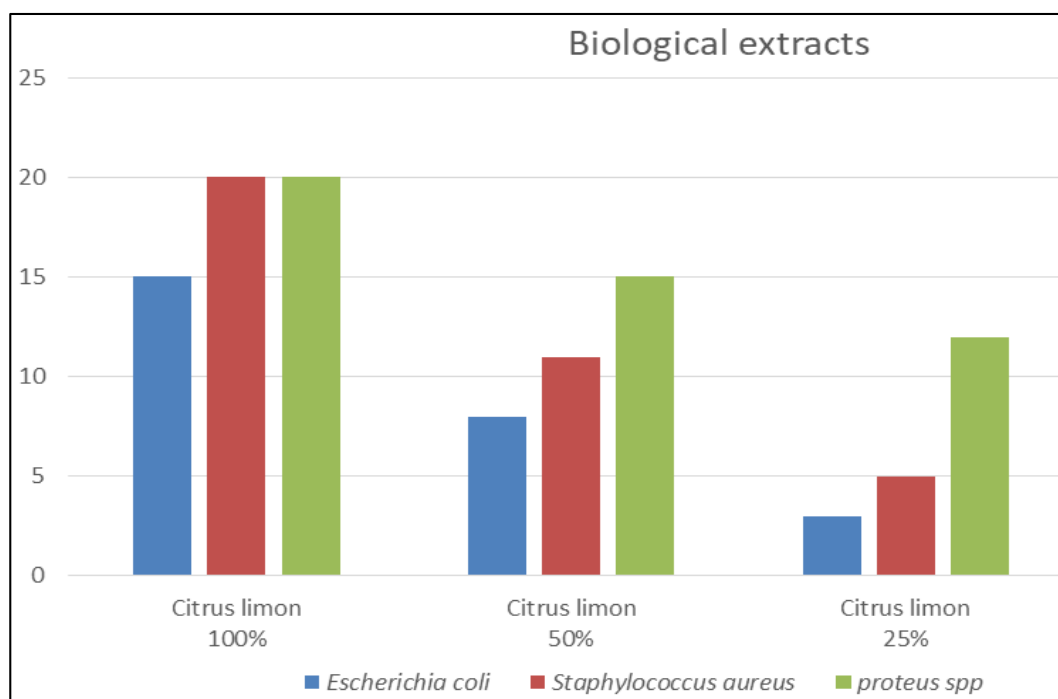


Fig 3: Show *Citrus limon*, juice results (zone of inhibition in mm) against *E. coli*

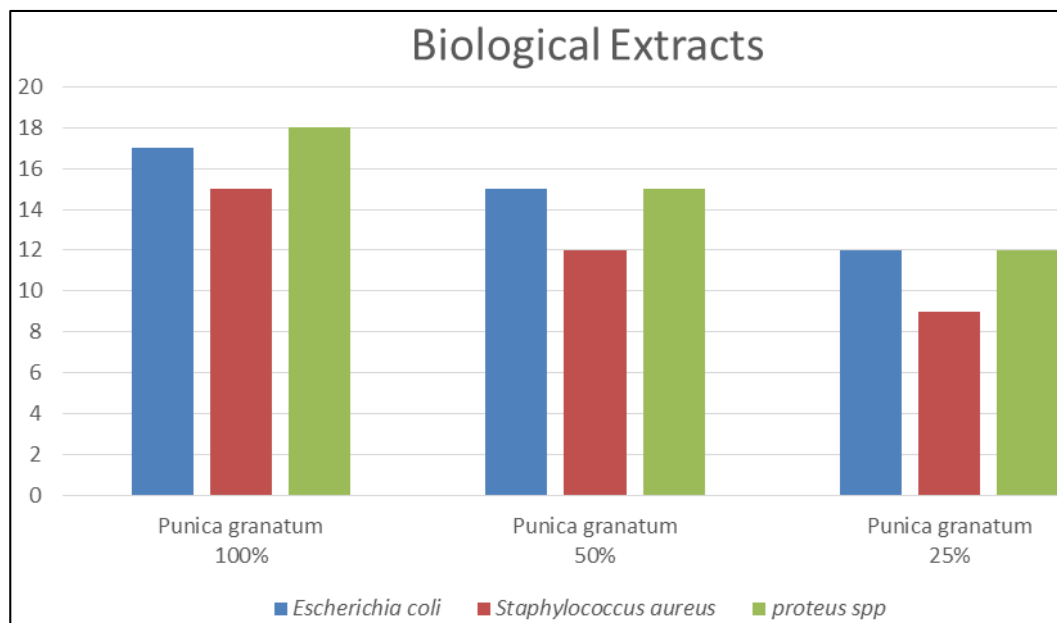


Fig 4: Show *Citrus limon*, juice results (zone of inhibition in mm) against *E. coli*

The phytochemicals found in pomegranate fruit, primarily alkaloids and tannins, are linked to its antimicrobial activity. Of these, the punicalagin compound ellagitannin has been shown to have antimicrobial properties [20].

This result was consistent with that of Hayes and Markovic (2002) [21, 22], who looked into the antimicrobial properties of lemons and discovered that they have strong antimicrobial action against *S. aureus*, *Klebsiella*, *Escherichia coli*, *P. aeruginosa*, and other bacteria. Additionally, *C. limon* has excellent bacterial suppression against *S. aureus*, *P. aeruginosa*, and *P. vulgaris*, according to Al-Ani *et al.* (2009) [23, 24].

The study's findings showed that the juice of *Citrus limon* and *Daucus carota* created zones of inhibition against *Proteus* species. This confirms its use as an anti-infective by demonstrating the presence of strong antibacterial activity. Numerous essential vitamins and minerals can be found in carrots. They include vitamin A, B1, B2, B6, C, D, and E, which are also thought to be antioxidants and immune system boosters, as well as phytochemicals, glutathione, calcium, potassium, and the antioxidants beta and alpha carotene [23].

Conclusions

The effectiveness of the juices of *Citrus limon*, *Punica granatum*, and *Daucus carota* against urinary tract-causing organisms has been recorded, demonstrating the juices' antibacterial properties that are significant to the local market. The type of compounds causing the antibacterial effect must be identified through additional phytochemical elucidations. This study is widely regarded as a successful method for finding new antibacterial compounds in the juice of *Citrus limon*, *Punica granatum*, and *Daucus carota*.

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