Effect of plant extracts compared to antibiotics in inhibiting the growth of microorganisms isolated from urinary tract infections.

Aqeel H. Atallah

Food Science Department, College of Agriculture, University of Karbala, Iraq.

Abstract

The adding resistance to both recently developed and conventional antimicrobial agents is largely attributed to the different defense mechanisms evolved by bacterial pathogens against these medicines. This growing problem of antibiotic resistance among pathogenic microorganisms highlights the critical need to screen a wide range of medicinal shops for their implicit antibacterial exertion.

Factory excerpt – grounded remedy has lately surfaced as a feasible volition to conventional antibiotic treatment, driven by the adding frequency of antibiotic resistance, the high cost of certain pharmaceutical agents, and their associated adverse goods on cases.

Pomegranate (*Punica granatum*) and lime (Citrus *aurantifolia*) fruit excerpts have demonstrated notable antibacterial parcels. The findings of this study indicate that pomegranate excerpt exhibits inhibitory goods against Staphylococcus aureus, while lime excerpt may be more effective than certain conventional antibiotics in treating named urinary tract pathogens, including *E. coli, S. aureus,* and *Proteus* species.

The primary ideal of this study is to estimate the eventuality of pomegranate (*Punica granatum*) and lime (Citrus *aurantifolia*) fruit excerpts as sources for the development of new antibacterial agents.

Keywords : Medicinal shops, Antibiotics, Microorganisms, Urinary tract infections.

Introduction

Urinary tract infection (UTI) is one of the most common contagious conditions, characterized by the presence of pathogenic microorganisms in the urine along with associated clinical symptoms. It represents a significant bacterial infection affecting both men and women, with an advanced frequency reported among ladies [1,2].

According to the guidelines of the National Institute for Health and Care Excellence(NICE), a urinary tract infection(UTI) is defined by the presence of both clinical symptoms and bacteriuria (the presence of bacteria in the urine) [5]. Typical clinical instantiations of a urinary tract infection(UTI) include increased urinary frequency, dysuria, pyuria, abdominal discomfort, back pain, fever, and urgency [6,8]. still, none of these signs alone are sufficient to establish a definitive opinion of a urinary tract infection(UTI) in a communicative case [7,8].

ISSN 2072-3857

In order to determine the appropriate work-up and position of dubitation for urinary tract infections, it is important to be grateful for the frequency of these diseases among various groups [8]. Accurate opinion of urinary tract infection(UTI) requires both the presence of clinical symptoms and evidence by a positive urine culture. Accordingly, determining the true prevalence of UTIs remains grueling, largely due to underreporting [10]. During adolescence, the risk of contracting a urinary tract infection (UTI) is approximately two for boys and eight for girls [11].

Manly circumcision status, peri-urethral foliage, micturition disorders, intestinal dysfunction, original anatomical features, and aseptic practices are significant determinants in the pathogenesis of urinary tract infections (UTIs). Furthermore, the development of complaints is influenced by both bacterial and host factors, including as bacterial motility and adherence, host vulnerability, and inherited predilection, all of which affect the pathogenicity of uro-pathogens [12].

The maturity of urinary tract infections(UTIs) are caused by Gram-negative aerobic bacteria belonging to the family *Enterobacteriaceae*, which are generally set up in the gastrointestinal tract. The most current pathogen is Escherichia coli, counting for roughly 70 – 95 of cases. Other causative agents include *Klebsiella* species (1 – 2), *Proteus* species (1 – 2), *Staphylococcus* species (5 – 10), as well as *Enterobacter*, *Citrobacter*, and *Serratia* species [1,3]. For applicable treatment selection grounded on culture and perceptivity, croakers also need to be apprehensive of original patterns of microbial vulnerability in UTIs; still, variations in antimicrobial vulnerability may be told by the degree of population exposure to a specific antibiotic [4].

Since ancient times, shops have served as a major source of medicinal composites that contribute significantly to the conservation of mortal health. According to the World Health Organization, roughly 80 of the global population relies on factory excerpts or their active ingredients as part of traditional drug systems. likewise, natural products constitute further than half of all presently used clinical medicinal [13].

Phytochemicals enjoying antimicrobial and antioxidant conditioning include vitamins A, C, E, and K; carotenoids; terpenoids; flavonoids; polyphenols; alkaloids; tannins; saponins; colors; enzymes; and colorful essential minerals [14].

thus, the webbing of factory excerpts and phytochemicals for antimicrobial exertion provides a abecedarian base for the development of new antimicrobial

ISSN 2072-3857

agents. The preface of ultramodern and advanced logical methodologies has decreasingly attracted the attention of factory scientists toward phytochemical examinations. These approaches have significantly contributed to the identification of new natural coffers as implicit raw accoutrements for the pharmaceutical assiduity [15].

Material and Methods

Bacterial isolates:

In microbiology laboratories, diverse clinical microbial isolates, comprising Gram-positive and Gram-negative bacteria, were gathered and identified utilizing the API identification method alongside traditional biochemical assays [16]. In order to attain pure societies, the isolates were later clothed *Escherichia coli*, *Staphylococcus aureus*, and *Proteus* species were among the bacterial species connected.

Antibiotic Sensitivity Test

Utilizing Mueller-Hinton agar and commercially available antimicrobial discs, antimicrobial vulnerability testing was carried out utilizing the Kirby-Bauer fragment prolixity technique. The interpretation of results was carried out in agreement with the guidelines of the National Committee for Clinical Laboratory norms(NCCLS) [17].

Each antimicrobial agent's compass of inhibition zones was categorized as sensitive, moderate, or resistant using the criteria provided by the National Committee for Clinical Laboratory Standards (NCCLS) Subcommittee on Antimicrobial Vulnerability Testing [18].

ISSN 2072-3857

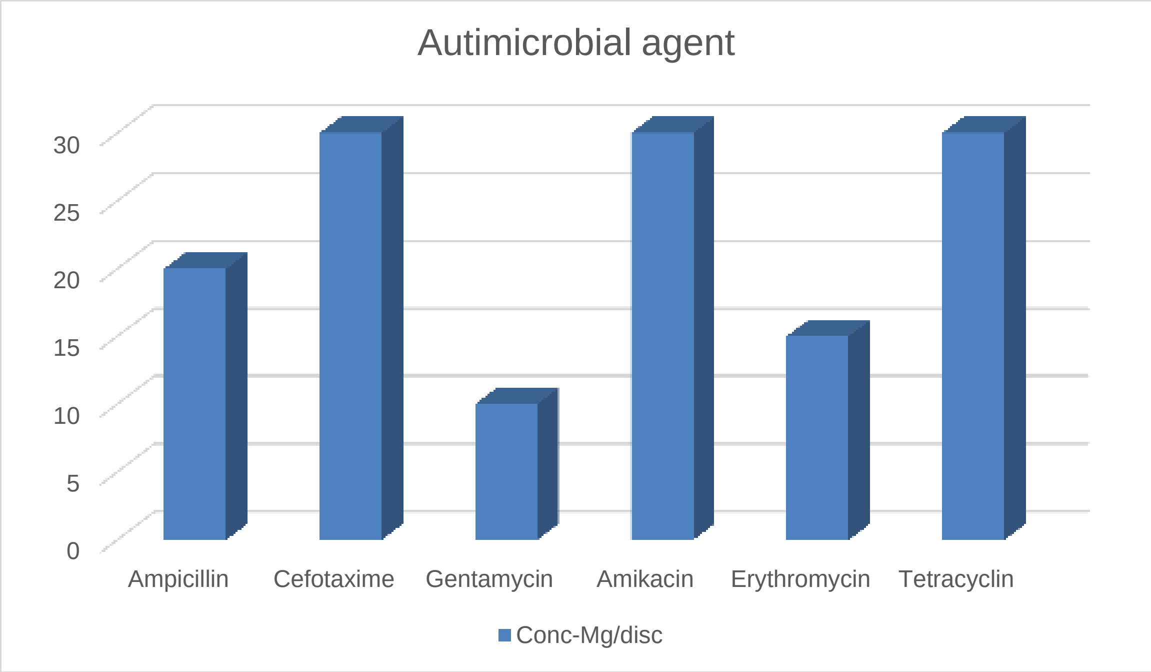


Figure :(1) Anti-microbial agents used and their concentration s per disc

Source of plant extract

Citrus limon and Punica granatum were the factory species used in this study. The samples were collected from a original request.

Preparation of plant extract

The fruits (Punica *granatum and Citrus limon*) were washed using sterile distilled water. To gain the crude excerpts, the samples were cut into small pieces and manually pressed. The performing excerpts were also filtered using sludge paper into castrated holders to insure chastity and remove solid remainders [19]. The juice concentration is 100%, 50%, and 25% in both *pomegranate* juice and *lemon* juice.

Determination of anti-bacterial activity

Antimicrobial vulnerability testing was performed using the Kirby – Bauer fragment prolixity system. Sterile Petri dishes containing Mueller – Hinton agar (MHA) were prepared according to the manufacturer's instructions (Hi-Media, India).

Antibacterial exertion was estimated using the well-conditioned prolixity system. For this purpose, 15 mL of molten MHA was poured into sterile Petri dishes and allowed to solidify for 10 twinkles. A standardized 0.1 microbial inoculum suspense was also slightly swabbed onto the agar face and allowed to dry for 5 twinkles.

Wells of 6 mm periphery were aseptically punched into the agar using a sterile corn borer, icing a minimal distance of 30 mm between conterminous wells. A fixed volume

ISSN 2072-3857

of factory excerpt was also introduced into each well. The plates were latterly incubated at 37 °C for 24 hours [16]. The diameter of the inhibition zones that developed around the discs was used to measure the antibacterial activity.

Results and Discussion

Antibiotic sensitivity

The results of the antimicrobial perceptivity test showed that AK (30) was the most effective antibiotic against Escherichia coli (17 mm), while other antibiotics displayed lower exertion against this organism. CTX and SAM demonstrated the loftiest effectiveness against Staphylococcus aureus (27 mm and 25 mm, independently). In addition, CTX and TE were the most effective antibiotics against Proteus species (35 mm and 31 mm, independently). likewise, SAM, GM, and AK showed moderate exertion against Proteus species, each with an inhibition zone of 25 mm.

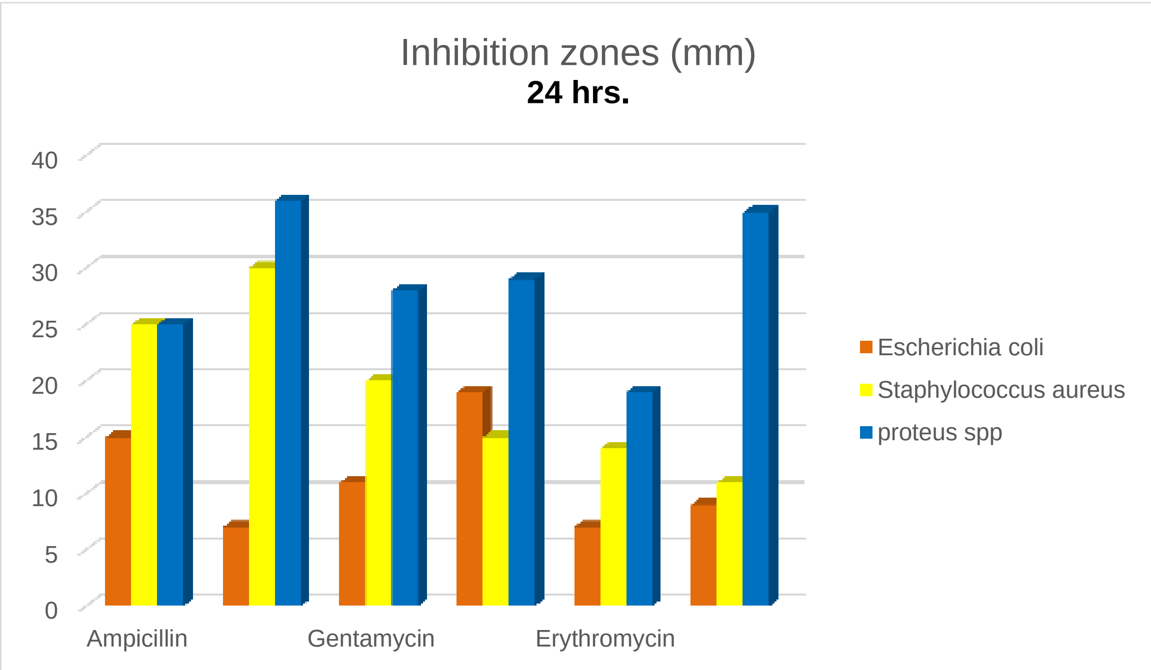


Figure (2) show anti-biotics susceptibility results (zone of inhibition in mm) against *E coli*

ISSN 2072-3857

Antibacterial of biological extracts

The results presented in Table (2) indicate that Citrus Limon displayed inhibitory exertion against E. coli at 100 attentions, with lower inhibition observed at 50 attentions, while no inhibitory effect was recorded at other attention. In addition, Punica granatum showed no inhibitory exertion against E. coli at any tested attention. According to NCCLs cheat [12], The results indicated that Proteus spp. and Escherichia coli were sensitive to Daucus carota (carrot) juice, while Staphylococcus aureus showed resistance. In addition, Citrus limon displayed inhibitory exertion against Staphylococcus aureus at 100 attentions, with lower inhibition observed at 50 and 25 attentions. Punica granatum also showed antibacterial exertion against Staphylococcus aureus at 100 and 50 attentions, whereas no inhibitory effect was observed at lower attention and with Daucus carota juice. Overall, Staphylococcus aureus demonstrated resistance to several tested treatments at reduced attention.

The results showed that Citrus limon juice displayed antibacterial exertion against Proteus spp. at attention of 100, 50, and 25. also, Daucus carota juice showed inhibitory goods at 100 and 50 attentions. In discrepancy, Proteus spp. was resistant to Punica granatum juice at all tested attention

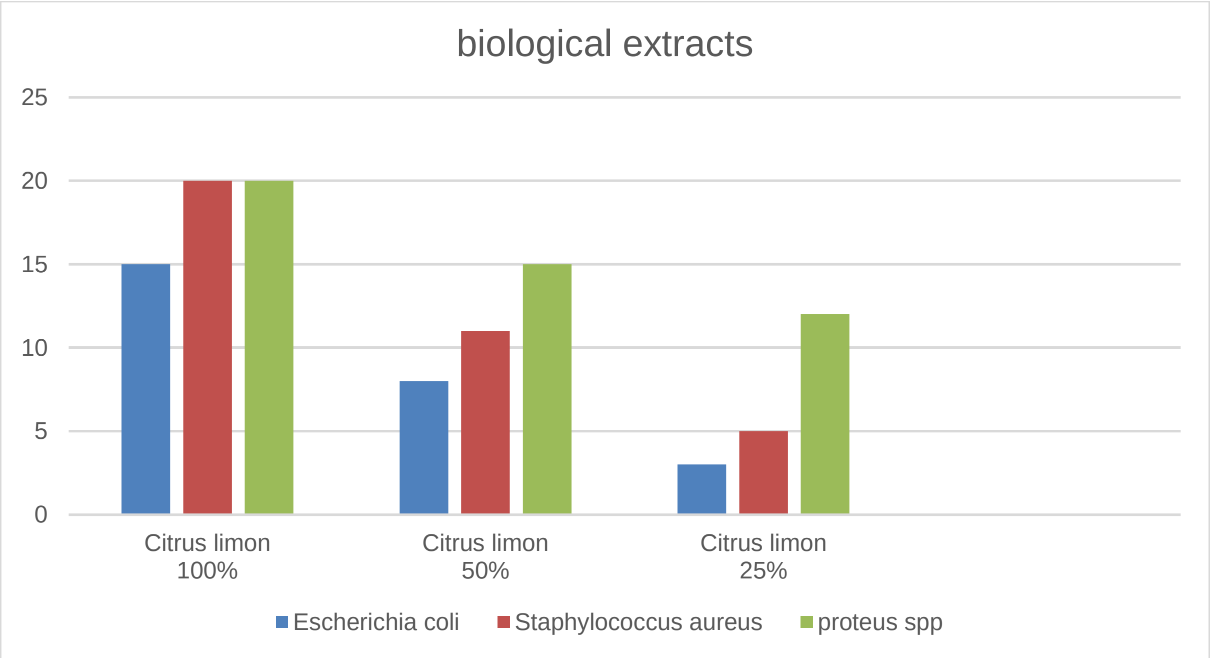
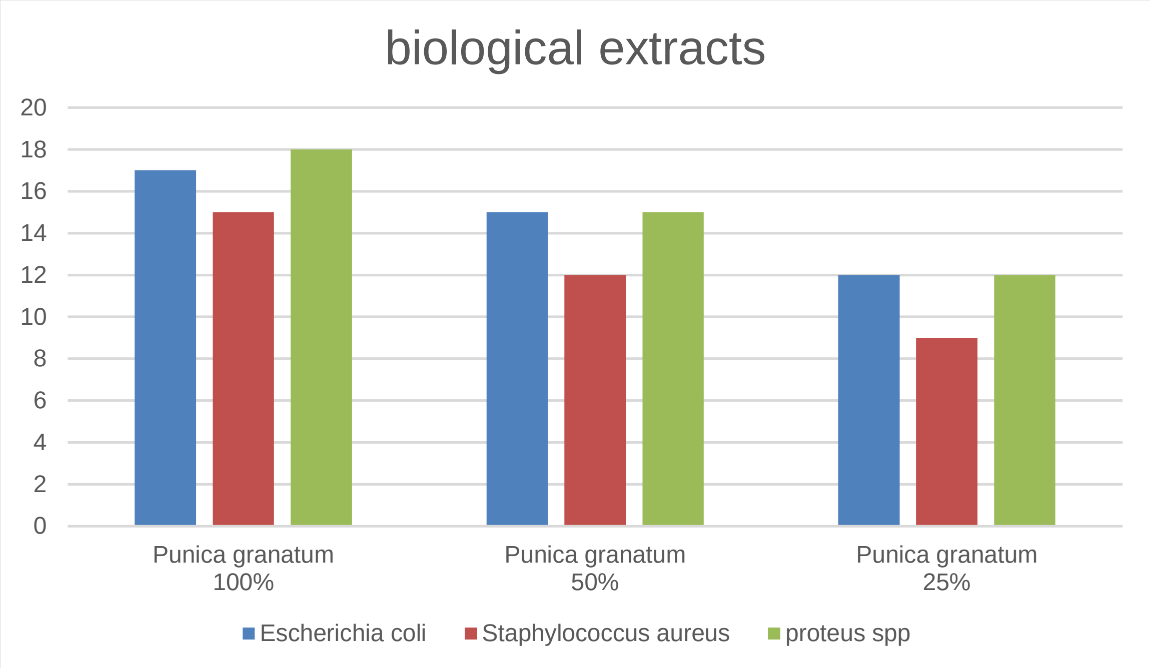


Figure (3-4) show Citrus limon, juice results (zone of inhibition in mm) against E coli

ISSN 2072-3857



Pomegranate fruit's antibacterial activity is linked to its phytochemical components, especially tannins and alkaloids. Punicalagin, a ellagitannin, has been shown to have notable antibacterial properties among these composites [20].

This finding aligns with the work of Hayes and Markovic (2002) [21,22], Research examining the antibacterial effects of lemon (Citrus limon) has documented significant suppression of Staphylococcus aureus, Klebsiella species, Escherichia coli, Pseudomonas aeruginosa, along with various other harmful bacteria. In addition, *C. limon* has demonstrated effective antibacterial activity against *S. aureus*, *P. aeruginosa*, and *Proteus* vulgaris, according to Al-Ani et al. (2009) [23,24].

The findings of the study indicated that *Citrus limon* and *Daucus carota* authorities produced zones of inhibition against Proteus species, attesting their implicit use as anti-infective agents through the demonstration of significant antibacterial exertion. Carrots are known to contain a wide range of essential vitamins and minerals, including vitamins A, B1, B2, B6, C, D, and E, which are honored for their antioxidant parcels and vulnerable- boosting goods. In addition, they contain phytochemicals, glutathione, calcium, potassium, and antioxidant composites similar as beta- carotene and nascence- carotene [23].

Conclusions

Citrus limon, *Punica granatum*, and *Daucus carota* have been shown

ISSN 2072-3857

to be effective against microbes that cause urinary tract infections, demonstrating their strong antibacterial potential within locally accessible manufacturing settings. However, more phytochemical characterization and explanation are needed for the particular bioactive composites that are responsible for this antibacterial activity. All things considered, this work offers a viable method for identifying novel antibacterial compounds from the authority of *Daucus carota*, *Punica granatum*, and *Citrus limon*.

References

[1]Heising, P. (2010). Urinary tract infections and antibiotic resistance. Urologe A, 49, 612–617.

[2]Liza, D.L.T., & Jonathan, O. (2006). Urinary tract infections: Causes, symptoms and treatment. American Journal, 132, 328–337.

[3]Boscia, J.A., et al. (1986). Epidemiology of bacteriuria in an elderly ambulatory population. American Journal of Medicine, 80, 208–214.

[4]Kunin, C.M. (1997). Detection, Prevention and Management of Urinary Tract Infections (5th ed.). Baltimore: Williams & Wilkins, pp. 128–164.

[5]Zorc, J.J., Levine, D.A., et al. (2005). Clinical and demographic factors associated with urinary tract infection in young febrile infants. Pediatrics, 116(3), 644–648.

[6]National Institute for Health and Clinical Excellence (NICE). (2007). Urinary tract infection in children: Diagnosis, treatment and long-term management. NICE Clinical Guideline 54. Available at: http://www.nice.org.uk/cg054

[7]Atallah, A.H., Masaoodi, N.N.A., & Obaid, K.H. (2022). Evaluation of the effect of ciprofloxacin on some cytokines in mice. Journal of Pharmaceutical Negative Results, pp. 1239–1243.

[8]McLoughlin, T.G. Jr., & Joseph, M.M. (2003). Antibiotic resistance patterns of uropathogens in pediatric emergency department patients. Academic Emergency Medicine, 10(4), 347–351.

[9]Sahi, R., & Carpenter, C. (2008). Does this child have a urinary tract infection? Annals of Emergency Medicine.

[10]Quigley, R. (2009). Diagnosis of urinary tract infections in children. Current Opinion in Pediatrics, 21(2), 124–128.

[11]Ghedria, L., Messaoudi, A., Ben Meriem, C., & Guediche, M.N. (2004). Profile of antimicrobial resistance of agents causing urinary tract infections in children. Tunis Med, 82(3), 299–305.

ISSN 2072-3857

[12]University of Wisconsin. (n.d.). Pediatric urinary tract infection module. Available at: http://www.urology.wisc.edu/education/module_7_pediatric_uti.pdf

[13]Kirbag, S., Zengin, F., & Kursat, M. (2009). Antimicrobial activities of extracts of some plants. Pakistan Journal of Botany, 41(4), 2067–2070.

[14]Madhuri, S., & Pandey, G. (2009). Some anticancer medicinal plants of foreign origin. Current Science, 96(6).

[15]Shakeri, A., Hazeri, N., Vlizadeh, J., Ghasemi, A., & Tavallaei, F. (2012). Phytochemical screening, antimicrobial and antioxidant activity of Anabasis aphylla L. extracts. Kragujevac Journal of Science, 34, 71–78.

[16]Mbata, T.I., Debiao, L., & Saikia, A. (2006). Antibacterial activity of crude extract of Chinese green tea (Camellia sinensis) on Listeria monocytogenes. Internet Journal of Microbiology, 2.

[17]Sharma, K.D., Karki, S., Thakur, N.S., & Attri, S. (2012). Chemical composition, functional properties and processing of carrot. Journal of Food Science and Technology, 49, 22–32.

[18]Staniszewska, M., Kula, J., Wieczorkiewicz, M., & Kusewicz, D. (2005). Essential oil of cultivated carrots: Chemical composition and antimicrobial activity. Journal of Essential Oil Research, 17, 579–583.

[19]Kichlbauch, J.A., Hannett, G.E., Salfinger, M., Archinal, W., Monserrat, C., & Carlyn, C. (2000). Use of NCCLS guidelines for disk diffusion susceptibility testing in New York State laboratories. Journal of Clinical Microbiology, 38(9), 3341–3348.

[20]Elgayyar, M., Draughon, F.A., Golden, D.A., & Mount, J.R. (2001). Antimicrobial activity of essential oils from plants against selected pathogenic and saprophytic microorganisms. Journal of Food Protection, 64, 1019–1024.

[21]Machado, T.B., Leal, I.C.R., Amaral, A.C.F., Santos, K.R.N., Silva, M.G., & Kuster, R.M. (2002). Antimicrobial ellagitannin of Punica granatum fruits. Journal of the Brazilian Chemical Society, 13(1), 606–610.

[22]Atallah, A.H., Al-Saedi, S.R., & Khudaier, A.M. (2019). Study the effect of biological extracts compared with antibiotics on bacteria isolated from urinary tract infections. Indian Journal of Public Health Research & Development, 10(8).

[23]Hayes, A.J., & Markovic, B. (2002). Toxicity of Backhousia citriodora (lemon myrtle): Antimicrobial and in vitro cytotoxicity. Food and Chemical Toxicology, 40(4), 535–543.

[24]Atallah, A., Shawkat, M.S., & Mohammed, M.A.S. (2015). Inhibitory effect of some plant extracts on acetylcholinesterase

activity in mice. Iraqi Journal of Science, 56(2A), 1039–1046.

[25]Al-Zoreky, N.S. (2009). Antimicrobial activity of pomegranate (Punica granatum L.) fruit peels. International Journal of Food Microbiology, 134, 244–248.

ISSN 2072-3857