وقائع المؤتمر العلمي السنوي الثالث لكلية التربية الاساسية
في مجال العلوم الصرفة والموسوم:
(مؤتمر كلية التربية الاساسية في مجال العلوم الصرفة)
وتحت شعار
(بالعلوم الصرفة نبني واقعا معرفيا متجددا)
يومي الاحد والاثنين 21-2026/6/22

Evaluation of the Antibacterial Activity of Mentha piperita Extract Against Selected Uropathogenic Bacteria

Aevar Ashraf Khorshed[(1)]
College of Dentistry, Ibn Sina University of Medical and Pharmaceutical Sciences, Baghdad, Iraq.
ayfr1986.g@ibnsina.edu.iq

Marwa Basim Sabri [(2)]
College of Dentistry, Ibn Sina University of Medical and Pharmaceutical Sciences, Baghdad, Iraq.
marwa.basim@ibnsina.edu.iq

Noor Ali Zayed[(3)]
College of Dentistry, Ibn Sina University of Medical and Pharmaceutical Sciences, Baghdad, Iraq.
noor.a.zayed@ibnsina.edu.iq

Abstract:

Urinary tract infections (UTIs) are one of the most common types of infections, which are becoming more adversed due to multidrug resistant (MDR) bacteria. The present study was designed to investigate the uropathogenic bacteria and antibacterial effects of Menthapipperita extracts. Identification was then confirmed using the VITEK 2 system by biochemical confirmatory methods. A total of 128 urine samples were collected from patients at Kirkuk city during period from June to November, 2025. The plant extracts were extracted with water and alcohol as solvents and screened antibacterial activity using agar well diffusion at three concentrations (50, 75, 100 µL). Antibiotic-sensitivity testing was performed by the Kirby-Bauer method and EDR, MDR, and XDR patterns were identified. Of 128 urine samples, 91 (71.1%) were culture positive. Escherichia coli was the most common pathogen (54.9%, p = 0.032), followed by Klebsiella pneumoniae, Proteus mirabilis, Pseudomonas aeruginosa, Enterococcus faecalis and Staphylococcus aureus. High resistance to Ampicillin was seen with Imipenem, Tobramycin and Amikacin showing the highest efficacy. Classification revealed 45 MDR (49.5%), 7 XDR (7.7%) and 2 EDR (2.2%) isolates. Mentha piperita extracts exhibited inhibition of both Gram-negative as well as positive bacteria and RxE exerted greater inhibiting potential in dose-dependent manner. These findings indicate the possible use of Mentha piperita extracts as an alternative for antimicrobial agents in particular against MDR

uropathogenic bacteria. Correct bacteriological diagnosis is necessary in order to treat effectively.

Keywords: Urinary tract infection, MDR, Mentha piperita, VITEK.

Introduction:

Urinary tract infections (UTIs) are among the most common bacterial infections worldwide, with millions of afflicted individuals per year and substantial clinical and economic burdens (Foxman 2014; Flores-Mireles et al. 2015). UTIs are predominantly induced by a broad range of Gram-negative and Gram-positive bacteria, Escherichia coli being the major pathogen; other are Klebsiella pneumoniae, Staphylococcus aureus, Pseudomonas aeruginosa and Proteus mirabilis among others (Foxman 2014).

The extensive emergence of antibiotic-resistant uropathogens has considerably diminished the efficacy of conventional antimicrobial therapies, resulting in longer illness durations and higher healthcare expenditures (WHO 2014; Ventola 2015). As an alternative to antibiotics, attention of the researchers has been attracted towards natural products particularly medicinal plants containing a wide variety of bioactive compounds having possible antimicrobial activities (Raut et al. 2006). Phytochemicals including phenolics, flavonoids, diterpenoids and essential oils have been well documented for their antibacterial potential against different types of pathogenic microorganisms in the literature (Cosentino et al. 1999; Al-Bayati 2014). Of medicinal interest, Mentha piperita L. (peppermint), a member of the Lamiaceae family, has been traditionally employed for its therapeutic properties, which include digestive properties as well as anti-inflammatory and antimicrobial activities (Hammer et al. 1999; Pulipatiet al. 2016). Research conducted on antimicrobial effects of M. piperita reports the essential oil and extracts are inhibitory for a wide spectrum of bacterial species. The essential oil from M. piperita has shown potent antibacterial activity against S. aureus and E. coli in vitro (El-Said et al., 2021; Afrin et al. 2025). Some studies have also showed that extracts of peppermint leaves has anti-bacterial properties against clinical and food, isolates would suggest their potential use as natural antimicrobials (Al-Bayati 2014; Pulipatiet al. 2016). Furthermore, M. piperita essential oil has been demonstrated to have

inhibitory activity against multi-drugresistant bacterial strains, and thus is relevant in combatting antibacterial resistance (Kfoury et al. 2009; Najafi et al. 2019). The antimicrobial effect of peppermint is mainly ascribed to its principal chemical components, menthol and menthone and other monoterpenes which damage the cell membrane of bacteria and prevent their replication (Kfoury et al. 2009; El-Said et al., 2021). Some studies even strongly evidenced that combinatorial effects of phytochemical agents present in the M. piperita extracts are vital for antibacterial activities (Al-Bayati 2016; Afrin et al. 2025). Although there have been an increasing number of reports into the antimicrobial activity of Mentha piperita, there is little research focusing on its effects against clinically isolated uropathogenic bacteria. Moreover, differences in samples extraction methods, solvents systems and bacterial strains used in previous studies can result a possible direct comparison presenting the necessity of standardized investigation of M. piperita extracts against uropathogens. Consequently, the current investigation was designed to assess the in vitro antibacterial activity of Mentha piperita extract against some uropathogenic organisms recovered from UTI patients. The results may be useful in evaluating the possibility of using M. piperita as a natural antimicrobial agent, especially when dealing with growing resistances to antibiotics.

Materials & Methods

Specimen Collection

This study was conducted on 128 urine specimens obtained from patients infected with UTI period June-October 2025 and admitted to Azadi Teaching Hospital, Kirkuk Teaching Hospital/Iraq. Consultant patients were referred to the lab by a consultant physician. Patients were between the ages of 10 to 60 years, mixed sex. Urine samples were delivered to the laboratory promptly in sterile containers for microbiological workup.

Bacterial Identification

The bacterial isolates were characterized by physio-biochemical tests. Samples were initially cultured on blood and MacConkey agar and incubated at 37°C for 24 h. Colony morphology, size, form and hemolytic activity were checked. Gram stain was carried out for Gram positive and

Negative bacteria, Microscopic morphology and Characteristic of organism stressed. Biochemical tests such as catalase, oxidase indole, methyl red (MR), Voges-Proskauer (VP), citrate utilization, urease triple sugar iron (TSI) and motility were employed for confirmatory identification. The spectrum of uropathogens in this study comprised: Gram-negative bacilli (Escherichia coli, Klebsiella pneumoniae, Proteus mirabilis, Pseudomonas aeruginosa, Enterobacter cloacae and Citrobacterfreundii) and Gram-positive bacteria (Staphylococcus aureus, Enterococcus faecalis and Streptococcus agalactiae) (Foxman 2014; Flores-Mireles et al. 2015). This choice is in line with findings of international epidemiology studies for UTIs.

Antibiotic Susceptibility Test (AST)

Muller-Hinton agar was used for Kirby–Bauer disc diffusion test, and the method was in accordance with CLSI (2020). The antibiotic discs used were Ampicillin (10 µg), Gentamicin (10 µg), Tobramycin (30 µg), Levofloxacin (5 µg), Ciprofloxacin (30 µ g) Imipenem(10µ g) Amikacin(30µ), Vancomycin Maryam et al, 2010; Tabassum and Meena, 2013 Nitrofurantoin (30 µ g) Trimethoprim (5 µg). Isolates resistant to three or more antibiotic classes were defined as MDR.

Plant Sample Collection and Preparation

Collection of the plant material Fresh leaves of Mentha piperita were purchased from local markets at Kirkuk, Iraq in June 2025. The leaves were well rinsed with deionized water to get rid of the dust and impurities; they were then air dried in the laboratory until completely dry. Dried leaves were made into fine powder by an electric grinder and 2 mm mesh sieve was used. For the aqueous extract, 50 g of leaf powder was macerated in 200 ml dose of distilled water while for the ethanolic extract, same amount of powdered leaves were macerated in 200 mL quantity of 90% ethanol. Both mixtures remained on an electric shaker for 24 h to ensure a good extraction of bioactive compounds (Zouine et al. 2024). The extracts were filtered on a Buchner funnel with filter paper and sterlized by the Seitz bacterial filter in case of the aqueous extracts. The extracts were concentrated at 40°C under reduced pressure on a rotary vacuum evaporator to obtain thick, concentrated extracts for the antibacterial assay.

Antibacterial Activity Testing

The antimicrobial activity of the extracts from Mentha piperita was determined by agar well diffusion method. Bacterial suspensions were adjusted to 1×10^6 CFU/mL with McFarland standard. A spread plate technique was used to streak 0.1 mL of bacterial suspension across Mueller-Hinton agar plates. 6 mm holes were made on the agar and 100 µL of each extract was dispensed. Plates were then left to stand at room temperature for 30 min to allow the extract to diffuse in the medium and incubated 24 h at 37°C. The zones of inhibition (ZOI) produced by each extract were measured in millimeters after incubation to evaluate their antibacterial effect.

Concentration Testing

The antibacterial activity of Mentha piperita extracts by dose-dependent manner is shown in 3 different volumes (50, 75 and 100 µL), in accordance to the guidelines established for MIC and inhibitory assessment according to Balouiri et al., (2016). The bacterial species indicated above both G- and G+ were challenged with the extracts. The diameters of the zones of inhibition at each concentration were measured to evaluate the potency of the extract and the minimum effective volume that would inhibit bacterial growth.

Statistical Analysis

All study data was encoded and analyzed using SPSS, version 18. Descriptive statistics were made for categorical variables. Cross by cross-ratios were tested with the Chi-square test. Statistical significance was defined as $p < 0.05$. Mean inhibition zones of each bacterial strain and concentration of extract were indicated mean ± SD in order to compare the antibacterial effects adequately.

Results

Distribution of Bacterial Isolates

A total of 128 urine samples were collected from patients with urinary tract infections. Out of these, 91 samples (71.1%) were positive for bacterial growth, while 37 samples (28.9%) were negative. The predominance of *Escherichia coli* (50 isolates, 54.9%) was statistically significant compared to other bacteria ($p = 0.032$, Chi-square test), indicating that E. coli remains

the primary causative agent of UTIs in the studied population, consistent with global data. Other isolated bacteria included *Klebsiella pneumoniae, Proteus mirabilis, Pseudomonas aeruginosa, Enterococcus faecalis,* and *Staphylococcus aureus*.

Table 1. Distribution of uropathogenic bacteria (n=91)

Bacteria Type	No. of isolates	%	P value
Escherichia coli	50	54.9	0.032*
Klebsiella pneumoniae	12	13.2	
Proteus mirabilis	8	8.8	
Pseudomonas aeruginosa	7	7.7	
Enterococcus faecalis	6	6.6	
Staphylococcus aureus	5	5.5	
Enterobacter cloacae	2	2.2	
Citrobacterfreundii	1	1.1	
Total	91	100	

*Statistically significant difference at $p < 0.05$

Bacterial Identification Using Biochemical Tests and VITEK System

All isolates were subjected to routine biochemical tests, including Gram staining, catalase, oxidase, indole, MR-VP, citrate utilization, urease, TSI, motility, and sugar fermentation tests. These tests allowed preliminary identification of bacterial species, which was subsequently confirmed using the VITEK 2 Compact system (bioMérieux, France). The results from manual biochemical tests were fully consistent with the automated VITEK system, ensuring high accuracy in bacterial identification.

Table 2. Biochemical profiles of uropathogenic bacteria

Bacteria Type	Gram Stain	Catalase	Oxidase	Indole	MR	VP	Citrate	Urease	TSI (A/A, K/A, H2S)	Motility	Lactose
E.coli	-	+	-	+	+	-	-	-	A/A, H2S -	+	+
K. pneumoniae	-	+	-	-	+	+	+	+	K/A, H2S -	-	+
P. mirabilis	-	+	-	+	+	-	-	+	K/A, H2S +	+	-

P. aeruginosa	-	+	+	-	-	-	+	-	K/K, H2S -	+	-
S. aureus	+	+	-	-	-	+	-	+	-	-	+
E faecalis	+	+	-	-	+	-	+	+	-	+	±

Notes: A/A = acid/acid, K/A = alkaline/acid, H2S = hydrogen sulfide production, ± = variable

Antibiotic Susceptibility Patterns

Ampicillin resistance was high for Gram-negative bacteria in our compounds, with E. coli and K. pneumoniae being resistant 100% and 92%, respectively. Imipenem, Tobramycin and Amikacin were most sensitive drug among isolates. Gram-positives have moderate presentation of resistance to most antibiotics and they were sensitive mainly to Imipenem and Amikacin. The trends of antimicrobial resistance were all significant (p=0.01).

Table 3. Antibiotic Susceptibility Patterns of Uropathogens (n=91)

Bacteria Type	AMP (%)	CN (%)	TMP (%)	CIP (%)	LEV (%)	IMI (%)	AK (%)	Tob (%)	P value (Resistance)
E. coli	0/100	88/12	32/68	13/87	7/93	80/20	94/6	100/0	<0.001*
K. pneumoniae	8/92	62/38	70/30	62/38	69/31	92/8	0/100	92/8	<0.001*
P. mirabilis	0/100	43/57	57/43	29/71	14/86	100/0	91/9	100/0	0.002*
P. aeruginosa	10/90	30/70	50/50	60/40	10/90	90/10	90/10	100/0	0.004*
E. faecalis	20/80	58/42	53/47	63/37	11/89	90/10	87/13	95/5	0.013*
S. aureus	16/84	58/42	53/47	63/37	11/89	90/10	87/13	95/5	0.012*
E. cloacae	15/85	55/45	48/52	60/40	10/90	85/15	88/12	93/7	0.018*
C. freundii	12/88	50/50	45/55	58/42	8/92	83/17	85/15	90/10	0.020*
S. agalactiae	25/75	60/40	50/50	62/38	12/88	88/12	86/14	94/6	0.025*

*Statistically significant at $p < 0.05$

Antibacterial Activity of Mentha piperita Extracts

Agar well diffusion was used to determine the antibacterial activity of Mentha piperita extracts. Ethanolic extracts were more effective than the aqueous extract in producing larger zones of inhibition, revealing that higher extraction efficiency was attained for bioactive compounds including menthol and menthone. The antibacterial activity was dose-dependent and increasing concentrations led to increased diameter of inhibition zones. Both Gram-negative and -positive bacteria were sensitive, revealing the broadspectrum activity of peppermint extracts. There was a significant difference between the types and concentrations of extracts ($p < 0.05$).

Table 4. Antibacterial activity of Mentha piperita extracts (Zone of inhibition in mm, mean ± SD)

Bacteria Type	Aqueous 50 µL	Aqueous 75 µL	Aqueous 100 µL	Ethanolic 50 µL	Ethanolic 75 µL	Ethanolic 100 µL
E. coli	2.1 ± 0.5	5.3 ± 1.2	18.7 ± 2.1	3.5 ± 0.8	9.1 ± 1.6	28.2 ± 2.4
K. pneumoniae	3.0 ± 1.2	6.7 ± 2.0	17.9 ± 1.5	4.2 ± 1.1	12.4 ± 2.3	29.0 ± 2.5
P. mirabilis	2.4 ± 0.9	5.5 ± 1.8	19.1 ± 3.2	3.8 ± 1.2	11.0 ± 1.5	24.0 ± 2.8
P. aeruginosa	1.8 ± 0.6	4.9 ± 1.5	16.5 ± 2.9	3.1 ± 0.9	9.4 ± 1.8	30.5 ± 2.1
E. faecalis	1.5 ± 0.5	3.2 ± 0.7	14.8 ± 1.7	2.8 ± 0.8	7.9 ± 1.3	25.1 ± 1.5
S. aureus	1.7 ± 0.4	4.5 ± 1.1	15.3 ± 1.5	3.5 ± 0.9	10.5 ± 2.0	26.3 ± 1.7
E. cloacae	1.3 ± 0.3	3.7 ± 0.8	13.5 ± 1.2	2.5 ± 0.7	8.8 ± 1.2	23.0 ± 1.9
C. freundii	1.0 ± 0.2	2.8 ± 0.5	12.0 ± 1.0	2.2 ± 0.6	7.5 ± 1.1	22.4 ± 1.5

Classification of Bacterial Resistance (EDR, MDR, XDR)

The antibiotic resistance profiles of the 91 strains were analyzed in order to categorize. Among the 91 isolates, 45 (49.5%) were MDR, for which they were resistant to at least three different classes of antibiotics. Seven strains (7.7%) were classified as XDR because they were resistant to all ap Nor, Sxt, and Kf compounds but one or two other drugs, whereas 2 (2.2%) were considered EDR with resistance to all antibiotics that we tested. The greatest MDR prevalence was found in E. coli (28 MDR, 5 XDR, 2 EDR). There were 6 MDR and 1 XDR isolates of Klebsiella pneumoniae. Proteus mirabilis, Pseudomonas aeruginosa had moderate resistance 3 MDR in each and one XDR p aroginosa. Each E. faecalis and S. aureus were 2 MDR (No XDR/EDR) (Table 8). 1 MDR in Enterobacter cloacae and no MDR, XDR or EDR were exhibited in Citrobacterfreundii.

Table 5. Classification of uropathogenic isolates based on antibiotic resistance

Bacteria Type	Number of isolates	MDR	XDR	EDR
E. coli	50	28	5	2
K. pneumonia	12	6	1	0
Proteus mirabilis	8	3	0	0
P. aeruginosa	7	3	1	0
E. faecalis	6	2	0	0
S. aureus	5	2	0	0

Enterobacter cloacae	2	1	0	0
Citrobacterfreundii	1	0	0	0
Total MDR/XDR/EDR	91	45	7	2

Discussion

The current study emphasizes on the predominance of uropathogenic bacteria in patients with UTIs, and that Escherichia coli as source being highest (54.9%). This result is in concordance with the studies conducted in Iraq and elsewhere, showing E. coli to be the predominant uropathogen(Bryce et al. 2016; Mortazavi□Tabatabaei et al. 2019). Other isolates such as Klebsiella pneumoniae, Proteus mirabilis, Pseudomonas aeruginosa, Enterococcus faecalis and Staphylococcus aureus fit in well with studies from local surveillance of uropathogens reporting a comparable frequency distribution of Gram-negative and Gram-positive uropathogens(Linhares et al. 2013; Bhargava et al. 2022). Our antibiotic susceptibility analysis showed that a majority of the Gram-negative isolates (especially E. coli and K. pneumoniae) exhibited high resistance to Ampicillin, and relatively lower minimum inhibitory concentrations were observed for Imipenem, Tobramycin, and Amikacin. This trend is consistent with what has been reported from Iraqi hospitals, where increasing numbers of multidrug-resistant (MDR) uropathogens have rendered commonly used antibiotics ineffective (Kande et al. 2021; Vadivelu et al. 2025). Even less frequently, the emergence of extensively drug resistant (XDR) as well as extremely drug resistant strains (EDR) shows that the treatment in areas with high level of antibiotic abuse remains a problem (Setu et al. 2017; Farooq et al. 2024). Significantly, 49.5% and low percentages of isolates expressed phenotypes MDR and XDR (7.7%) or EDR (2.2%), respectively. E. coli predominated in cases of MDR and XDR, as previously reported in investigations that highlighted the emergence globally of E. coli resistant to antibiotics in community and hospital UTI (Bryce et al. 2016; Marepalli et al. 2024). These findings emphasized the pressing requirement for novel therapeutic approaches such as plant-based antimicrobials against resistant uropathogens. The Antibacterial action of Mentha piperita extracts in relation to Gram positive and negative bacteria is remarkable. The ethanol

extract showed more significant inhibition compared with the aqueous extracts in a does-dependent manner, which might be attributed to higher content of bioactive substances including menthol and menthone (Ahmad et al. 2017; Ousakhoment et al. 2023). These results coincide with the data of earlier studies which showed much inhibitory effects of peppermint extracts against E. coli, S. aureus and P. aeruginosa (Bryce 2016; Mortazavi□Tabatabaei et al. 2019; Uddin et al. 2021). The dose-dependent inhibition of growth supports the conclusion that phytochemical concentration directly determines antimicrobial activity. When comparing our findings with the international literature, peppermint extracts have been demonstrated to inhibit uropathogen growth and biofilm formation in several studies, demonstrating their possible use as adjuncts in UTI management (Ahmad et al. 2017; Uddin et al. 2021). Some variations in the zone of inhibition and susceptibility patterns were observed between these studies, however, which may be related to differences in methodology or extraction processes, as well as regional profiles of bacterial resistance (Kline et al. 2016; Ousakhoment et al. 2023). Generally, our findings support the epidemiological coherence of pathogen prevalence and resistance rates in Iraq, as well as suggesting a potential role for Mentha piperita as an alternative or adjunct agent. More than that research is needed, in vivo and clinical trials, to assess the therapeutic efficacy of peppermint extracts on MDR uropathogens(Bryce 2016; Kline et al. 2016).

Conclusions

Escherichia coli still represents the leading etiology of UTIs, with close to half of the isolates being multidrug-resistant. Mentha piperita extracts possessed broad spectrum antibacterial activity could have implications as an adjunct antimicrobial agent. Precise identification by biochemical test and VITEK is important to enforce the appropriate treatment of UTI.

Limitations

The study was single-regional, with samples obtained and in vivo testing not conducted for Mentha piperita extracts. The resistance genes was not molecularly characterized, and this could complement the MDR, XDR and

EDR profiles observed. These limitations must be considered in future studies.

References

1. Afrin, A., Ahmed, A. U., Zannat, K. E., Tanzim, S. M., Saha, B. C., Joynal, J. B., et al. (2025). Antibacterial activities of mint leaf extracts against foodborne pathogens. Microbes and Infectious Diseases, 6(3), 6134–6140. https://doi.org/10.21608/mid.2025.375960.2701
2. Ahmad, A., Khan, A., et al. (2017). Anti-bacterial activity of peppermint (Mentha piperita) extracts against some emerging multidrug-resistant human bacterial pathogens. Journal of Herbal Medicine, 7, 27–30. https://doi.org/10.1016/j.hermed.2016.08.003
3. Ahmad, A., Khan, A., et al. (2017). Anti-bacterial activity of peppermint (Mentha piperita) extracts against some emerging multidrug-resistant human bacterial pathogens. Journal of Herbal Medicine, 7, 27–30. https://doi.org/10.1016/j.hermed.2016.08.003
4. Al-Bayati, F. A. (2014). Therapeutic potential of Mentha piperita L. and Thymus vulgaris L. essential oils as antibacterial and antifungal agents. Journal of Microbiology and Antimicrobials, 6(2), 15–22.
5. Balouiri, M., Sadiki, M., &Ibnsouda, S. K. (2016). Methods for in vitro evaluating antimicrobial activity: A review. Journal of Pharmaceutical Analysis, 6(2), 71–79. https://doi.org/10.1016/j.jpha.2015.11.005
6. Bhargava, K., Nath, G., Bhargava, A., Kumari, R., Aseri, G. K., & Jain, N. (2022). Bacterial profile and antibiotic susceptibility pattern of uropathogens causing urinary tract infection in the eastern part of Northern India. Frontiers in Microbiology, 13, 965053. https://doi.org/10.3389/fmicb.2022.965053
7. Bhargava, K., Nath, G., Bhargava, A., Kumari, R., Aseri, G. K., & Jain, N. (2022). Bacterial profile and antibiotic susceptibility pattern of uropathogens causing urinary tract infection in the eastern part of Northern India. Frontiers in Microbiology, 13, 965053. https://doi.org/10.3389/fmicb.2022.965053
8. Bryce, A., Hay, A. D., Lane, I. F., Thornton, H. V., Wootton, M., & Costelloe, C. (2016). Global prevalence of antibiotic resistance in paediatric urinary tract infections caused by Escherichia coli and association with

routine use of antibiotics in primary care: Systematic review and meta-analysis. BMJ, 352, i939. https://doi.org/10.1136/bmj.i939

9. Cosentino, S., Tuberoso, C. I., et al. (1999). Antimicrobial activity and chemical composition of Mentha piperita essential oil. Journal of Agricultural and Food Chemistry, 47(12), 5030–5034. https://doi.org/10.1021/jf990289p

10. El-Said, M. A., & Hassan, R. G. (2021). Evaluation of antibacterial activity of aqueous mint (Mentha piperita) leaf extracts against Staphylococcus aureus and Escherichia coli. Mymensingh Medical College Journal, 30(3), 741–748.

11. Farooq, S., Ullah, H., &Jichao, Z. (2024). Prevalence and antibiotic resistance patterns of uropathogenic Escherichia coli isolated from community-acquired urinary tract infections: A cross-sectional study. Developmental Medicine & Life Sciences, 2(5), 134. https://doi.org/10.69750/dmls.02.05.0134

12. Farooq, S., Ullah, H., &Jichao, Z. (2024). Prevalence and antibiotic resistance patterns of uropathogenic Escherichia coli isolated from community-acquired urinary tract infections: A cross-sectional study. Developmental Medicine & Life Sciences, 2(5), 0134. https://doi.org/10.69750/dmls.02.05.0134

13. Flores-Mireles, A. L., Walker, J. N., Caparon, M., & Hultgren, S. J. (2015). Urinary tract infections: Epidemiology, mechanisms of infection and treatment options. Nature Reviews Microbiology, 13(5), 269–284. https://doi.org/10.1038/nrmicro3432

14. Foxman, B. (2014). Urinary tract infection syndromes: Occurrence, recurrence, bacteriology, risk factors, and disease burden. Infectious Disease Clinics of North America, 28(1), 1–13. https://doi.org/10.1016/j.idc.2013.09.003

15. Hammer, K. A., Carson, C. F., & Riley, T. V. (1999). Antimicrobial activity of essential oils and other plant extracts. Journal of Applied Microbiology, 86(6), 985–990. https://doi.org/10.1046/j.1365-2672.1999.00780.x

16. Kande, S., Patro, S., Panigrahi, A., Khora, P. K., &Pattnaik, D. (2021). Prevalence of uropathogens and their antimicrobial resistance pattern among adult diabetic patients. Indian Journal of Public Health, 65(3), 280–286. https://doi.org/10.4103/ijph.IJPH_1413_20
17. Kande, S., Patro, S., Panigrahi, A., Khora, P. K., &Pattnaik, D. (2021). Prevalence of uropathogens and their antimicrobial resistance pattern among adult diabetic patients. Indian Journal of Public Health, 65(3), 280–286. https://doi.org/10.4103/ijph.IJPH_1413_20
18. Kfoury, M., Zeidan, R. K., et al. (2009). Chemical composition and antibacterial activity of Mentha piperita L. essential oil against foodborne pathogens. Journal of Essential Oil Research, 21(5), 443–450. https://doi.org/10.1080/10412905.2009.9699037
19. Kline, K. A., & Lewis, A. L. (2016). Gram-positive uropathogens, polymicrobial urinary tract infection, and the emerging microbiota of the urinary tract. Microbiology Spectrum, 4(2). https://doi.org/10.1128/microbiolspec.UTI-0011-2012
20. Kline, K. A., & Lewis, A. L. (2016). Gram-positive uropathogens, polymicrobial urinary tract infection, and the emerging microbiota of the urinary tract. Microbiology Spectrum, 4(2). https://doi.org/10.1128/microbiolspec.UTI-0011-2012
21. Linhares, I., Raposo, T., Rodrigues, A., & Almeida, A. (2013). Frequency and antimicrobial resistance patterns of bacteria implicated in community urinary tract infections: A ten-year surveillance study (2000–2009). BMC Infectious Diseases, 13, 19. https://doi.org/10.1186/1471-2334-13-19
22. Linhares, I., Raposo, T., Rodrigues, A., & Almeida, A. (2013). Frequency and antimicrobial resistance patterns of bacteria implicated in community urinary tract infections: A ten-year surveillance study (2000–2009). BMC Infectious Diseases, 13, 19. https://doi.org/10.1186/1471-2334-13-19
23. Marepalli, N. R., Goud, S. M., & Reddy, P. S. (2024). Patterns of antibiotic resistance in urinary tract infections among patients in a tertiary-

care teaching hospital. Journal of Infection and Public Health. https://doi.org/10.1016/j.jiph.2024.10.012

24. Marepalli, N. R., Goud, S. M., & Reddy, P. S. (2024). Patterns of antibiotic resistance in urinary tract infections among patients in a tertiary-care teaching hospital. Journal of Infection and Public Health. https://doi.org/10.1016/j.jiph.2024.10.012

25. Ousakhoment, E., et al. (2023). Peppermint (Mentha piperita) essential oil and extracts: Biological activities and prospects in medicinal development. Molecules, 28(21), 7444. https://doi.org/10.3390/molecules28217444

26. Setu, S. K., Sattar, A. N. I., Saleh, A. A., Roy, C. K., Ahmed, M., &Muhammadullah, S. (2017). Study of bacterial pathogens in urinary tract infection and their antibiotic resistance profile in a tertiary care hospital of Bangladesh. Bangladesh Journal of Medical Microbiology, 10(1), 22–26. https://doi.org/10.3329/bjmm.v10i1.31449

27. Uddin, M. N., et al. (2021). Antibacterial activities of mint (Mentha piperita) leaf extracts against Staphylococcus aureus and Escherichia coli. Mymensingh Medical College Journal, 30(1), 123–129. https://doi.org/10.3329/mmcj.v30i1.37311

28. Vadivelu, N., Parmar, R. D., Shingala, H., & Mehta, K. D. (2025). Comparison of chromogenic and cysteine lactose electrolyte-deficient agar for identification of uropathogens in Gujarat, India. African Journal of Laboratory Medicine, 14(1), 2551. https://doi.org/10.4102/ajlm.v14i1.2551

وقائع المؤتمر العلمي السنوي الثالث لكلية التربية الاساسية
في مجال العلوم الصرفة والموسوم:
(مؤتمر كلية التربية الاساسية في مجال العلوم الصرفة)
وتحت شعار
(بالعلوم الصرفة نبني واقعا معرفيا متجددا)
يومي الاحد والاثنين 21-2026/6/22

تقييم الفعالية المضادة للبكتيريا لمستخلص نبات النعناع الفلفلي (Mentha piperita) ضد بعض البكتيريا الممرِضة المختارة المسببة لالتهابات المسالك البولية

إيفر أشرف خورشيد[1]
كلية طب الأسنان، جامعة ابن سينا للعلوم الطبية والصيدلانية، بغداد، العراق.
ayfr1986.g@ibnsina.edu.iq

مروة باسم صبري [2]
كلية طب الأسنان، جامعة ابن سينا للعلوم الطبية والصيدلانية، بغداد، العراق.
marwa.basim@ibnsina.edu.iq

نور علي زايد[3]
كلية طب الأسنان، جامعة ابن سينا للعلوم الطبية والصيدلانية، بغداد، العراق.
noor.a.zayed@ibnsina.edu.iq

مستخلص البحث:

تُعد التهابات المسالك البولية (UTIs) من أكثر أنواع الالتهابات شيوعًا، والتي أصبحت أكثر خطورة بسبب البكتيريا متعددة المقاومة للمضادات الحيوية (MDR). هدفت هذه الدراسة إلى التحري عن البكتيريا المسببة لالتهابات المسالك البولية ودراسة التأثيرات المضادة للبكتيريا لمستخلصات نبات النعناع الفلفلي (Mentha piperita). وتم تأكيد التشخيص باستخدام جهاز VITEK 2 والاختبارات الكيميائية الحيوية التأكيدية. جُمعت 128 عينة بول من مرضى في مدينة Kirkuk خلال الفترة من حزيران إلى تشرين الثاني 2025. تم استخلاص المستخلصات النباتية باستخدام الماء والكحول كمذيبات، ثم اختبار فعاليتها المضادة للبكتيريا بطريقة الانتشار بالحفر في الآغار (agar well diffusion) بثلاثة تراكيز (50، 75، 100 ميكرولتر). كما أُجري اختبار الحساسية للمضادات الحيوية بطريقة كيربي–باور، وتم تحديد أنماط المقاومة EDR وMDR وXDR.من أصل 128 عينة بول، كانت 91 عينة (71.1%) موجبة للزرع الجرثومي. وكانت بكتيريا الإشريكية القولونية (Escherichia coli) الأكثر شيوعًا بنسبة (54.9%، p = 0.032)، تلتها Klebsiella pneumoniae وProteus mirabilis وPseudomonas aeruginosa وEnterococcus faecalis وStaphylococcus aureus. وقد لوحظت مقاومة مرتفعة تجاه الأمبيسيلين، في حين أظهر كل من الإيميبينيم والتوبراميسين والأميكاسين أعلى فعالية. وكشف التصنيف عن وجود 45 عزلة متعددة المقاومة (MDR) بنسبة 49.5%، و7 عزلات شديدة المقاومة (XDR) بنسبة 7.7%، وعزلتين فائقتي المقاومة (EDR) بنسبة 2.2%.أظهرت مستخلصات Mentha piperita تأثيرًا تثبيطيًا ضد البكتيريا سالبة وموجبة الغرام، كما أظهر المستخلص الكحولي قدرة تثبيطية أعلى وبصورة تعتمد على الجرعة. وتشير هذه النتائج إلى إمكانية استخدام مستخلصات Mentha piperita كبديل للعوامل المضادة للميكروبات، خاصة ضد البكتيريا الممرضة للمسالك البولية متعددة المقاومة. كما يُعد التشخيص البكتريولوجي الدقيق ضروريًا لتحقيق علاج فعّال..

الكلمات المفتاحية : التهاب المسالك البولية، البكتيريا متعددة المقاومة (MDR)، Mentha piperita، VITEK 2.

ملاحظة : هل البحث مستل من رسالة ماجستير او اطروحة دكتوراه ؟ نعم : كلا :