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Evaluation of the Effectiveness of Hot Aqueous Extract of Thyme in Inhibiting Staphylococcus aurous Isolated from Cases of Tonsillitis

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Abstract:
This study aimed to evaluate the antibacterial activity of the hot aqueous extract of Thymus vulgaris on five identified isolates of Staphylococcus aureus, isolated from individuals suffering from chronic tonsillitis, obtained from the Al-Ghari Research Center. Antibiotic susceptibility testing was performed on the five isolates, and the test results showed a significant variation in the strength of the five antibiotics used on the isolates under study. Isolates 1, 2, and 4 showed resistances to the antibiotic doxycycline (CD), while isolates 3 and 5 showed intermediate resistance to the same antibiotic. The results also indicated that isolates 1, 3, 4, and 5 were resistant to the antibiotic OX., The second isolate was intermediately resistant, while the resistance of the isolates under study varied with respect to the other three antibiotics.
Qualitative testing was performed to detect some of the active chemical compounds of this extract. The extract was found to contain phenols, flavonoids, tannins, proteins, and carbohydrates., All isolates showed sensitivity to the hot aqueous extract of thyme at a concentration of 100 mg/ml. All isolates were resistant to the extract at a concentration of 12.5 mg/ml, while the isolates showed varying levels of resistance to the two concentrations of 25 and 50 mg/ml.

Introduction

The tonsils are collections of lymphoid tissue located near the entrance to the digestive and respiratory tracts and play a key role in our immune system. They act as a front line of defense, forming the initial immune response to inhaled or ingested pathogens. The lymphoid tissue in the nasopharynx consists of a circumferential tonsillar ring, known as Waldeyer's ring, which consists of the palatine tonsils (oral tonsils), lymph nodes (nasopharyngeal tonsils), lingual tonsils, and tubular tonsils. The tonsils are collections of lymphoid tissue located near the entrance to the digestive and respiratory tracts and play a key role in our immune system. They act as a front line of defense, forming the initial immune response to inhaled or ingested pathogens. The lymphoid tissue in the nasopharynx consists of a surrounding tonsillar ring, known as Waldeyer's ring, which consists of the palatine tonsils (oral tonsils), lymph nodes (nasopharyngeal tonsils), lingual tonsils, and tubular tonsils. Chronic tonsillitis is an infection of the palatine tonsils caused by bacteria and sometimes viruses. It is classified as acute or chronic tonsillitis. This disease affects a high percentage of individuals worldwide, particularly children. Complications of tonsillitis are uncommon and may include rheumatic fever, ear infections, sleep apnea, peritonsillar abscesses, and scarlet fever. For chronic and recurrent tonsillitis, tonsillectomy is the recommended last resort. The main causes of acute and chronic tonsillitis are Streptococcus spp., Staphylococcus aureus, and Hemophilus influenza (Mostafa et al., 2018). Staphylococcus aureus (Staphylococcus aureus) is a Gram-positive, spherical, non-motile, asexual bacterium. It is arranged in grape clusters or in pairs, with single cells. It is facultatively anaerobic. The diameter of a single cell is 0.5-1.5 micrometres, while the diameter of a growing colony is 1 millimetre. Yellow in color on the agar medium,

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and its colonies after incubation in aerobic conditions are soft, high and shiny, while in anaerobic conditions the colonies are small and Gray in color. The optimum temperature for growth is 37°C and the pH value = 7.6-7.4. These bacteria are found in different areas of the body (normal flawra), especially in the nose, pharynx, vagina and anus at a rate of (20-60%). They are also found in different areas of the skin such as the hands, face and hair. The pathogenic factors of these bacteria are their production of coagulase, which is an enzyme produced by pathogenic S. aureus strains. This yeast has the ability to convert the fibrinogen compound to fibern in the plasma, thus disabling the immune compounds that fight germs. These bacteria cause many pathological infections such as skin ulcers, tissue and bone necrosis, pneumonia, pharyngitis, and endocarditis. They may also cause conjunctivitis. The eye. These bacteria can resist a wide range of antibiotics (Stark, 2013).

Thymus vulgaris is a flowering plant belonging to the Lamiaceae family. It grows between 15 and 31 cm in height and 41 cm in width. Wild thyme is cultivated in most European countries, including France, Switzerland, Spain, Italy, Bulgaria, Portugal, and Greece (Leal et al., 2017).

Thyme is also an aromatic plant that has been used since ancient times in many regions of the world as a food and medicinal substance. Plants in the Lamiaceae family are annual or perennial plants native to temperate regions. Although plants in this family are distributed throughout the world, they tend to be concentrated in the Mediterranean region. Herbaceous plants are characterized by square-shaped stems and simple, opposite leaves (Ali, 2002). The Lamiaceae family includes approximately 211 genera and 4,111 species, most of which are of great economic importance for their production of essential oils (Aziz Drioiche, 2022). For centuries, thyme species have been used in traditional medicine for their antiseptic, antiviral, and antioxidant properties. Thyme is also an interesting source of cyclic Penta terpenes with numerous properties, such as anti-inflammatory, hepatoprotective, antimicrobial, anti-HIV-1, antiulcer, gastroprotective, hypoglycemic, anti-hyperlipidemic, and toxic, particularly against various tumour cell lines (Leal et al., 2017). Humanity has used various plants found in its environment to treat various diseases. These plants represent a vast reservoir of compounds attributed to secondary metabolites, which have the advantage of being highly diverse in chemical composition (Zeghad, 2009). Plants and their aromatic scent have long been essential to human health, and research has been conducted. Huge progress in the twentieth century in herbal medicine has been the subject of many clinical and scientific studies for its amazing properties for thousands of years (and although medicinal plants have deteriorated today and their species are constantly decreasing, what is available of them almost meets the need if they are well exploited, some of them are found naturally in the country, some are grown in farms and home gardens, and some are imported from foreign markets. Medicinal plants can be made more effective in the field of treatment and therapy, if the results reached by many doctors, scientists, and wise men in the past are reviewed to raise the general health level and correct all misconceptions. 2012) Kalt,) The aim of our study is to demonstrate the importance of medicinal plants and how to use them in the right ways in treating health problems such as treating chronic tonsillitis. The aim of the study: Due to the continuous increase in the ability of pathogenic bacteria to resist the various types of antibiotics currently used in the treatment of pathological infections, and to know the suitability of the aqueous extract of thyme, which is widely used as a good food substance, and for the purpose of finding alternative therapeutic methods that are more effective in eliminating The subject of study was proposed on pathogenic bacteria.

Methods

Hot water extract

The method of Parekh and Chanda (2007) was followed by weighing 50g of dry plant powder and dissolving it in 500ml of boiled distilled water after cooling it to 60°C. The mixture was then placed on a sterile magnetic hot plate for 2 hours. The mixture was then filtered using medical gauze, followed by filter papers of 3, 6, and 1. No. Whatman. The filtrate was distributed in centrifuge

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tubes at 3000 rpm for 10 minutes. The filtrate was then evaporated using a rotary evaporator under low pressure and a temperature of 40-50°C. The residue was dried using large-surface-area plates in an oven at 40°C until the water was completely evaporated, thus obtaining a dry powder from the aqueous extract. It was then placed in sterile, tightly sealed glass tubes. Store in the refrigerator at 4°C until ready to use. Concentrations were prepared by dissolving 2 grams of plant extract powder in 10 ml of distilled water for the hot aqueous extract, which is the basic stock solution. Using the general dilution law V2C2=1V1C, concentrations of 12.5, 25, 50, and 100 mg/ml were prepared and sterilized using Millipore filters with 0.22 µm holes (Al-Awadi, 1993). We prepared isolates of S. aureus bacteria and placed them in a Petri dish containing solid Mueller-Hinton agar. We then made small holes in the dish and added a quantity of extract concentrations, starting with a concentration of 12.5%, 25%, 50%, and 100%, for 24 hours. We then measured the diameter of the zone of inhibition.

Method for measuring bacterial sensitivity to antibiotics

Prepare Mueller-Hinton agar (MHA) medium, pour it into Petri dishes, and leave it to stand for 24 hours. To solidify. Antibiotic susceptibility testing was performed according to CLSI recommendations (2018) using the Kirby-Bauer disc diffusion method on Mueller-Hinton agar. Bacterial suspensions of S. aureus isolates were prepared by transferring 3-4 colonies less than 24 hours old from mannitol salt agar (MSA) to 5 ml of physiological saline (PSA) (Douglas, N. F. 2016). The turbidity of the suspension was compared with that of a standard turbidity constant (0.5 McFarland). The suspension was then spread onto the Hinton Muller agar in all directions using a sterile cotton swab to ensure even dispersion and left at room temperature for 5 minutes to ensure absorption. Antibiotic discs were placed on the surface of the agar and inoculated with bacteria using sterile metal forceps. The plates were incubated at 37°C for 18-24 hours, and the results were read the next day by measuring the inhibition zones formed around the antibiotic discs (CD-IPM-Cip-OX-FOX) which were estimated in millimetres and interpreted as recommended by the Clinical Laboratory Standards Institute where bacteria were considered susceptible or moderately resistant after comparing them to standard diameters of inhibition zones established in (CLSI, 2018).

Results:

Five identified isolates of Staphylococcus aureus, isolated from individuals with chronic tonsillitis, were obtained from the Al-Ghari Research Laboratory. Antibiotic susceptibility tests were performed on the isolates, as shown in Table (1), which shows a marked variation in the resistance of the five isolates to the types of antibiotics used in the study.

Table No. (1) Antibiotic sensitivity test

No.bacteria	Antibiotic	Zone diameter (mm)	Sensitivity rat
1.	CD	0	**R**
	CIP	12	**I**
	IPM	17	**I**
	FOX	22	**I**
	OX	5	**R**
2.	CD	0	**R**
	CIP	10	**R**
	IPM	22	**S**
	FOX	24	**S**
	OX	13	**I**
3.	CD	0	**R**

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	CIP	18	**I**
	IPM	32	**S**
	FOX	27	**S**
	OX	13	**I**
4.	CD	0	**R**
	CIP	0	**R**
	IPM	12	**I**
	FOX	23	**S**
	OX	18	**S**
5.	CD	10	**R**
.	CIP	22	**I**
	IPM	26	**S**
	FOX	30	**S**
	OX	22	**S**

The results showed that all isolates were resistant to the antibiotic CD, while isolate No. (1, 4) were resistant to the antibiotic CIP, and only one isolate was resistant to the antibiotic OX.
from this study and previous similar studies that thyme has a high antagonistic capacity against many microbes due to the high toxicity of the plant extracts, given its content of active compounds, including phenolic compounds, flavonoids, tannins, saponins, and volatile oils. We note a direct relationship between the concentration levels of the plant extract and its inhibitory power. The higher the concentration of the extract, the greater its inhibitory power, depending on the type of bacteria. Gram-positive and Gram-negative stains.



Testing bacterial susceptibility to thyme using the well-diffusion susceptibility method.
5 mm diameter holes were made in Hinton-Muller agar plates using Derham tubes. Using an electronic pipette, 20 µL of thyme aqueous solution at different concentrations (12.5%, 25%, 50%, and 100% mg/ml) were injected into each hole. The plates were then placed in an incubator and left for 35 minutes until they were well saturated. Table (2)

Table (3-2) Testing bacterial susceptibility to the hot aqueous extract of thyme using the well-diffusion susceptibility method

Sample no.	Concentration 100%		Concentration		Concentration 25%		Concentration %12.5 Inhibition zone	

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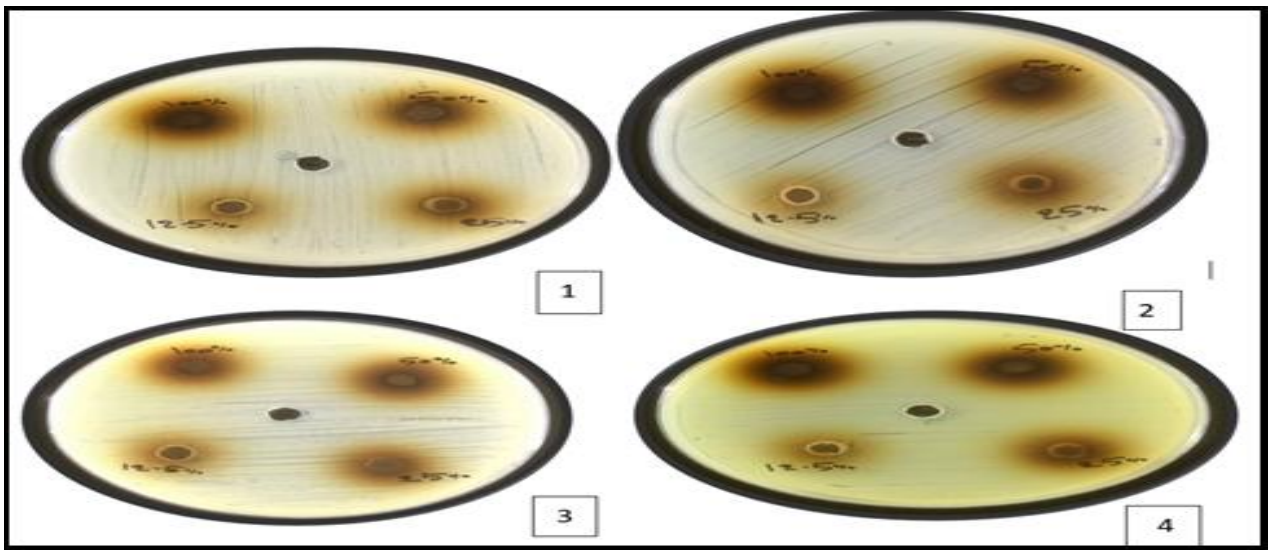
	Inhibition zone diameter mm		50% Inhibition zone diameter mm		Inhibition zone diameter mm		diameter mm	
1	22	S	12	I	4	R	0	**R**
2	22	S	18	S	0	R	0	**R**
3	24	S	17	S	8	I	0	**R**
4	23	S	10	I	0	R	0	**R**
5	24	S	21	S	13	I	0	**R**

The results also showed that isolates (2, 3, and 5) were sensitive to the aqueous extract of thyme at a concentration of 50 mg/ml, while all isolates were resistant to the effect of the herbal extract at a concentration of 12.5 mg/ml.



The results of the current study showed the effectiveness of the hot aqueous extract in eliminating Staphylococcus aureus bacteria resistant to common antibiotics, as all isolates were sensitive to the extract at a concentration of 100%, while all isolates were resistant to the extract at a concentration of 12.5 mg/ml. As for the concentrations of 50 and 25, the sensitivity of the bacteria varied between sensitive, moderately sensitive and resistant. The study also showed that the average inhibitory zone increases directly as the concentration of the plant extract increases. The results of this study are consistent with a study conducted by Fayyad et al., and Aziz and Touria [Fayad et al., 2013: Aziz, 2022]. Many studies indicate that the reason for the inhibitory ability of thyme is due to its containing compounds such as voltyl oils, saponins, and tannins, according to [Aziz and Touria, 2022]. Through the results we presented in the current study and previous studies, we note the inhibitory ability of thyme on types of bacteria that cause many diseases in humans, animals, and plants, whether they are Gram-positive or Gram-negative bacteria. This is consistent with what was mentioned by Issa et al., (2013) and Al-Maliki (2006).

The results also indicated that isolates 1, 3, 4, and 5 were resistant to the antibiotic OX., The second

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isolate was intermediately resistant, while the resistance of the isolates under study varied with respect to the other three antibiotics.

Conclusions

We conclude from this study that the antibiotics cefoxitin and imipenem had the strongest effect on the isolates under study, while the study showed that all isolates were resistant to the antibiotic doxycycline. The results also showed that a hot aqueous solution of thyme at a concentration of 100 mg/ml showed a clear effect against E. coli and Staphylococcus aureus. The results also showed that isolates (2, 3, and 5) were sensitive to the aqueous extract of thyme at a concentration of 50 mg/ml, while all isolates were resistant to the effect of the herbal extract at a concentration of 12.5 mg/ml. We conclude from this study and previous similar studies that thyme has a high antagonistic capacity against many microbes due to the high toxicity of the plant extracts, given its content of active compounds, including phenolic compounds, flavonoids, tannins, saponins, and volatile oils. We note a direct relationship between the concentration levels of the plant extract and its inhibitory power. The higher the concentration of the extract, the greater its inhibitory power, depending on the type of bacteria. Gram-positive and Gram-negative stains.

References

1. Mohsen Aqeel, 2009. Food replaces medicine, Dar Al-Hujjah Al-Bayda, Beirut, Lebanon, second edition.
2. Ali, 2006. World Medicinal Plants: Description, Components, Methods of Use and Cultivation. Maaref Establishment, Alexandria, Egypt.
3. Al-Awady, Salwa Saber. (1993). A study of the antimicrobial activity of Thymus vulgaris oil against a number of pathogenic bacteria. Master's Thesis, College of Veterinary Medicine, University of Baghdad.
4. Al-Maliki, A. (2006). A study of the biological activity of protein extracts and essential oils from Thymus seeds. Journal of Basra Research (Scientific Studies), Part 1, Issue 32, pp. 54-6.
5. Issa, M., Abbar, F., and Hikmat, (2013). A study of the inhibitory activity of Thymus vulgaris oil against a number of pathogenic bacteria. Tikrit University Journal of Agricultural Sciences, p. 68.
6. Parekh, J. and Chanda, S. (2007) In Vitro Antibacterial Activity of the Crude Methanol Extract of Woodfordi fruticosa Kurz. Flower (Lythraceae). Brazilian Journal of Microbiology, 38, 204-207.
7. Mostafa AA, Al-Askar AA, Almaary KS, et al (2018). Antimicrobial activity of some plant extracts against bacterial strains causing food poisoning diseases. Saudi J Biol Sci.; 25:361.
8. Leal et al., (2017). Thymus Plants: A Review—Micropropagation, Molecular and Antifungal Activity. 10.5772/66623.
9. Rusul N., Jinan M H. (2023). Detection of Virulence Genes of Pathogenic Escherichia coli Isolated from Different Sources., Al-Harf Journal ., Issue August, No. 18, P: 130-138.
10. Zeghad.(2009). Etude du contenu polyphénolique de deux plantes médicinales d'intérêt économique (Thymus vulgaris, Rosmarinus officinalis) et évaluation de leur activité antibactérienne. Thème de magister . Université Mentouri Constantine.
11. Stark, L, (2013),"Staphylococcus aureus-Aspects of pathogenesis and molecular epidemiology", Linkoping university medical dissertation, pages 12-14.
12. CLSI. (2018). Clinicaland Laboratory Standars Institute. Performance standards for Antimicrobial Susceptibility Testing; Twenty - Second Informational Supplement. CLSI document M 100 - S26. Wayne, PA: Clinical and laboratory standards institute.
13. Al-Fatlawey, Esraa S., Kadhim, D. A. and Omara, A. M. (2026). 'Thalassemia and Glycated Hemoglobin (HbA1c): Pathophysiological Interferences, Analytical Challenges, and Clinical Management Implications: A Comprehensive Review' .,*Kuwait Scientific Research Journal of Medical Sciences, 3*(2), pp. 1-15.
14. Douglas, N. F. (2016). Meropenem in the treatment of complicated skin and soft tissue infections. J. Therapeutics and clinical risk management. 2(4):401-415.
15. Thom SM, Horobin RW, Seidler E, et.al. Factors affecting the selection and use of tetrazolium

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salts as cytochemical indicators of microbial viability and activity. Journal of Applied Bacteriology. 1993;74(4):433–443.
16. Zahraa H R A .,Hussein S N .(2023). Isolation and identification of fungus contaminated with white pepper and detection of Mycotoxins produced from it in Al-Najaf Governorate .,Al-Harf Journal., Issue August, No. 18.
17. Swapnesh Bhaduri. Unveiling the Silent Threat: The Escalation and Defence Against Antibiotic Resistance. International Journal of Antibiotics. 2025; 02(02):1-26
18. Hemlata Sharma HS. Next-gen crops: Genetic engineering for healthier and hardier plants. Kuwait Research Journal of Agriculture and Life Science. 2024, Jul;3(1):59-64
19. Tahseen Khan. Monkeypox Virus (MPXV): Epidemiology, Pathogenesis, and Control Strategies: Exploring the Recent Resurgence of Monkeypox, Its Transmission Dynamics, Clinical Manifestations, and Public Health Responses. International Journal of Virus Studies. 2025; 02(01):29-34
20. V Hans. Decoding Innate Immunity: Mechanisms, Components, and Clinical Implication. Research and Reviews : A Journal of Immunology. 2025; 15(02).
21. Mazher SA, Hussein AS, Ali ZH. A Study on the Effect of the Antibiotic Ibuprofen on the Histological Structure of the Kidneys in White Rats. Kuwait Research Journal of Agriculture and Life Science. 2025 Jul;4(3):1-7.
22. Shaily Rastogi, Devansh Mehta, Shallu Sharma (2021). Objective Review of Thymus ulgaris: A Review with Latest Updates on Pharmacological Properties and hytoconstituents, Inventi Journals. ,3(4)33-43.
23. Fayad, N.K, Al-Obaida, Al-Noor, T, Ezzat, M, (2013), Water And Alcohol Extraction Of Thyme Plant (Thymus Vulgaris) And Activity Study Against Bacteria Tumors And Used As Anti-Oxidant In Margarine Manufacture, Innovative Systems Design and Engineering, volume 4, number 1.
24. Aziz Drioiche, Touriya Zair. (2022). Correlation between the chemical composition and the antimicrobial properties of seven samples of essential oils of endemic Thymus in Morocco against multi-resistant bacteria and pathogenic fungi. Saudi Pharmaceutical Journal. Volume 30. Issue 8