تأثير إضافة الجلاتين الحيواني والكاراجينان في الخصائص الكيميائية والفيزيائية لكرات السمك المجمدة

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الملخص

تنتشر التهابات الجلد التي تسببها الجراثيم في العديد من المناطق وتسبب أعراضًا ومظاهر سريرية مختلفة مثل الخراجات والدمامل وغيرها. هدف البحث إلى دراسة فعالية المستخلص الكحولي لأوراق السنا مكي في تثبيط نمو البكتيريا المسببة لالتهابات الجلد (المكورات العنقودية الذهبية والزائفة الزنجارية) بعد دراسة حساسية ومقاومة هذه البكتيريا للمضادات الحيوية (جنتاميسين، فانكومايسين، سيبروفلوكساسين، ليفوفلوكساسين، كوتريموكسازول وإيميبينيم). أجري البحث في مختبرات خاصة في مدينة حلب بين شهري مارس ويونيو/2024 وتم الحصول على عزلات بكتيرية من مختبر أبحاث الأحياء الدقيقة في كلية العلوم بجامعة حلب. أظهرت نتائج الدراسة أن فعالية المستخلص الكحولي لأوراق السنا مكي تفوق فعالية العديد من المضادات الحيوية المدروسة.

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Antibacterial Activity of Senna makki Plant against some Pathogenic Bacteria Isolated from some Skin Lesions

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Abstract:

Skin infections caused by bacteria are widespread in many areas and cause various clinical symptoms and manifestations such as abscesses, boils, etc. The aim of the research was to study the effectiveness of the alcoholic extract of Senna makki leaves in inhibiting the growth of bacteria that cause skin infections (*Staphylococcus aureus and Pseudomonas aeruginosa*) after studying the sensitivity and resistance of these bacteria to antibiotics (Gentamicin, Vancomycin, Ciprofloxacin, Levofloxacin, Cotrimoxazole and Imipenem). The research was conducted in private laboratories in the city of Aleppo between March and June/2024 and bacterial isolates were obtained from the Microbiology Research Laboratory at te Faculty of Science at the University of Aleppo. The results of the study showed that the effectiveness of the alcoholic extract of Senna makki leaves was superior to the effectiveness of many of the studied antibiotics.

Keywords: abscesses**,** manifestations**,** *Staphylococcus aureus*, antibiotic

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I. Introduction

The emergence and rapid spread of Antimicrobial Resistance are driven by multiple interconnected factors, including the misuse and overuse of antibiotics in human medicine, veterinary practice, and agriculture, measures must be taken to reduce the problem, such as controlling the use of antibiotics, developing research to better understand the genetic mechanisms of resistance, and continuing studies to develop new drugs, whether synthetic or natural. Current predictions estimate that within 25 years, nearly all bacteria will be resistant to most healthcare antibiotics, with antibiotic-resistant infections potentially causing 10 million deaths annually by 2050. The ultimate goal is to provide patients with appropriate and effective antimicrobial drugs that are safer and stop the increasing indiscriminate use of antibiotics (1,2,3,4).

The use of medicinal plants in combination with antibiotics has been increasing in the past 20-25 years, and according to the World Health Organization (WHO), 65-80% of the world's population relies on traditional medicines to meet their primary care needs. It is one of the important alternative methods as plant medicines cause fewer or no side effects when compared to synthetic antibiotics. (5,6).

Skin Infections

The skin is a barrier that limits invasion and growth of pathogenic bacteria. The cutaneous antimicrobial defense mechanisms include the mechanical rigidity of the stratum corneum and its low moisture (7) content,, production of lysozyme, acidity (pH 5), and defensins (8). Specically, most areas of skin are dry, creating an unfavorable environment for bacterial replication. Dead keratinocytes slough and physically remove colonizing bacteria. Skin is cooler than normal body temperature and slightly acidic; most bacteria grow best at a neutral pH and at 37°C. If organisms can evade cutaneous host defenses, the next line of protection involves the imunune system, or skinassociated lymphoid tissue (7).

. Resident Gram-positive bacteria, including *Staphylococcus, Micrococcus, Staphylococcus aureus, and Streptococcus pyogenes*, are the skin pathogens. To be pathogenic, bacteria must possess various virulence factors such as adhesion to, growth on, and invasion of the host. Bacteria possess several virulence genes that allow growth in these distinct niches. Skin infections caused by S*taphylococcus aureus and Streptococcus pyogenes* include abscesses, boils, and inflammation. Skin infections are characterized by erythema and cellulitis and

vary in severity depending on the type and virulence of the causative bacteria and patient-related factors such as age, sex, and others (9,10,11).

Furthermore, *S. aureus and S. pyogenes* produce toxins that can elicit a superantigenic response, causing massive release of cytokines. But Gram-negative bacteria such as Pseudomonas aeruginosa, Pasteurella multocida, Capnocytophaga canimorsus, Bartonella sp., Klebsiella rhinoscleromatis, and Vibrio vulni®cus are not typical resident skin microbes but can cause skin infections (12, 13).

Senna makki Plant :

Senna makki is an evergreen shrub that grows throughout the year. It has antimicrobial and anti-inflammatory properties. It is commercially cultivated in Pakistan, India, Sudan and Egypt. It has been used in traditional Indian medicine for its beneficial pharmacological effects. The present study aims to investigate the efficacy of the plant leaf extract against the pathogens causing skin infections. Understanding the scientific basis of the traditional application of the plant is essential to optimize its benefits and minimize any potential risks as interest in natural medicines increases. (14).

All parts of these plants have medicinal effects. The leaves, seeds, and fruits of the Senna makki plant are all valuable. The pharmacological properties of Senna makki include laxative, antipyretic, purgative, and diuretic effects (14). S. alexandrina is a small shrub that grows to a height of about 2 feet and produces the best and most desirable forms of medicine. The plant body consists of an erect, smooth, pale green stem, and the branches are long and spreading, each with leaves four or five inches long, lanceolate or oppositely ovate, and have a thick, sticky and sweet flavor, with small yellow flowers. The pods generally contain six seeds and are oblong in shape, about 2 inches long and 7/8 inch wide (14).

2. Materials and methods

2-1- Bacterial isolates :

Studied Bacteria causing skin infections were obtained from the Microbiology Research Laboratory at the Faculty of Science, University of Aleppo , The identity of the isolated bacteria was determined based on their morphological characteristics and the results of the biochemical tests given in the Bergey Identification Guide of 1994, and their sensitivity and resistance to standard

antibiotics commonly used in treatment were studied using the disk diffusion method on agar (15).

2-2-Sensitivity of the tested bacteria to antibiotics:

The sensitivity of the studied bacteria to antibiotics was tested by Agar diffusion method, where it was grown on Mueller-Hinton Agar by brushing method, starting from a bacterial suspension with a Macfarland turbidity amount of 0.5 and antibiotic tablets were placed on the surface of the cultured dishes in the air incubator for 24 hours at 37°C. After the incubation period, the diameters of the bacterial inhibition halos were measured with a graduated ruler according to the Kirby-Bauer Method.

The diameters of the bacterial suppression halos were compared with the standard diameters based on the Clinical and Laboratory Standards Institute to determine whether the bacteria are resistant or sensitive to the studied antibiotics (15).

2-3-Preparation of plant extract:

The dried leaves were crushed very finely, and 50 g of plant powder was soaked with about 250 ml of solvent (Ethanol) for 24 hours and three times in a row, in 1-liter opaque flasks, the extract was filtered and the solvent was evaporated each time at a temperature less than 50 ° C and under pressure Diluted with rotary evaporator to obtain dry extracts The percentage of each extract was calculated by dividing the dry extract by the weight of the plant powder multiplied by 100 (16).

2-4-The antibacterial activity of bacteria :

A bacterial suspension was prepared for the studied microbial species (*Staphylococcus aureus, Pseudomonas aeruginosa*) at a concentration of 0.5 McFarland (1.5×10^8 cfu /ml). Muller-Hinton solid medium was inoculated with the studied bacteria. wells of 6 mm diameter were made in each plate and 100 µl of extract was added. 10% in each one using sterile pipettes. Placing dishes in the fridge for two hours in order for the extract to diffuse in the agar and then incubating at a temperature of 37 ° C for a whole day. The second hole was a Negative Control containing distilled water. The inhibition activity of the extracts was then determined by measuring the diameter of the area of inhibition formed around the pelvis in mm (15)

3-Results and Discussion :

3-1-Plant classification :

The scientific name : *Senna alexandrina*

Family: Fabaceae

Genus : Senna
Common Name: Senna makki
Flower Colour: Yellow

3-2-Preparation of plant extract:

The percentage of the extracts ranged from dry weight 9.6% (4.8 g) This increase can be explained by the high percentage of active substances in the plant.

3-3- Sensitivity of the tested bacteria to antibiotics:

The bacterial isolates belonged to two bacterial species: *Staphylococcus aureus* and *Pseudomonas aeruginosa. Pseudomonas aeruginosa* was resistant to all antibiotics studied: Gentamicin, , Ciprofloxacin, Levofloxacin, Cotrimoxazole and Imipenem. While *Staphylococcus aureus* was resistant to gentamicin, ciprofloxacin, levofloxacin and cotrimoxazole and sensitive to imipenem and vancomycin Table 1.

Table 1. Resistance of tested bacteria

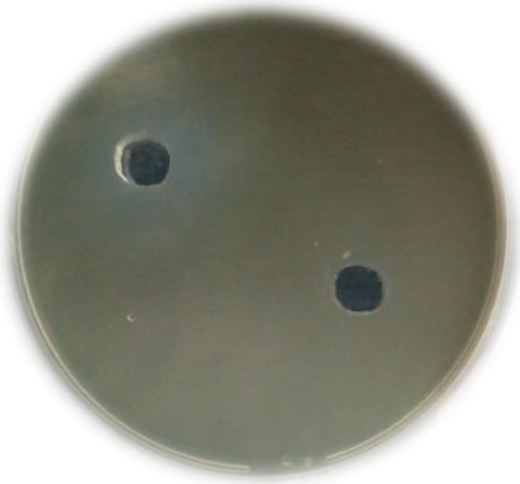
Antibiotic	*Pseudomonas aeruginosa*	*Staphylococcus aureus*
Gentamicin	R	R
Vancomycin	/	S
Ciprofloxacin	R	R
Levofloxacin	R	R
Cotrimoxazole	R	R
Imipenem	R	S

3-4-Test the antibacterial activity of bacteria:

The ethanolic extract outperformed all astudied antibiotics with respect to both types of bacteria which were studied. The diameters of the inhibition zone were 34mm against *Staphylococcus aureus* and 18 mm against *Pseudomonas aeruginosa* (17,18). The results of the current study are close to the study of researcher Al-Ebrahemi *et al*., 2009, as the diameters of the inhibition halos of the alcoholic extract of the leaves of the Senna makki plant ranged between 21 and 26 mm against *Staphylococcus aureus* bacteria and 14-17 mm against *Pseudomonas aeruginosa* bacteria (19). This is due to the plant containing a wide range of secondary metabolic compounds such as anthraquinones, flavonoids, tannins and coumarins that affect microorganisms in particular, as the main action of flavonoids towards bacteria and yeast is their ability to form a complex with cellular and soluble proteins and combine with the cell wall of bacteria, affecting the permeability of the bacterial wall and thus the death of bacteria (19) figer (1).
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(a) Antibacterial Activityagainst *Staphylococcus aureus*



(b) Antibacterial Activityagainst *Pseudomonas aeruginosa*

4- Conclusion:

Since Senna makki is one of the plants found in the flora of the Syrian Arab Republic, we recommend conducting more studies on the antibacterial efficacy of different parts of the plant, as it is a safe, commonly used and inexpensive plant. We also recommend making it a part of the composition of the phenomenon of antibacterial drugs in order to reduce the resistance of antibiotics, which has been increasing in recent decades as a result of the random and incorrect use of common antibiotics.

5-References:

1. Nazir, A., Nazir, A., Zuhair, V., Aman, S., Sadiq, S. U. R., Hasan, A. H and Bulimbe, D. B. (2025). **The global challenge of antimicrobial resistance: mechanisms, case studies, and mitigation approaches.** *Health Science Reports*, 8(7), e71077.

2. Zouine, N., El Ghachtouli, N., El Abed, S., & Koraichi, S. I. (2024). **A comprehensive review on medicinal plant extracts as antibacterial agents: Factors, mechanism insights and future prospects.** *Scientific African*, 26, e02395.

3. Samy RP and Ignacimuthu S (2000). **Antibacterial activity of some folklore medicinal plants used by tribals in Western Ghats of India**. *J Ethnopharmacol*.69 : 63-71.

4-Mohammed, H. J. (2011). **Screening of antibacterial properties for some Iraqi plants against Salmonella typhimurium**. *The Iraqi Journal of Veterinary Medicine*, 35(2), 28-35.

5. Suffredini B Sada HS Goncalves A Rei AO Gales AC Varella AD and Younges RN (2004). **screening of antimicrobial extracts from plants native to the Brazillian Amazon Rainforest and Atlantic Forest**. *Braz J Med Biol Res*.37; 379-384.

6-Kaur GH Arora DS (2009). **Antibacterial and phytochemical screening of anethum groveolens, Foeniculum vulgare and Trachy spermum ammi**. *Res. Article.*

7- Xia, J., Hochgerner, M., Wei, Q., Zhong, X. G., & Wang, J. (2025). **Redefining the Skin Barrier: A Microbiome-Integrated Multilayered Defense Model.** *Barrier Immunity.*

8- P. Baker, C. Huang, R. Radi, S. B. Moll, E. Jules, and J. L. Arbiser,"**Skin Barrier Function: The Interplay of Physical, Chemical, andImmunologic Properties,**" *Cells 12*, no. 23 (2023): 274.

9- Stevens DL, Bisno AL, Chambers HF et al. **Practice guidelines for the diagnosis and management of skin and soft-tissue infections**. *Clin Infect Dis* 2005; 41: 1373–1406.

10- Ki V, Rotstein C. **Bacterial skin and soft tissue infections in adults: a review of their epidemiology, pathogenesis, diagnosis, treatment and site of care**. *Can J Infect Dis Med Microbiol* 2008; 19: 173–184.

11- Templer, S. J., & Brito, M. O. (2009). **Bacterial skin and soft tissue infections.** *Hospital physician*, 26, 9-16.

12- May AK. **Skin and soft tissue infections**. *Surg Clin N Am* 2009; 89: 403–420.

13- Jones ME, Karlowsky A, Draghi D et al. **Epidemiology and antibiotic susceptibility of bacteria causing skin and soft tissue infections in the USA and Europe**: *a guide to appropriate antimicrobial therapy. Int J Antimicrob Agents* 2003; 22: 406–419

14- Osunga, S., Amuka, O., Machocho, A. K., & Getabu, 2023.,A. **Ethnobotany Of Some Members Of The Genus Cassia** (SENNA MAKKI)

15- Weinstein, M. P., & Lewis, J. S. (2020). **The clinical and laboratory standards institute subcommittee on antimicrobial susceptibility testing: background, organization, functions, and processes.** *Journal of clinical microbiology*, 58(3), 10-1128.

16- Handa, S. S. 2005. **Traditional and Modern methods of extraction of essential oils from aromatic plants**. **Presentation at the training course on cultivation, postharvesting and processing technologies of medicinal and aromatic plants in developing countries**. *ICS-UNIDO organized at Bomako, Mali* (West Africa), 25-29.

17-Nadia, A. S.; Bidlack, W. R. and Crecelins. (2000). **Hytoantimicrobials in :Natural food Atimicrobial System Aidu. A. Seds, CRC** (New York). 325-417..

18- Vamos-Vigyazo, L. (1981). **Polyphenol oxidase and peroxidase in fruits and vegetables. Crit. Rev. Food** *Sci. Nutr.* 15: 49-127.

19- Al-Ebrahemi, L. J., Al-Alaq, S. A., & Al-Amrii, M. M. (2009). **Morphological studies for Cassia italica (Mill.) and effect of alcoholic and hot water plant extract on different bacteria and yeast.** *iraq journal of market research and consumer protection***,** 1(1).