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Comparison of the inhibitory activity of Moringa oleifera and Moringa peregrina extracts against two types of human pathogenic bacteria

Abdullah hussein shalaal[1], F.h.R. Al-miahy[2]

[1,2,] Department of Horticulture, College of Agriculture and Marshlands, University of Dhi Qar, Iraq.

[1]*E_mail: abbdallahhussain@utq.edu.iq*

[2]*E_mail: Falah-ha@utq.edu.iq*

Abstract

The study aimed to investigate the effect of the alcoholic extract of the leaves of two Moringa species on two types of bacteria, Gram-positive Staphylococcus aureus and Gram-negative Klebsiella pneumoniae, which are pathogenic to humans. The results of the analysis of the alcoholic extract of the leaves of two Moringa species indicated that the Moringa oleifera leaf extract had an inhibitory effect on the growth of Staph. aureus bacteria. All concentrations of the ethanolic extract of Moringa oleifera leaves had a significant inhibitory effect on the growth of Staph. aureus and the effect increases with the increase of the used concentration, as the diameter reached a maximum of 18.17 mm at a concentration of 100 mg ml-1. Moringa oleifera leaf extract did not have an inhibitory effect on the growth of Klebsiella pneumoniae bacteria at all extract concentrations. The results of the analysis of the alcoholic extract also showed that the Moringa peregrina leaf extract had an inhibitory effect on the growth of Staph. aureus bacteria. All concentrations of the ethanolic extract of Moringa oleifera leaves had a significant inhibitory effect on the growth of Staph. aureus bacteria. The effect increases with the increase of the used concentration, as the diameter reached a maximum of 16.17 mm at a concentration of 100 mg ml-1. Moringa oleifera leaf extract did not have an inhibitory effect on the growth of Klebsiella pneumoniae bacteria at all extract concentrations.

Keywords. inhibitory activity, Moringa oleifera, Moringa peregrina.

I.Introduction

Plants contain large and diverse amounts of chemicals that have the ability to prevent and cure many diseases (Jamil et al. 2007). Moringa is considered a complete food and has many medicinal uses in addition to its high nutritional value (Sultan et al. 2008). Moringa has many pharmaceutical effects that are used in the treatment of many diseases in the traditional medical system (Abalaka et al. 2012). Moringa leaf extracts have biological properties, and these properties vary depending on the type of solvent used to extract the active ingredients contained in these leaves (Doughari et al. 2007). Moringa has antimicrobial properties, which explains why it is widely used in the treatment of respiratory diseases in humans (Anwar et al. 2007 ؛ Lockett et al. 2000).). showed that Doughari et al. 2008 the antibacterial activity of the aqueous and ethanolic acetate extracts of Moringa leaves was highest in the ethanolic extract, and lowest in the aqueous extract at a concentration of 1 liter. (Renitta et al. 2009 ؛ Mahewish et al. 2021). found that the ethanolic extract of Moringa leaves, flowers and seeds had antibacterial activity against Pseudomonas aeroginosa, Staphylococcus aureus and Escherichia coli. (Bukar et al. 2010). found that the ethanolic extract of Moringa leaves had a broad spectrum of activity against the tested bacteria. (Devendra et al. 2011؛ Muhe et al . 2024). noted that the chloroform extract of Moringa leaves had an antibacterial activity against Singh bacteria. They found that the aqueous, ethanolic, methanolic and hexane extracts of Moringa leaves had an inhibitory effect against several strains of bacteria, namely Staphylococcus aureus, Pseudomonas aeruginosa, and Escherichia coli (Singh , 2015 ؛ Muhe et al. **2023**). The aqueous, ethanolic, methanolic and hexane extracts of Moringa leaves had an inhibitory effect against several strains of bacteria, namely Staphylococcus aureus, Pseudomonas aeruginosa, and the hexane extract produced

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the least inhibition of all tested bacteria, while the methanolic extract produced the highest inhibition for all types. This experiment aimed to know the antagonistic activity of the aqueous and alcoholic extracts of Moringa leaves in inhibiting the growth of some types of Gram-positive and Gram-negative bacteria.

II.Materials and Methods

Plant Sample Collection and Preparation

Leaves were collected from the field, cleaned, washed with distilled water, and dried. 20 g of each were air-dried and placed in a Panasonic electric mixer. 200 ml of 70% ethanol was added to the mixture. The mixer was operated for 15 minutes, then the mixture was stirred intermittently in a hotplate magnetic stirrer for 48 hours at 45-50°C. The solution was then centrifuged at 3000 rpm for 30 minutes. The sediment was discarded, and the filtrate was taken. The process was repeated three times to ensure the removal of the sediment. The filtrate was filtered using Whatman No. 1 filter paper. The filtrate was dried in a water bath at 60°C. The extract was placed in sterile bottles and stored in a refrigerator at 5°C until use (Balajee et al. 2004).

Medicinal Efficacy of Plant Extracts

The inhibitory activity of two Moringa species' leaf extracts was tested as a simple cross-linked (CRD) experiment with a single factor comprising four treatments and three replicates. Four concentrations of Moringa species' leaf extracts (0, 25, 50, and 100 mg/ml) were applied to two separate bacterial species.

Bacterial Isolates

Two bacterial isolates were selected: Gram-positive Staphylococcus aureus and Gram-negative Klebsiella pneumoniae, a human pathogen.

Testing the effectiveness of two Moringa species' leaf extracts against two types of bacteria

The effectiveness of four concentrations of Moringa leaf extract (0, 25, 50, and 100 mg/ml) was tested against the two selected bacteria, as reported in (1999). Smânia et al. and Vanden and Vlietinck (1991) used Mueller Hinton Agar culture medium for bacterial growth, according to the manufacturer's instructions. 15-20 ml of the culture medium was placed in each Petri dish and left to solidify. The plates were then seeded using the spreading method, placing 50 microliters of bacterial suspension prepared from the bacterial isolates. The culture was spread using sterile cotton swabs. 6 mm diameter holes were then made in the agar, into which 0.1 ml of the sample to be tested for the inhibitory effectiveness of the leaf extract was placed, according to the concentrations used. The plates were then incubated for 24-48 hours at 37°C under aerobic conditions. The result was recorded by measuring the diameter of the inhibition zones in millimeters using a ruler.

III.Results and Discussion

It is clear from the results of Table (1) that the *Morinca oleifera* leaf extract has an inhibitory effect on the growth of Staph. aureus bacteria. All concentrations of the ethanolic extract of Morinca oleifera leaves had a significant inhibitory effect on the growth of Staph. aureus bacteria, and the effect increased with the increase in the concentration used, as the diameter reached a maximum of 18.17 mm at a concentration of 100 mg ml-1. The Morinca oleifera leaf extract did not have an inhibitory effect on the growth of Klebsiella pneumoniae bacteria at all extract concentrations.

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Table 1. The effect of *Moringa oleifera* leaf extract on inhibiting the growth of two types of bacteria pathogenic to humans

Inhibition zone diameter (mm)		Leaf extract concentration (mg/ml)
kleb.pneumoniae	***Staph. aureus***	
0	**0**	**control**
0	**15.17**	**25**
0	**17.00**	**50**
0	**18.17**	**100**
0	**1.675**	***LSD 0.05***

Table (2) also shows that the *Moringa peregrina* leaf extract has an inhibitory effect on the growth of Staph. aureus bacteria. All concentrations of the ethanolic extract of Moringa oleifera leaves had a significant inhibitory effect on the growth of Staph. aureus bacteria, and the effect increased with the increase in the concentration used, as the diameter reached a maximum of 16.17 mm at a concentration of 100 mg ml-1. The Moringa oleifera leaf extract did not have an inhibitory effect on the growth of Klebsiella pneumoniae bacteria at all extract concentrations.

Table 2. The effect of *Moringa peregrina* leaf extract on inhibiting the growth of two types of bacteria pathogenic to humans

Inhibition zone diameter (mm)		Leaf extract concentration (mg/ml)
kleb.pneumoniae	***Staph. aureus***	
0	**0**	**control**
0	**14.00**	**25**
0	**15.17**	**50**
0	**16.17**	**100**
0	**1.803**	***LSD 0.05***

The antibacterial effect of Moringa is due to the fact that its various parts contain numerous biologically active compounds that have beneficial effects. Moringa leaves contain many active compounds, which can be attributed to the inhibitory effect (Tables 1, 2). The reason for the difference in the inhibitory effects of the leaf extracts of the two Moringa species on bacterial growth is due to the difference in the type and quantity of active substances present in these extracts of the two species, as shown in the gas chromatography results mentioned above. The inhibitory differences resulting from the different concentrations of the extracts used are due to the structural nature of these microorganisms and the concentration of active

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substances in these extracts (Awadh et al., 2001). The optimal effects of medicinal plants may not be due to a single active substance, but rather to the interaction of several compounds (Kianbakht and Jahaniani, 2003). Several studies have indicated that plant extracts and oils containing 9,12-octadecadienoic acid (Z,Z) (linoleic acid) and ((Z,Z,Z)-9,12,15-ocatadecadienoic acid (linolenic acid) exhibit antioxidant and antimicrobial activity (Krishna et al., 2012; Tian et al., 2018). The high content of n-hexadecanoic acid (palmitic acid) in Moringa leaf extract has anti-inflammatory and anticancer effects (Aparna et al., 2012; Korbecki et al., 2019; Kim et al., 2020).

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