Phytochemical and Antimicrobial Study for *Phoenix dactylifera* L. (Ajwa Date) Seeds Extract

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Received: 05/11/2023
Accepted: 10/01/2024
Online: 29/12/2024

ABSTRACT

Background: The world is moving towards recycling waste from various sources, especially natural products, and reusing it in various medical, agricultural, and industrial fields. Date seeds are considered one of those sources, as seeds are rich in different natural compounds with nutritional and medical value. **Objective:** Ajwa date seeds (*Phoenix dactylifera*) are one of those natural wastes highlighted in this study to investigate their major phytochemical components and their biological activity against some types of bacterial strains compared to traditional antibiotics in terms of effectiveness. **Methods:** The work was done at the Biotechnology Research Centre/Al-Nahrain University in 2023. The seed powder was subjected to a cold hydro-ethanolic maceration process, and an estimation protocol for qualitative and quantitative analysis with the aid of different chromatography techniques was applied. Phenolic compound extraction with Folin reagent was followed to evaluate the total phenolic contents in the seeds. Total flavonoid content was investigated by applying the rutin standard curve equation. Moreover, high-performance liquid chromatography (HPLC) has been used for the proposed individual components both qualitatively and quantitatively. The biological activity of ethanolic seeds extract residue had been investigated as antibacterial activity against Gram-negative and Gram-positive bacteria isolated from the upper respiratory tract of patients admitted to hospitals at different Baghdad regions between November 2023 and February 2024. **Results:** Each 100 gm from *P. dactylifera* date seed produced about 8 gm residues. The ethanolic seeds extract was rich in many secondary metabolite compounds. Salicylic acid, vanillic acid, and benzoic acid represented the major phenolic compounds in the extracted residue among the other phenols. Meanwhile, fewer flavonoid contents have been investigated in the extract. The seed extract suppresses the growth of some bacterial types under study, especially the Gram-negative ones. **Conclusions:** Ajwa date seeds represent good sources rich in many secondary metabolite components, making the plant a candidate model curative agent for bacterial resistance species that are considered an aggravating problem in society at the present time.

Keywords: *Acinetobacter baumannii*, Ajwa seeds, *Phoenix dactylifera*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Streptococcus pneumoniae*, Total phenols.

DOI: https://doi.org/10.24126/jobrc.2024.18.2.880

1- Introduction

Dates are an excellent source of simple carbohydrates, mainly in the form of glucose and fructose, rich in dietary non-starch polysaccharides and minerals such as potassium and magnesium. Consuming about nine date fruits daily can secure about 10% and 16% of daily energy and carbohydrate intakes, respectively, and provides about one-fourth of the recommended intake of non-starch polysaccharides and potassium. In addition, dates are a rich source of antioxidant components demonstrating important bioactive properties (1).

The Kingdom of Saudi Arabia was the native country of Date palms (*Phoenix dactylifera*) crop production. About 20 million fruit-producing date palm trees were grown there, and approximately 72,000 tons of date seeds were disposed of annually as waste in this country (2).

This major waste product of the date can form an essential source for different industrial ingredients, producing components such as biofuels, biopolymers, and organic acids. The *P. dactylifera* fruit (date) is naturally rich in nutritional and non-nutritional compounds that comprise varied secondary metabolites (3).

As there are growing needs for the development of natural phytochemical sources that include dietary fiber, natural antioxidants, new antibiotics, functional food ingredients, or medicinal products and nutraceuticals, researchers have gotten big interests and afford for improving safe, rich sources for these needs even from plant wastes like the peels, skin, and seeds (4).

For this reason, and considering the increased antimicrobial resistance for both Gram-positive (G +ve) and Gram-negative (G -ve) bacteria, new therapeutics were required. The present study investigated the role of the phenolic components of Phoenix dactylifera seed extract as an antibacterial agent candidate against various microorganisms due to its role as a natural source of antioxidant agents.

2-Materials and Methods

Plant Collection and Extraction:

P. dactylifera L. date was collected from markets in the Kingdom of Saudi Arabia. The seeds were taken out, cleaned, dried, and crushed with the aid of an electrical industrial miller to get fine powder, which was kept in clean containers away from humidity. For the Extraction of date seed's major active constituents represented by total phenolic and flavonoid components, a method reported by (5) was employed. Briefly, about 100 g of dried crushed seeds were placed in a 2000-liter capacity Erlenmeyer flask to be subjected to 80%v/v aqueous ethanol as a cold alcoholic maceration method. The flask was kept in an orbital mechanical shaker for about one week in a dark place and filtered. Extraction steps were repeated, and the collected filtrates were dried with a rotary evaporator apparatus at 45 degrees Celsius. The residue was weighted, designated as total phenolic extract, and kept in a dark container for the next steps**.**

Quantitative Estimation of Total Phenolic Content (TPC) in ethanolic extracts

The amount of total phenolic compounds represented by µg Gallic acid equivalent (GAE) / each mg seed extract was determined by the Folin – Ciocalteu method with slight modification (6). Firstly, the Gallic acid standard curve was plotted between different concentrations of the prepared standard Gallic acid solution (30, 40, 60, and 80) µg /ml against the reading absorption of each to get a straight-line equation used for the calculation of the extract phenolic compound concentration after the following reaction; one ml from each standard solution/ Extract was mixed with one ml folin-reagent, each in separated tubes, mixed and stand for 5 minutes. An Aliquot of five ml of distilled water was added, followed by the addition of 1 ml of a saturated solution of sodium carbonate Na_2CO_3 10%, and kept in the dark at room temperature for 60 minutes. Finally, the absorbance was read at 760 nm against a blank sample containing all reagents and distilled water instead of the extract. Total Phenolic Compounds (TPC) was expressed as µg GAE /mg of dry extracts.

Quantitative Estimation of Total Flavonoid Content (TFC) in ethanolic extracts

To determine the total flavonoid content (TFC) in the seed extract, Rutin standard solutions were prepared according to (7) in concentrations (0.15, 0.31, 0.62, and 1.25) mg/ml for rutin standard. Rutin Standard was a curve applied at the end of the reaction between the absorption of each standard solution and its concentration. 1 ml of the seed extract (0.1mg/ml) was mixed with 4 ml of distilled water, and then 0.3 ml of $NaNO_2$ (5%) was added for 5 min. An Aliquot of 0.3 ml of the 10% $AlCl_3$ was added and stood for another 5 minutes. Finally, 2 ml NaOH (1M) was added and incubated at room temperature for 30 min. All prepared standard solutions were applied for the same reagents. The absorbance was measured against the blank solution at 510 nm. TFC was expressed as mg of Rutin equivalents/mg dry plant extract.

Qualitative analysis of Phenolic compounds by Thin Layer Chromatography (TLC)

A silica gel GF_{254nm} plate was used to represent the stationary phase to apply this technique as a qualitative analysis. The mobile phase for this assay was composed of (Toluene Ethyl acetate: Formic acid: Methanol) in the ratio of 55: 30: 10:5, then placed into a well-closed glass tank to be saturated with the mobile system vapors. A drop from the extracts and phenolic and flavonoid standard were applied to the plates using capillary tubes. The separated spots were visualized under UV light at 366 nm and 254 nm at the end of the developing step, and the relative factor (R_f value) for each constituent detected as a fluorescent spot under UV light was calculated (8).

R_f value = Distance moved by spot (the constituent) / Distance moved by the solvent (8).

Table(1): shows the standard phenolic compound and flavonoids used in this assay.

Table (1): Standards used in TLC

Flavonoids	Phenolic acids
1. Luteolin	**1.** Chromogenic acid
2. Rutin	**2.** Gallic acid
3. Catechin	**3.** Cinnamic acid-
4. Epicatechin	**4.** p-Coumaric acid
5. Quercetin	**5.** Caffeic acid
6. Quercetin	**6.** Pyrogallol
7. Apennine	**7.** Hydroquinone
8. Kameapherol	

Phenolic Compounds Analysis by High-Performance Liquid Chromatography (HPLC) Technique

The HPLC conditions for analyzing the phenolic compounds of the seed residue were applied according to (9), as shown in Table (2).

Table (2): High-Performance Liquid Chromatography (HPLC) conditions analysis for phenolic compounds

Phenolic compounds	Phenolic acids	
Instrument	**Shimadzu, Japan**	
Mobile phase	**A= 0.1% Acetic acid (20%) B= Methanol (80%)**	
Column	**ODS_{C18} (250× 4.6 Id) mm/5µm particle size**	
Flow rate	**0.8 ml/min**	
Injection Volume	**20 µl**	
Concentration of sample	**50 mg / 1 ml**	
Detection wavelength	**UV-Vis at λ 254nm for phenolic acids & 280nm for flavonoids**	
Column Temperature	**Room Temperature**	
Phenolic acid Standards used	**Phenolic acid**	**Injection concentration (ppm)**
	Vanillic acid	**1**
	Ellagic acid	**1**
	Gallic acid	**1**
	Syringic acid	**1**
	Chlorogenic acid	**1**
	Caffeic acid	**1**
	Ferulic acid	**1**
	Sinapic acid	**1**
	Salicylic acid	**1**
	Benzoic acid	**1**
Flavonoids Standards used	**Rutin**	**5**
	Catechin	**5**
	Quercetin	**5**
	Kaemferol	**5**

Bacterial Sensitivity Test for Different Traditional Antibiotics by Disk Diffusion Method:

Bacterial isolates, including *Pseudomonas aeruginosa (P. aeroginosa), Acinetobacter baumannii (A. baumannii), Staphylococcus aureus (Staph. aureus),* and *Streptococcus pneumonia (St. pneumonia*) had been obtained from Biotechnology Research Center/Al-Nahrain university. These strains represented isolated pathogens from the upper respiratory system of patients admitted to different hospitals in /Baghdad. Isolation and characterization for these pathogens had been done at the lab previously. Each inoculum was inoculated onto a brain heart infusion (BHI) medium and incubated at 37 degrees Celsius for 18 -24 hours, according to Kirby–Bauer's disk diffusion method (10). Briefly, A physiological saline solution was inoculated with each bacterial colony separately, and the concentration was compared with MacFarland tube number 0.5, which represents (1.5 $*10^8$) cells/ml. Bacterial planktonic cells were spread using cotton swabs on a Mueller-Hinton solid medium. All the processes are applied under sterile conditions. The antimicrobial disks were dispensed onto the inoculated solid plate's surface using an aseptic technique 30 mm apart from the next disk. The plates were incubated aerobically at 37 degrees Celsius for 16-18 hours. Then, the zones of inhibition were measured by a ruler. Results were compared with extensively referenced Clinical and Laboratory Standards Institute tables of antibacterial indications (11).

Antimicrobial Activity of the Seeds Extract by Agar Well Diffusion Method

The antimicrobial activity of the Ajwa seeds extract was tested against isolated bacterial species at concentrations ranging from (100, 50, 25, 12.5, 6.25, and 3.125) mg/ml proceeding agar well diffusion method using the Muller-Hinton agar medium (12). The agar plate surface containing 20 ml of solid Muller-Hinton agar medium was spread with 100 µl of each microbial inoculum separately using an L-shape diffuser over the entire

agar surface. Then, a hole with a diameter of 5 mm was punched aseptically with a sterile cork borer and a volume (100 µl) of each extract concentration with an equal distance between one hole and another. Then, agar plates were left in the cultivation chamber hood for an hour and incubated overnight at 37°C. The diameters of bacterial growth inhibition (mm) were measured using a ruler after the completion of the incubation period (12-14).

3-Results

The Seeds Extract Residue Yields:

The extraction process for *P. dactylifera* L. date seeds yielded 8gm residue from each 100 gm. dried powdered seed as hydro-alcoholic residue.

Quantitative Estimation of Total Phenolic Content (TPC) and Total Flavonoids content (TF)

The straight-line equation obtained from the Gallic acid standard curve is shown in Figure (1)

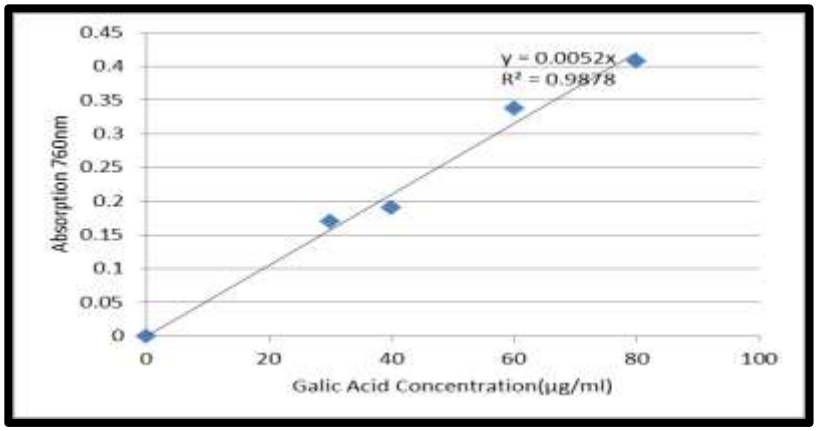


Figure (1): Calibration curve of Gallic acid for determination of total phenolic compounds in Ethanolic extract

When applying the straight-line equation, results showed that each 150-gm seed contained 3gm of total phenolic compound (20mg/g seeds).

The total flavonoid content (TFC) was calculated according to the straight-line equation obtained from the Rutin standard curve, Figure (2).

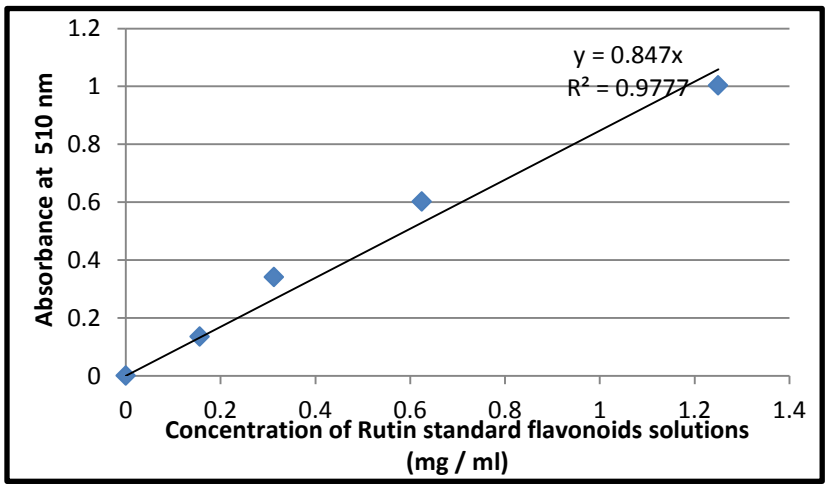


Figure (2): Calibration curve of Rutin for determination of Total Flavonoid Content in Ethanolic extract.

It was found that the total flavonoids were 106 mg/g seed extract.

Qualitative Analysis of Phenolic Compounds by Thin Layer Chromatography (TLC)

This identification was based on the resemblance in R_f values of standards and separated compounds. Figure (3) and Table (3) represent the phenolic components of Ethanolic extracts of seeds, identified according to the corresponding standards R_f values.

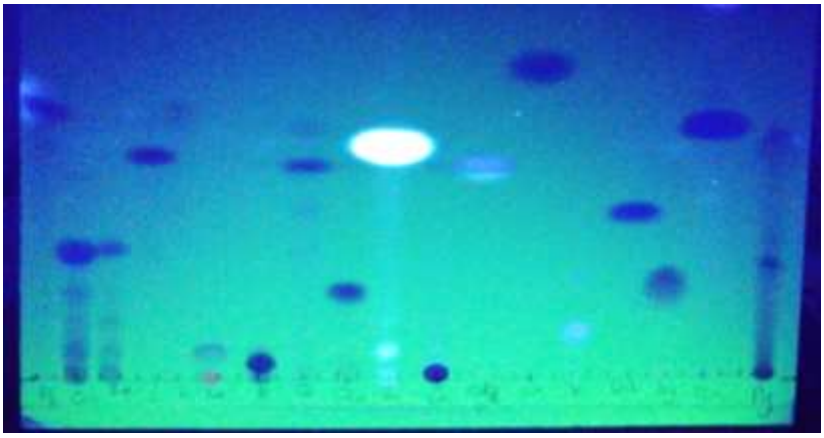


Figure (3): TLC chromatogram for Ajwa seeds extract (Ex) and standard flavonoids

Table (3): R_f values of standards and separated predicted phenolic acids and flavonoids from seeds ethanolic extracts by TLC.

Standards Phenols	**R_f of standards**
Chromogenic acid	0.128
Caffeic acid	0.53
Cinnamic acid	0.25
Hydroquinone	0.207
Gallic acid	0.414
p-Coumaric acid	0.643
Pyrogallol	0.543
Standards Flavonoids	**R_f of standards**
Catechin	0.307
Epicatechin	0.32
Kameapherol	0.43
Rutin	0.036.
Apennine	0.63
Luteolin	0.55
Quercetin	0.52
Quercetin	0.214
Hesperidin	o.5
Scopolamine	0.572

Phenolic Compounds Analysis by HPLC technique

Figures (4) and (5) show the HPLC chromatograms of phenolic standards and phenolic compounds investigated in plant seeds, respectively.

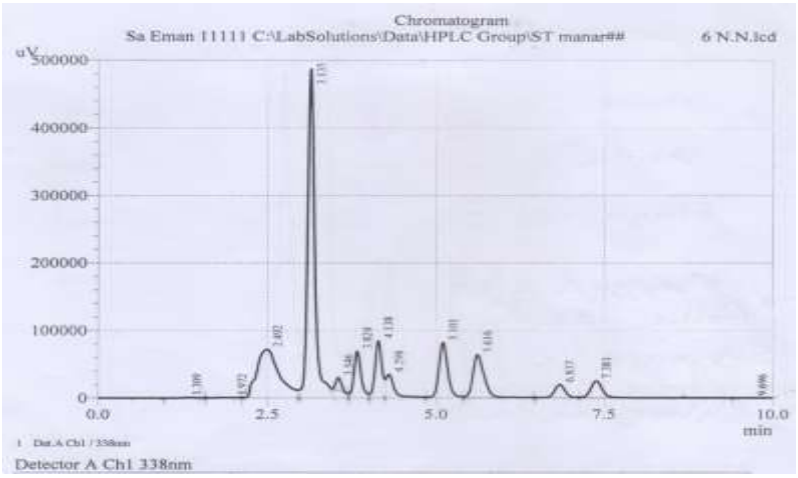


Figure (4): The HPLC chromatogram of phenolic standard compounds

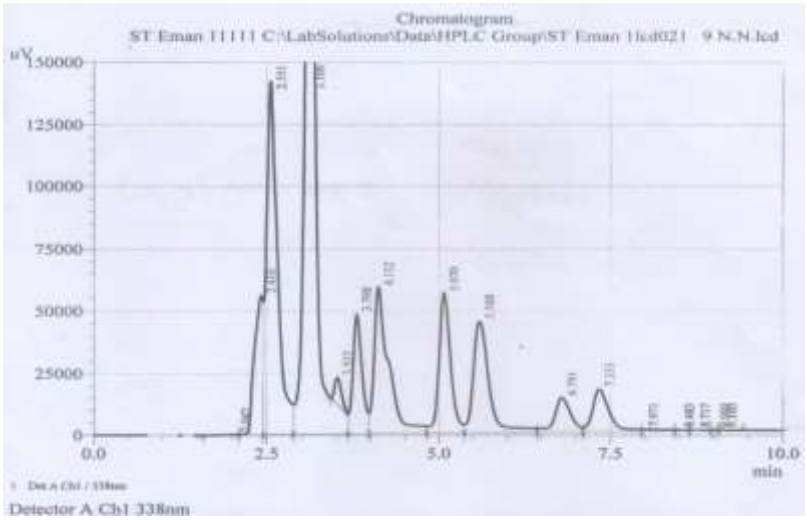


Figure (5): The HPLC chromatogram of phenolic compounds investigated in the seeds

Figures (6) and (7) represent the HPLC chromatograms of standard flavonoids and those present in the seed ethanolic extract, respectively.

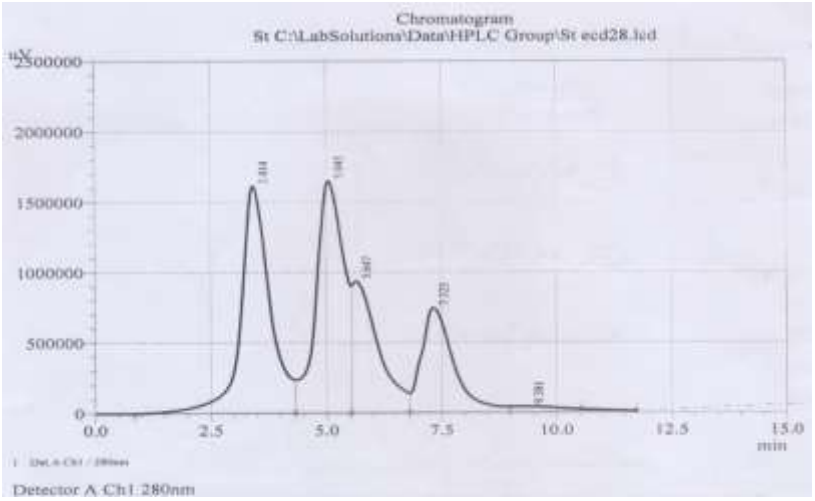


Figure (6): The HPLC chromatogram of standard flavonoids

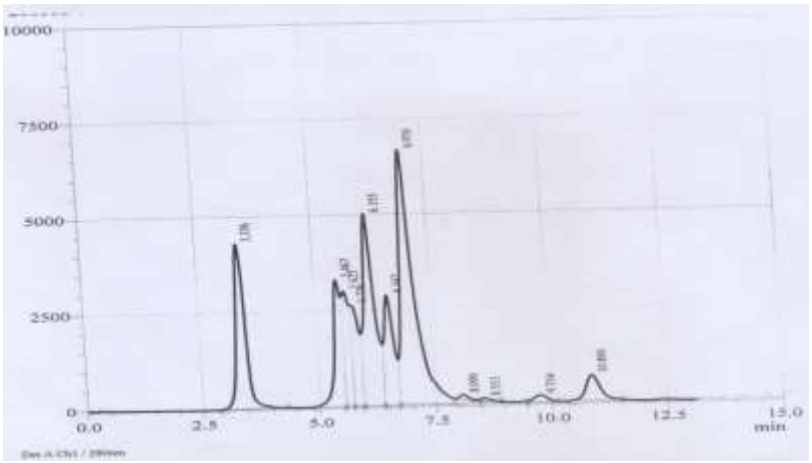


Figure (7): The HPLC chromatogram of flavonoids present in the seed ethanolic extract

Tables (4) and (5) show the quantitative amount of each phenolic and flavonoid compound present in the seed extract, corresponding to standard compounds.

Table (4):The HPLC data represents retention time (Rt) in minutes, area under the curve, and concentration (µg / ml) for standards and the extracted phenolic compounds

Phenolic compound	Conc. µg / ml	Rt.in minutes For Standard phenols	The area under the curve For Standard phenols	Rt.in minutes For the extracted phenols	The area under the curve For extracted phenols	Concentration µg / ml	Concentration µg /g.plant
vanillic acid	1	2.492	1668852	2.55	1578746	0.946	1.597
Ellagic acid	1	3.135	3733833	3.106	3216535	0.861	1.4544
Gallic acid	1	3.546	108466	3.517	73848	0.68084	1.15
Syringic acid	1	3.824	519704	3.798	464684	0.894132	1.51
Chromogenic acid	1	4.138	628481	--	---	Nil	Nil
Caffeic acid	1	4.298	315876	---	---	Nil	Nil
Ferulic acid	1	5.101	763955	5.076	678582	0.8882	1.4996
Sinapic acid	1	5.616	766132	5.588	709087	0.92554	1.5626
Salicylic acid	1	6.837	226221	6.791	224297	0.991495	1.6739703
Benzoic acid	1	7.381	310229	7.333	28742	0.92635	1.564

Table (5): The HPLC data represents retention time (Rt) in minutes, area under the curve, and concentration(µg / ml) for standards and the extracted flavonoid compounds.

Phenolic / flavonoid compound	Conc. µg / ml	Rt.in minutes For Standard phenols	The area under the curve For Standard phenols	Rt.in minutes For the extracted phenols	The area under the curve For extracted phenols	Concentration µg / ml	Concentration µg /g.plant
Rutin	**5**	**3.414**	**71576301**	**3.376**	**61372**	**0.004287**	**0.00724**
Quercetin	**5**	**5.647**	**36819741**	**5.625**	**31339**	**0.004255**	**0.0072**
Catechin	**5**	**5.045**	**69203063**	**nil**	**Nil**	**Nil**	**Nil**
Kaempferol	**5**	**7.323**	**38793414**	**nil**	**Nil**	**Nil**	**Nil**

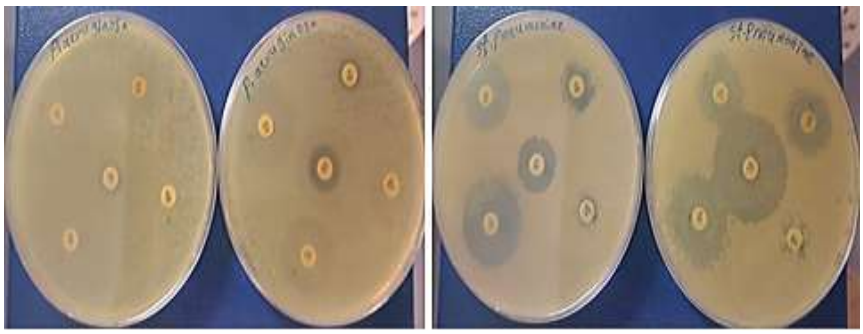
Effect of Ajwa Seed Extract on Pathogenic Bacteria:

Ajwa seed extract exhibited the highest inhibitory zone against *P. aeroginosa* tested bacterial strain at concentation100 mg/ml with an intermediate effect as the inhibition activity of the traditional antibiotics Doxycycline (10µg) and Vancomycin (30µg). The diameter of the inhibition zone for the antibiotics as a sensitivity test against pathogenic bacteria was investigated in Table (6) and Figure (8). Meanwhile, the inhibition zones for Ajwa seed extract are shown in Table (7) and Figure (9).

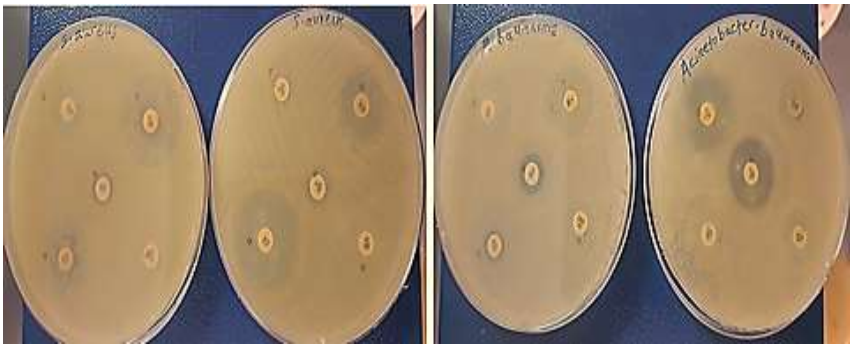
Table (6): The antibiotic sensitivity test of G- ve and G+ ve bacteria*

Antibiotic / Isolate No.	Rifampin RA (5µg)	Ceftriaxone CRO (10µg)	Amikacin AK (10µg	Doxycycline DO (10µg	Vancomycin VA (30µg)	Clindamycin DA (10µg)	Clarithromycin CLR (5µg)	Levofloxacin LEV (5µg)	Ampicillin AM (25µg)	Tetracycline TE (10µg)
Staph. aureus	**S**	**R**	**R**	**R**	**R**	**S**	**R**	**R**	**R**	**R**
	29mm	-	9mm	10mm	15mm	26mm	7mm	9mm	-	17mm
A. baumannii	**S**	**R**	**R**	**S**	**S**	**R**	**S**	**S**	**I**	**R**
	20mm	14mm	12mm	25mm	22mm	-	20mm	20mm	18mm	15mm
Strep. pneumoniae	**R**	**R**	**R**	**S**	**S**	**S**	**R**	**S**	**R**	**R**
	13mm	7mm	16mm	28mm	20mm	22mm	12mm	30mm	9mm	20mm
P. aeruginosa	**R**	**R**	**R**	**S**	**S**	**R**	**R**	**R**	**R**	**R**
	12mm	-	14mm	20mm	20mm	-	-	8mm	7mm	15mm

***S: sensitive, R: resistant, I: intermediate**



A: *Pseudomonas aeroginosa* **B: *Strep. Pneumoniae***



C: *Staph. aureus* **D: *Acinetobacter baumannii***

Figure (8): Antibiotic sensitivity assay for the tested isolate after incubation at 37 degrees Celsius for 24 hours

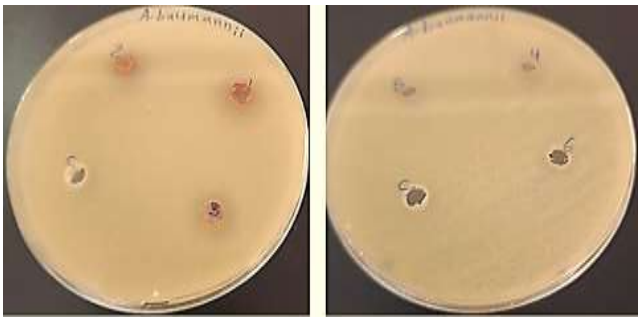
Table (7): Effect of different concentrations of Ajwa extract on G- ve and G+ ve bacteria

Con. of Ajwa Seeds Extract / **Diameter** / **Isolate Type**	**Con.1 100mg/ml**	**Con.2 50mg/ml**	**Con.3 25mg/ml**	**Con.4 12.5 mg/ml**	**Con.5 6.25 mg/ml**	**Con.6 3.125mg/ml**
P. aeruginosa G-ve	19mm	15mm	12mm	6mm	-	-
Strep. pneumoniae G+ve	10mm	7mm	3 mm	2mm	-	-
A. baumannii G-ve	7mm	5mm	3mm	2mm	-	-
Staph. aureus G+ve	6mm	4mm	3mm	2mm	-	-

A: Effect of Ajwa seeds extract on *Strep. pneumoniae*

B: Effect of Ajwa seed extract on *Pseudomonas aeroginosa*

C: Effect of Ajwa seed extract on *Staph. aureus*



D: Effect of Ajwa seed extract on *Acinetobacter baumannii*

Figure (9): Effect of Ajwa extract on G-ve and G+ve bacteria after incubation at 37 degrees Celsius for 24 hours

4- Discussion

Nowadays, most of the waste, especially plant waste, is recycled, and extensive studies are conducted to highlight its importance in various medical, agricultural, and industrial fields. The current study sheds light on Ajwa date seeds as one of the natural wastes in an attempt to recycle and benefit from them for the whole world problems in terms of finding alternatives used to inhibit the growth or kill microorganisms, especially after the exacerbation of the bacterial resistance problem toward many traditional drugs, even for the new generation, making this waste as a model for many industries, and the economic importance that can be fully utilized. The current study showed that total phenolic compounds as an active biological and antioxidant component reached about 2gm in each 100 g Ajwa seed, representing a significant raw material with medical and therapeutic importance (3-6). This was reported in many studies regarding the possibility of investigating active compounds with medical and biological significance (3),(7),(16). An *in vitro* and *in silico* analysis study conducted by (15) indicated that the methanolic extract of Ajwa date seeds plays an important role in the management of diseases through different essential components, especially phenolic components that possess antioxidant, anti-proteolytic, anti-hemolytic, and anti-bacterial activities (15). However, a more detailed study is required based on pharmacological aspects to determine the mechanisms of action of Ajwa dates components in disease prevention. In contrast, another study focused on organic substances made from materials organically sourced as safe and high-quality products and even more effective than those made from synthetic materials (16). Besides that, studies have been designed to explore the crucial effects of Ajwa fruits and seeds on skincare and topical treatments (17-19). Vanillic acid, Ellagic acid, Gallic acid, Syringic acid, Ferulic acid, Sinapic acid, Salicylic acid, and Benzoic acid all are phenols with known medical effects and pharmacological effectiveness, which Ajwa date seeds are rich in as this study concluded that. Therefore, recent studies have focused on the antioxidant effect of Ajwa date seeds, represented by the cytotoxic effect of seed extract and the possibility of treating some types of tumors and sarcoma cells in humans (20).

For this reason, the current study suggests paying attention and moving towards utilizing such extracts as natural plant sources for their antibacterial effects against some bacterial strains, as results showed that the antimicrobial activity of Ajwa seed extract on both Gram-negative bacteria and Gram-positive bacteria .exhibited the highest inhibitory zone diameter, at 100 mg/ml against tested bacterial strains. Thus, one of the proposed solutions might be to use alternatives for traditional antibiotics, from which the problem of resistance and treatment failure emerged all over the world. The inhibition induced by plant extracts against a particular organism is affected by several factors, including external and internal factors. The antioxidant activity represents one of the important defense strategies against different pathological states of several diseases.

5- Conclusion

Phoenix dactylifera L date seeds, known as 'Ajwa,' are rich in many secondary metabolite compounds, mainly phenolic compounds. These make this natural plant product a candidate model for predicted solutions for bacterial resistance, an aggravating problem in society today.

Acknowledgment

The authors would like to acknowledge the Biotechnology Research Center/Al-Nahrain University/ Ministry of Higher Education for support in completing all work requirements.

Conflicts of Interest

There is no conflict of interest regarding the publication of this manuscript.

Funding

The research did not receive any financial support from any institution.

Author Contribution

All authors confirm their contribution to the paper as follows: study conception: Zainab Yaseen; study design: Ghydaa H. Aljeboury and Wael Adil Obaid; data collection, analysis, and interpretation of results: Rawaa Adnan Khalaf and Zainab Yaseen. All authors reviewed the results and approved the final version of the manuscript.

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التحري الكيمياوي النباتي والفعالية ضد الآحياء المجهرية لمستخلص بذور تمر العجوة *Phoenix dactylifera* L.

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الخلاصة

خلفية البحث: لقد أصبح إعادة تدوير النفايات وخاصة مخلفات المنتجات الطبيعية وإعادة استخدامها في مختلف المجالات الطبية والزراعية والصناعية الشغل الشاغل لكثير من الباحثين هذه الأيام، حيث يتجه العالم نحو إعادة تدوير المخلفات من مصادر مختلفة ، وتعتبر بذور التمر أحد تلك المصادر، حيث تعد بذورها غنية بمركبات طبيعية مختلفة ذات قيمة غذائية وطبية. **الهدف من البحث:** بذور تمر العجوة (*Phoenix dactylifera*) هي أحد تلك النفايات الطبيعية التي تم تسليط الضوء عليها في هذه الدراسة للتحقيق في المكونات الكيميائية النباتية الرئيسية وفعاليتها الحيوية وتأثيرها ضد نمو بعض أنواع السلالات البكتيرية مقارنة بالمضادات الحيوية التقليدية من حيث الفعالية. **الطرق ومواد العمل:** تم إجراء العمل في مركز بحوث التقنيات الاحيائية/ جامعة النهرين في عام 2023. تم إخضاع مسحوق البذور لعملية النقع المائي الإيثانولي البارد وتم تطبيق بروتوكول تقدير للتحليل النوعي والكمي بمساعدة تقنيات الكروماتوغرافيا المختلفة في الدراسة الحالية. تم اتباع استخلاص المركبات الفينولية باستخدام كاشف الفولين لتقييم المحتوى الفينولي الكلي في البذور. تم التحقق من محتوى الفلافونويد الكلي من خلال تطبيق معادلة منحنى الروتين القياسي. علاوة على ذلك، تم تطبيق كروماتوغرافيا السائل عالية الأداء (HPLC) على المكونات الفردية المقترحة نوعيًا وكميًا. تم التحري عن الفعالية الحيوية لبقايا مستخلص البذور الإيثانولي كنشاط مضاد للبكتيريا ضد البكتيريا سالبة لصبغة الجرام وموجبة لصبغة الجرام المعزولة من عينات الجهاز التنفسي العلوي للمرضى الذين تم إدخالهم إلى المستشفيات في مناطق بغداد المختلفة بين نوفمبر 2023 وفبراير 2024. **النتائج:** أنتج كل 100 غرام من بذور تمر العجوة *P. dactylifera* حوالي 8 غرام كمردود الاستخلاص. كان مستخلص البذور الإيثانولي غنيًا بالعديد من مركبات الأيض الثانوية. مثل حمض الساليسيليك وحمض الفانيليك وحمض البنزويك كمركبات فينولية رئيسية من بين الفينولات الأخرى. في حين كان محتوى الفلافونويد هو الأقل في المستخلص. أبدى مستخلص البذور إلى ثتنيط نمو بعض أنواع البكتيريا قيد الدراسة، وخاصة سالبة لصبغة كرام. **الاستنتاجات:** تمثل بذور تمر العجوة مصادر جيدة غنية بالعديد من مكونات الأيض الثانوية، مما يجعل النبات نموذجا مرشحا لعلاج أنواع البكتيريا المقاومة التي تعتبر مشكلة متفاقمة في المجتمع في الوقت الحاضر.

الكلمات المفتاحية: بكتريا معوية ، نوى تمر العجوة ، *Phoenix dactylifera* ، الزائفة الزنجارية ، العنقودية الذهبية ، البكتريا المسبحية، الفينولات الكلية.