Effect of fig milk as an antimicrobial and antioxidant in extending the shelf life of meat

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Abstract

This study aimed to evaluate the chemical, microbial, and sensory properties of local chicken kofta treated with fig milk extract. The study involved collecting fig milk from the fruit and extracting it using three methods. The study included the following aspects. The study showed that the results of the active groups in the milk extract, which included phenols, flavonoids, and alkaloids, showed that the concentration of total phenols in the extract was higher than the rest of the groups. The results also showed that fig milk contains a group of minerals, including magnesium, calcium, and a percentage of potassium. The study showed that the results of chemical tests of fig milk showed that the percentage of protein in the plant reached 2.15%, the percentage of carbohydrates reached 31.4%, and the percentage of fat was 0.25%. The ash content and moisture were estimated at 3.5% and 49.1%, respectively. It is evident that the higher percentage of nutritional components is due to moisture than the total content of fig milk. The results of the statistical analysis at the level of (p 0.05) also showed that the fig milk extract has a high ability to displace free radicals, as fig milk was used in two states (fresh and frozen) at concentrations of (10, 20, 30, 40)%, and the highest value for inhibiting free radicals was at a concentration of (40%). The results proved that fresh fig milk has a higher ability to inhibit free radicals than frozen fig milk. The inhibitory activity of the fig milk extract was studied using different extraction methods (soxolite, vibrating device, ultrasonic device) towards two types of bacterial isolates (S. aurous, E. coli). The results showed that the plant extract resulting from using the saxolite method only gave an inhibitory activity balanced with the rest of the other extraction methods. It also showed that it was effective against mold (Aspergillus niger) and yeast (Candida albicans). Microbial tests were conducted on minced chicken meat samples treated with different concentrations of fig milk extract to study their effectiveness in reducing microbial growth for different storage times. The results of statistical analysis showed that the effectiveness of fig milk extract at a concentration of 100% had significant differences compared to other concentrations in the total number of bacteria in minced chicken meat samples. The effect of fig milk at different concentrations on liver functions and creatinine enzyme concentrations in rats was studied, in addition to examining urea. The results indicated that fig milk extract is not toxic. The results showed significant differences in the studied sensory characteristics (softness, juiciness, flavor, color and general acceptance) and the superiority of the concentration (50%), as it obtained the highest values in terms of softness, juiciness, flavor, color and general acceptance, reaching (6.2, 6.3, 6.1, 5.3 and 6.1) respectively when compared with the control treatments- .

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Introduction:

Figs are deciduous fruit trees of the genus Ficus. They were known in ancient times as a treasure trove of minerals and fiber. The ancient Pharaohs made them into a stomach medicine, while the Phoenicians made them to treat pimples. The Assyrians used them in preparing sweets. Abu Bakr al-Razi said they were beneficial in reducing body acids and preventing their harmful effects [5]. Fig milk has been used as an antioxidant for foods, or any change in flavor resulting from the oxidation of fats. Antioxidants improve the flavor of cooked meats and stabilize the color resulting from the curing process. It has also been used as an antibiotic, as antibiotics are chemicals produced by certain types of microorganisms that inhibit the growth of other types of bacteria. Antibiotics fall under the category of typical food preservatives because they do not affect the color, taste, or flavor of foods. Antibiotic treatment is used to reduce the risk of contamination by injecting the animal with these antibiotics before slaughter. Fig milk is used to coat slaughtered meat to reduce the risk of contamination. Fig milk works similarly to many preservatives capable of inhibiting or hindering food spoilage. The most commonly used substances are sulfur dioxide, sodium nitrate, nitric acid, and sorbic acid. Three key points must be taken into account when using any type of food preservative[6,32]it must have a specific benefit in the food industry, be safe to use and harmless to the consumer, and have a moderate content of the active preservative. This research aims to use fig milk to enhance the nutritional value of chicken meat with antioxidants and extend the shelf life of meat used at refrigerator temperatures. It will also be compared with fig milk stored at -18°C .

-3Materials and Methods

1-3Collecting Fig Milk Samples from the Fruit

Fig milk was collected from the local white fig tree (Ficus Carica). The fruit was cut at the point where it meets the stem and squeezed into a glass tube. It is preferable to cut unripe fruits, as they yield more fig milk than ripe ones. After filling the bottles, they are placed in a refrigerated container and then transferred to the refrigerator.

2-3Examination and Estimation of the Active Ingredients of Fig Milk

1-2-3Phenols: The total amount of phenolic compounds in the ethanolic extract was determined according to the method [23] using the standard Folin-Ciocalteu reagent. The total amount of phenolic compounds was expressed in milligrams of gallic acid equivalent (GAE) per gram of dry weight.

2-2-3Determination of flavonoid content:

The total flavonoid content in the crude extract was determined by the aluminum chloride colorimetric method according to the method [33], and the result was expressed as rutin equivalent mg per gram of dry weight.

3-2-3Determination of Alkaloid Content

•Extraction of Alkaloids from Fig Milk

20ml of fig milk was taken and extracted with methanol for 24 hours in a continuous extraction device (Soxholet) according to the method [29] The extract was shaken, and the methanol was evaporated on a rotary evaporator under vacuum at 45°C until dry. The presence of alkaloids was confirmed using the Drakenroff method. A portion of the extract was dissolved in dilute hydrochloric acid, and two drops of fig milk were added. The crystalline precipitate indicated the presence of an alkaloid. The sample that tested positive for alkaloids was then subjected to further quantitative evaluation.

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3-3Estimation of Mineral Elements

The concentrations of the elements under study were determined according to [8]. The absorbance of these digested samples was measured using a SHEMADZU AA 7000 atomic absorption spectrometer. The elements (magnesium, potassium, and calcium) were determined. 3-4 Chemical Tests

1-4-3Protein Estimation

The Kjeldahl method was used to estimate the protein content of the sample, based on the method described by [31] The protein content was calculated according to the following equation:

Protein % = Volume of HCl consumed x Moisture x 0.014 x 6.25 / Sample weight x 100

2-4-3Moisture Estimation

The moisture content of the sample was estimated as the weight loss before and after drying based on the drying method. Samples were placed in a well-preserved container and dried in an electric oven at 105°C for 16 hours. [5.[

Moisture percentage = Sample weight before drying - Sample weight after drying / Sample weight before drying x 100

3-4-3Estimation of ash content

The ash content of the sample was estimated by incinerating the sample after placing it in a ceramic flask of known weight in an incinerator at a temperature of approximately 252°C for 16 hours (A.O.A.C, 1995.(

Ash content (%) = Weight of the flask with the sample after incineration - Weight of the empty flask / Weight of the sample x 100

4-4-3Estimation of fat content

Fat content was estimated based on the method [15], and the fat content was calculated according to the following equation:

Fat content (%) = Weight of the flask before extraction - Weight of the flask after extraction / Sample weight x 100

5-3Evaluation of the effectiveness of fig milk as an antioxidant

Synthetic antioxidants widely used in foods have harmful effects on the human body. Numerous studies have been conducted to find natural alternatives. In this study, two types of fig milk were used: fresh and frozen. A 0.135 mM DPPH solution in methanol was prepared, and 1 ml of this solution was mixed with 10 µl of different concentrations of fig milk, both fresh and frozen. Concentrations ranged from 10 to 40%. Ascorbic acid was used as a standard antioxidant as a positive control at concentrations ranging from 1 to 4%. The reaction mixture was then thoroughly vortexed and left in the dark at room temperature for 30 minutes. Then the absorbance of the test samples was measured spectrophotometrically at (517 nm). These samples were read in duplicate and the ability to scavenge DPPH radicals was calculated using the following equation:

Free radical scavenging activity (%)= (A_control-A_sample)/A_control ×100

[26]

6-3Fig Milk Extract Preparation

Fig milk extract was prepared using three different methods to remove latex and separate the active ingredients in fig milk. The Scoslite method was chosen for the experiments as it yielded the best results.

1-3-6Alcoholic Extraction (Scoslite(

50ml of fig milk was taken in the alcohol extraction unit, and 350 ml of 85% ethyl alcohol was added. The extraction process continued for 12 hours at 40°C using a rotary evaporator vacuum at 35°C, resulting in a thick extract. Drying was completed using a

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convection oven at a temperature not exceeding 40°C. The final extract was then stored after drying until use [9.[

2-3-6 Preparing fig milk extract using ultrasonic waves.

50ml of fig milk is dried by placing it in an oven for 6 hours at 40°C. The product is then ground using a grinder to form a powder. The product is mixed with ethanol and placed in a sonic device. The product is then placed in an evaporator and extracted under permeate pressure. The product is then placed in a dryer to form the extract [9.[

3-3-6Preparing fig milk extract using a shaker

50ml of fig milk is dried by placing it in an oven for 6 hours at 40°C. The product is then ground using a grinder to form a powder. The product is mixed with ethanol and placed in a shaker. The product is then placed in an evaporator, and then placed in a dryer to form the extract [19]. Figure (3-4) shows the vibrator.

3-7Sources of isolates and their activation

This study used two bacterial isolates that were diagnosed in the Bacteriology Laboratory of the Center for Environment, Water, and Renewable Energy at the Scientific Research Authority. The isolates included Staphylococcus aureus and Escherichia coli. The isolates were activated 18-24 hours before testing at a temperature of 37°C. Nutrenl broth was used to activate E. coli and Staphylococcus aureus. As for fungi, we obtained mold (Aspergellus niger and yeast Candida albicans) from the fungi laboratory of the Research Department/Food Contamination. They were active in the food medium (Potato Dextrose broth), and were sterilized by (Autociave) at (121°C) and pressure (1 pound/inch2). The plates were incubated at a temperature of (25°C) for (3-5 days), and the control treatment medium was prepared for comparison according to [11 .[

1-3-7Preparation of bacterial and fungal suspensions

A 5 mm agar piece was taken from each bacterial isolate (Staphylococcus aureus, Escherichia coli) and transferred to a tube containing 5 mg of nutrient broth. The culture was incubated for 18-24 hours at 37°C until growth appeared through the formation of a turbidity visible to the naked eye. This turbidity was compared to the turbidity of a previously prepared MacFarland solution at a concentration of 0.5 [3]. The fungal suspension was prepared by taking a number of fungal colonies from the isolates (Staphylococcus aureus, Escherichia coli) (each separately) using a metal transfer needle (Needle) after sterilizing them with a flame and transferring them to tubes containing a quantity of sterile distilled water. The spores from each tube were counted by placing a drop on a special slide to count white blood cells to (1 X 106/Cfu), which represents the standard suspension [4[

3-8Sensory Evaluation

The sensory evaluation was conducted based on the method mentioned by [10] by adding the concentration (100%, 75%, 50%) to chicken meat samples weighing (200 g) for each sample, taking into account doubling the amount of fig milk extract at a ratio of (1:1) for each of the extracts and the chicken meat sample, and preparing a standard sample. The chicken meat samples (kofta) were grilled in an electric fryer at a temperature of (180°C) for (20 minutes), and the samples were sensory evaluated by ten experienced judges after providing them with information about the nature of the sensory evaluation according to the questionnaire designed for this purpose.

3-9 Statistical Analysis:

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The statistical program SPSS - Statistical Packages of Social Sciences (2019) was used to analyze the data to study the effect of various factors on the studied traits, using a completely randomized design (CRD). Significant differences between means were compared using the Least Significant Difference (LSD) test [26.[

-4Results and Discussion

1-4Active Groups of Fig Milk Extract.

Table (4-1) and Figure (4-1) show the results of the active groups in the milk extract, which included phenols, flavonoids, and alkaloids. The concentration of total phenols in the extract was higher than the other groups, reaching 18.8 mg of gallic acid equivalent/100 g. The results are consistent with the findings of [24,25] who conducted a chemical analysis of the concentration of total phenols, which was 4719 mg of gallic acid equivalent/100 g. Our results are somewhat in line with those of [21] who found that the total phenolic content in fig milk was 20.89 mg calc-equivalent/100 g.

The total flavonoid concentration in the fig milk extract was 9.56 mg rutin equivalent/100 g dry weight. This was consistent with the findings of [21], where the total flavonoid content was 9.34 mg rutin equivalent/100 g dry matter. The results were inconsistent with those of [12] where the average total flavonoid concentration was 18.82 mg quercetin equivalent/100 g dry matter. The alkaloid concentration was 98%. This was somewhat consistent with the findings of [21], where the total alkaloid content was 103% dry matter. This indicates that variations in the concentrations of active compounds in fig milk vary depending on the type of fig plant, plant part, and cultivation area [21 .[

Table (4-1). Active groups in fig milk extract.

Alkaloids %	flavonoids (mg Rutin/ 100 gm)	Phenols (mg Gallic/ 100 gm)
±7.098.0	9.56 ±1.76	48.8 ±23.41

Figure (4-1). Active ingredients in fig milk extracted from fig fruit.

2-4Estimation of mineral elements in fig milk.

Table (4-2) shows that fig milk contains a range of mineral elements, including magnesium, which reached 118 mg/100 g. Our results are consistent with those of [21], who conducted a chemical analysis of fig milk seeds, which confirmed the presence of magnesium, which reached 117.3 mg/100 g. However, they differ from what [16] reported, which stated that prickly pear contains

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magnesium, which reached 85 mg/100 g of dry plant weight. The same table shows a calcium concentration of 13.14 mg/100 g, consistent with the results of the study by [16], which reached 0.5412 mg/100 g of Algerian fig plant weight. This clearly demonstrates that plant type, plant part, and the location of cultivation and harvesting significantly influence the plant's element content. Table (4-2) shows a potassium concentration of 224.9 mg/100 g of dry plant. This is consistent with the results of the potassium concentration in [16], which reached 220 mg/100 g of dry plant, and differs from the results of [21] who, when chemically analyzing fig milk seeds, confirmed the presence of potassium at 0.253 mg/100 g of dry plant weight.

Table (4-2) Determination of mineral element concentrations in fig milk (mg/100 g.(

magnesium (Mg)	Potassium (K)	Calcium (Ca(
118±0.53	224.9± 16.37	13.14±0.09

3-4Chemical Composition of Fig Milk

The results of chemical tests on fig milk, shown in Table (4-3) and Figure (4-2), showed that the protein content in the plant was 2.15%, the carbohydrate content was 31.4%, and the fat content was 0.25%. The ash and moisture contents were estimated at 3.5% and 49.1%, respectively. This indicates that the higher percentage of nutritional components is due to moisture than the total content of fig milk. These results, based on the protein-to-fat ratio and moisture content, were consistent with those of [1], with the protein content reaching 2.166%, fat 0.28%, and moisture 51.96%. This was similar to our results, with the ash content reaching 4.09%. Our results also differed from those reported by [16] where the protein concentration in Algerian figs was 0.37 grams, the total fat 0.51 grams, the total carbohydrate 9.57 grams, and the dietary fiber 3.6 grams. This may be due to the type of fig plant, the soil, the cultivation conditions, and the harvest time .

Table 4-3. Chemical composition of fig milk extracted from figs.

Fiber	Ash	Moisture	Fat	Carbohydrates	Protein
0.68±13.6	0.20±3.5	2.95±49.1	0.04±0.25	2.07±31.4	0.17±2.15

Figure (4-2). Chemical composition of fig milk extracted from fig fruit.

4-4

Estimation of the antioxidant activity of fig milk.

The results of the statistical analysis at the ($p \leq 0.05$) level in Table (4-4) showed that the fig milk extract has a high capacity to scavenge free radicals. Concentrations of fresh and frozen fig milk (10, 20, 30, and 40%) yielded free radical inhibition rates of (51.33, 42.61,

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30.57, and 14.98%), (40.24, 33.43, 23.67, and 9.60%), respectively. The highest free radical inhibition value was at the (40%) concentration, and the lowest value was at the (10%) concentration. The results demonstrated that fresh fig milk has a higher capacity to inhibit free radicals than frozen fig milk. These results are consistent with those of [16]. The antioxidant capacity was evaluated using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging assay. The results indicated high free radical inhibition rates (68.75, 70.31, and 75%) for different fig milk varieties. On the other hand, the antioxidant activity of fig pulp extract was 18.91%. [20] reported that chitosan nanoparticles encapsulated in pumpkin alcoholic extract (CEx/CsNPs) had a free radical scavenging rate of 59.34% at a concentration of 3 mg/ml, which was higher than that of pumpkin methanolic extract at a concentration of 50 mg/ml.

Prickly pear has antioxidant and anti-inflammatory properties due to its high content of flavonoids, which combat free radical damage in the body and reduce joint and muscle inflammation caused by free radicals. Gout, arthritis, and allergies. This finding is useful for further advances in the fields of nutritional supplements, food additives, and drug synthesis in the future.

Table (4-4) Antioxidant activity of fresh and frozen fig milk

Concentrations	Fig milk activity per fruit (% frozen)	Fig milk activity per fruit (% fresh)	Ascorbic acid concentration (%)	Ascorbic acid activity (%
40%	2.17±40.24 a	2.85 ±51.33 a	4	3.77 ±98.2 a
30%	1.63±33.43 b	2.06 ±42.61 b	3	3.08 ±91.4 a
20%	1.29±23.67 c	1.34 ±30.57 c	2	2.68 ±80.5 b
10%	0.62±9.60 d	0.72 ±14.98 d	1	2.51 ±64.7 c
L.S.D. value	5.208 *	7.355 *	---	7.184 *
Means with different letters within a column are significantly different from each other. **) *P≤0.05.(**				

•The results in one column are averages of three replicates.

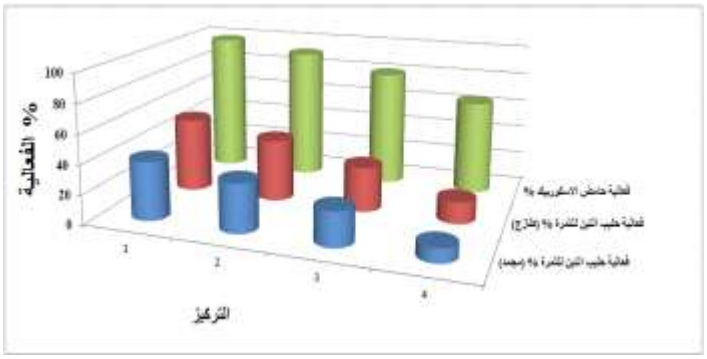

Figure (4-3). Comparison of the antioxidant activity of fig milk extracted from fresh and frozen fruit and ascorbic acid at concentrations (40% (1), 30% (2), 20% (3) and 10% (4.(

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5-4Inhibitory activity of fig milk extract on a group of bacterial isolates.

The inhibitory activity of fig milk extract was studied using different extraction methods (sucrose, vibrating, and ultrasonic devices) against two types of bacterial isolates (S. aurous and E. coli). The results showed that the plant extract produced by using the cosrose method only gave an inhibitory activity compared to the other extraction methods (extracted by vibrating and extracted by ultrasonic waves), as they did not show any inhibitory activity against the bacterial isolates (S. aurous and E. coli). On the other hand, the cosrose extract at a concentration of 100% showed an inhibitory activity of (37, 25) mm against the isolates (S. aurous and E. coli), respectively, and it was higher than the rest of the concentrations (75, 50, 25)%, as the inhibitory diameters reached (35, 23), (30, 20) and (25, 17) mm, respectively. Significantly compared to the control treatments (without treatment) and at a statistical significance level ($p \leq 0.05$), our results when using suxolyte in the extraction process agreed with the study of [14] that the inhibitory activity against a number of microorganisms contaminating refrigerated beef stored for 15 days, including S. aurous and E. coli, could be attributed to the extract containing terpenoids, flavonoids, tannins, saponins and alkaloids, which led to a reduction in the microbial count to very high levels, especially when the concentration of the alcoholic extract of fig milk was 200 mg/ml and 100 mg/ml. It agreed with [22] when they used the disc diffusion method to determine the antibacterial activity against S. aureus and E. coli. The results showed that the methanolic extracts of F. carica leaves showed an inhibitory effect against these bacteria. These results are consistent with those of [17] who examined the inhibitory activity of fig leaves and milk against S. aurous and E. coli bacteria. Using the diffusion-diffusion method and determining the diameters of inhibition zones, the results showed that fig milk has inhibitory activity, with an inhibitory zone diameter of 15 mm.

Table (4-5): Inhibitory activity of fig milk extracts using different extraction methods against some bacterial isolates.

E. coli	S. aureus	Bacterial isolates / Extract type	
Average damping diameter (mm) ± standard error		Concentrations%	
0	0	control	
0.82±17 b	1.6±25 c	25	Extraction with suxoleate
0.06 ±20 c	1.8±30 bc	50	
1.4±23 ab	1.8±35 ab	75	
1.6± 25 a	2.2±37 a	100	
0	0	25	Extraction with vibrating tube
0	0	50	
0	0	75	
0	0	100	
0	0	25	Extraction with ultrasonic waves
0	0	50	
0	0	75	

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0	0	100	
6.278 *	6.441 *	L.S.D. value	
Means with different letters within the same row are significantly different from each other) *.P≤0.05.(			

• The results in one column are averages of three replicates.

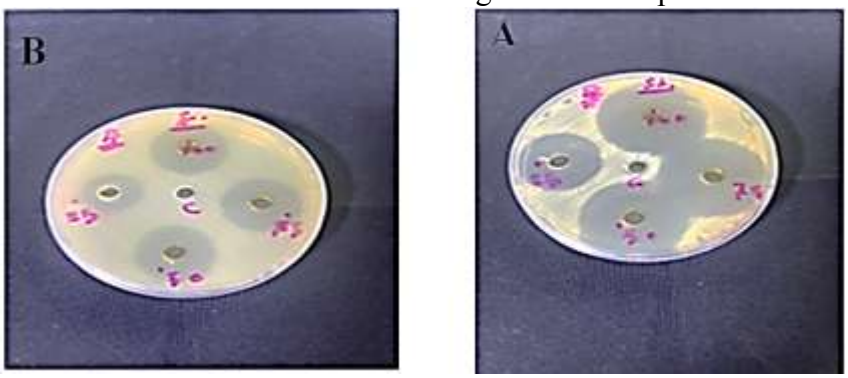

Figure (4-1) The inhibitory activity of fig milk extract at different concentrations (100, 75, 50, and 25%) using the saxoline technique against (A) Staphylococcus aureus and (B) Escherichia coli.

6-4The inhibitory activity of fig milk extract against fungi and yeasts.

The inhibitory activity of fig milk extract using the saxolite method against Aspergillus niger and Candida albicans yeast was demonstrated. The results showed that the effectiveness of fig milk extract using saxolite gave the highest inhibitory activity against A. niger and the fungal growth reached 20 mm compared to the rest of the extraction methods (75, 50, 25)% and reached (30, 27, 22) respectively, while the fig milk extract using the vibrating method was less effective and reached 24 mm. On the other hand, the extract concentration of 100% gained a significant difference at the level (P≤ 0.05) compared to the rest of the concentrations except for its comparison with the 75% concentration, where the diameter of the fungus reached 28 mm, as the concentration was directly proportional to the inhibitory activity for all extraction methods (Table 4-6a). The results showed that the vibrating fig milk extract had the highest inhibitory effect against A. niger mold. Fungal growth reached 24 mm at 100% extract concentration compared to the remaining concentrations (75, 50 and 25)%, which reached 28, 30 and 33 mm, and the control treatment, which reached 36 mm. The 100% extract concentration showed a significant difference at the level of (P≤ 0.05) compared to the remaining concentrations, except for its comparison with the 75% concentration, where the fungal diameter reached 24 mm (Table 4-6a). The results showed that the fig milk extract, using the ultrasonic method, provided inhibitory activity against A. niger mold. Fungal growth reached 23 mm at the 100% extract concentration, compared to the other concentrations (75, 50, and 25%), which reached 26, 29, and 32 mm, and the control treatment, which reached 36 mm. The 100% extract concentration showed a significant difference (P≤ 0.05) compared to the other concentrations, except for the comparison with the 75% concentration, where no significant differences were found (Table 4-6a.(

Table 4-6a: Inhibitory activity of fig milk extracts using different extraction methods against A. niger mold.

L.S.D. value	100%	75%	50%	25%	control	Concentrations / Extraction method
	Fungal growth rate (mm) ± standard error					
6.71 *	0.9 ±20 d	1.3 ±22 cd	1.3±27bc	1.7±30 ab	2.0±36 a	Hexane Extract
7.38 *	0.7 ±24 c	1.5 ±28bc	2.1±30 a	1.7±33 ab	2.0±36 a	(Sexolite Device)
7.02 *	0.8 ±23b	0.9 ± 26b	1.7± 29 a	1.8±32 a	2.0±36 a	Vibrating Device
Means with different letters within the same row are significantly different from each other.) *P≤0.05.(						

• The results in one column are averages of three replicates.

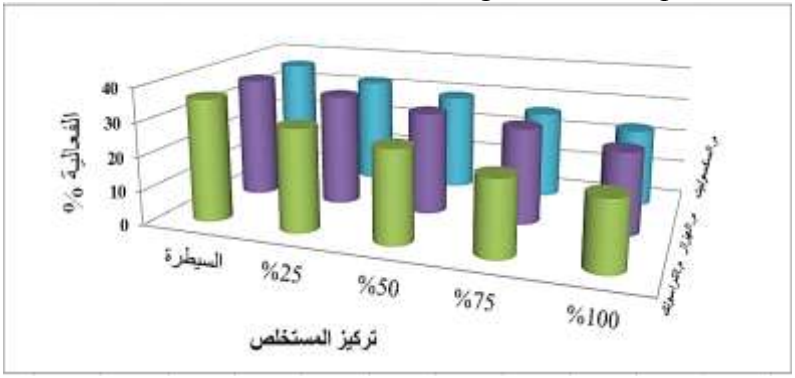

Figure (4-5): Inhibitory activity of fig milk extracts using different extraction methods on A. niger mold.

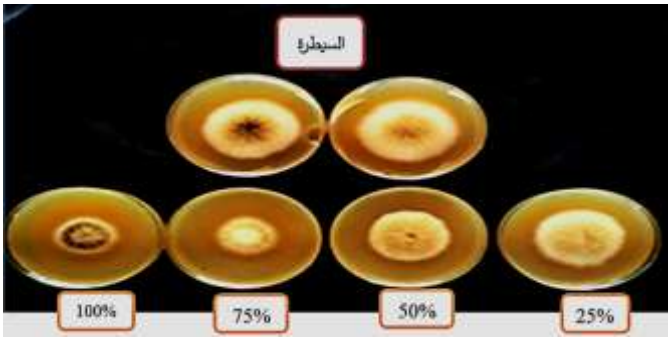

Figure (4-2) Inhibitory activity of fig milk extract using the saxolite technique at concentrations of (100, 75, 50, and 25)% against the mold Aspergillus niger.

The effectiveness of fig milk extract by suxelyte and vibrating extraction methods against C. albicans was not different from that of A. niger, while the fig milk extract by ultrasound method did not show any inhibitory activity at different concentrations against C. albicans, Table (4-6b) shows that the diameter of the inhibitory halo (transparent area formed around the extract-containing pit) was observed at concentrations (100, 75, 50%), and was (17, 11 and 8) mm, respectively, while the concentration (25%) did not show any activity compared to the control treatment. Our results are consistent with the study of [28] to evaluate the antifungal activity of ethanolic extract (suxelyte) of 48 fig species through the activity against C. albicans and the leaf disc diffusion method. The results

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showed that ethanol extracts of fig species had strong antifungal properties against yeast, and were the most effective among at least nine fig species, producing an inhibition zone ranging from 15 to 25.5 mm.

Table (4-6b) shows the inhibitory activity of fig milk extracted using three methods against C. albicans.

L.S.D. value	100%	75%	50%	25%	control	Concentrations / Extraction method
	Mean ± Standard Error					
5.29 *	0.72 ±17a	0.57± 11b	0.41± 8b	0 ±0 c	0 ±0 c	Hexane Extract (Succinate)
4.66 *	0.61± 13a	0.57± 11a	0.32 ±6b	0 ±0 c	0 ±0 c	Vibrator
NS	0 ±0	0 ±0	0 ±0	0 ±0	0 ±0	Ultrasonic Device
Means with different letters within the same row are significantly different from each other) *.P≤0.05.(						

• The results in one column are averages of three replicates.

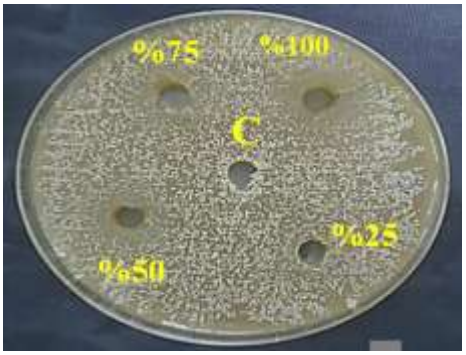

Figure (4-3) shows the inhibitory activity of fig milk extract using the saxolite technique at concentrations of (100, 75, 50, and 25%) against Candida albicans. 4-7 Microbial Tests

1-7-4Total Aerobic Bacteria Count

The results of the statistical analysis, at a significance level of (p≤ 0.05), in Table (4-7), showed that the effectiveness of the fig milk extract at a concentration of 100% had significant differences compared to the concentrations of 75% and 50% in the total bacterial count in the minced chicken meat samples. The remaining concentrations, in turn, had significant differences compared to the control samples. On the first day, at a concentration of 100%, the total bacterial count reached 310 x 23 cells/g, compared to the concentrations of 75 and 50%. The total number of aerobic bacteria reached 310 x 150 and 310 x 220 cells/g, respectively, in addition to the comparison with the control treatment of 510 x 5 cells/g (according to the Iraqi specifications for microbial limits for the standard specification for soft minced meat suitable for human consumption, issued by the Central Organization for Standardization and Quality Control in Iraq in 2006, which requires the number of aerobic bacterial cells to be at 1 x 106 cells/g for the product to be good for human consumption, and at 1 x 107 cells/g for the product to be acceptable, and the type of tests and plans for sample withdrawal for livestock and poultry meat).

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The effectiveness of the 100% concentration of fig milk extract after a storage period of four days reached 310 x 140 cells/g and at a concentration of 75% it reached 410 x 157 cells/g. After treating a chicken meat sample with fig milk extract at a concentration of 50%, the total number of aerobic bacteria reached 32 x 105 cells/g, compared to the control treatment, which reached a total number of aerobic bacterial cells (>710). After a storage period of 6 days, the average number of aerobic bacteria in minced chicken meat samples treated with 100% fig milk extract reached 410 x 260 cells/g, while when treated with 75% it reached 510 x 89 cells/g. However, the numbers of the remaining concentrations reached numbers that could not be counted (To Numerical to count - TNTC) after treating minced chicken meat samples with 50% concentration and the control sample. However, after increasing the storage period to eight days, the results showed that the meat samples treated with 100% fig milk extract were not accepted and the samples treated with the remaining concentrations were spoiled, in addition to the control samples. This indicates the high inhibitory effect of fig milk on preserving fresh chicken meat, especially at 100% concentration (Appendix 2). This is consistent with the results of [14], which showed that aerobic bacterial growth in control samples reached 6.88 x 10 cells/g after 7 days of storage. Meanwhile, al-Hafoud (2017) reported that mixing minced lamb with an alcoholic extract of male milk extended the meat's shelf life by 6 days at 4°C. The best effect was achieved at a concentration of 450 mg/ml, with the number of microorganisms decreasing more than at other concentrations .

Table (4-7) Effectiveness of fig milk extract in minced chicken meat samples (total number of aerobic bacteria) during refrigerated storage periods (□5.(

eighth day^{6}10x	sixth day^{4}10x	Fourth day^{3}10x	First day^{3}10x	Storage period / Extract concentration
±Standard Error Mean				
TNTC	(TNTC) >10000 a	>^{4}10 a	142.7± 10x50 a	control
>10	21.2 ±260 bc	2.7 ±140 c	1.2 ±23 c	100%
TNTC	173.2±10x 89 b	260 ±10x 157 b	8.4±150 b	75%
TNTC	>10000 a	21.5± ^{2}10x 32b	12.8±220 b	50%
	327.71 *	127.94 *	89.661 *	L.S.D. value
Means with different letters within the same row are significantly different from each other) *.P≤0.05.(				

Whereas (TNTC): cannot be counted (To numerical to count.(

The results in one column are averages of three replicates.

2-7-4Total Fungal Count

The results of Table (4-8) showed that the effectiveness of the fig milk extract on the first day at a concentration of 100% reached 36 cells/g. The differences did not reach statistical significance ($p \geq 0.05$) compared to the concentrations of 75%, 50%, and the control sample (not treated with the extract). The total number in the minced chicken meat samples reached (21, 23, and 27) cells/g. No significant differences were observed between the remaining concentrations (according to the Iraqi specifications for microbial limits, the type of tests, and sample withdrawal plans for

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livestock and poultry meat, 2006). The effectiveness of the 100% concentration of the fig milk extract after a storage period of four days reached 7 cells/g. At a concentration of 75%, the number of fungal colonies reached 18 cells/g. No significant differences were observed between the concentrations of (100 and 75%), which reached (7 and 18) cells compared. In the control (78) cells, while it reached significance after treating a chicken meat sample with fig milk extract at a concentration of 50%, which brought the total number of fungi and yeasts to 39 cells/g, which in turn brought the differences to significance compared to the control treatment, which reached a total number of 78 cells/g. After a 6-day storage period, the total cell count in minced chicken meat samples treated with 100% fig milk extract reached 9 cells/g. The effectiveness was the highest compared to the other concentrations, and did not reach significance compared to the 75% concentration, which reached a total cell count of 22 cells/g. The differences in turn reached significance compared to the 50% concentration, which reached a total cell count of 48 cells/g, and the control sample, which reached 317 cells/g. This indicates that the inhibitory effectiveness of fig milk extract increases proportionally with increasing concentration, which may be due to the content of total phenols and flavonoids, which have inhibitory activity against microorganisms through several mechanisms, as mentioned by [18] (Appendix 3). In agreement with [30] study, raw fig milk has strong anti-candida activity, likely due to the activity of protease enzymes that degrade the glucans in fungal cell walls. Fresh fig milk (used undiluted) may retain more effectiveness, as fruit harvesting can result in dilution or loss of milk, reducing antibacterial compounds. Bengal fig milk showed stronger antimicrobial effects than flexible fig, possibly due to higher concentrations of inhibitory compounds or interference with the respiratory chain in microorganisms. Plant-derived substances, especially fig milk, are promising for combating drug-resistant pathogens, but effectiveness depends on the bacterial/fungal makeup, processing methods, and plant species [11 .[

Table (4-8). Total fungal and yeast counts for minced chicken meat samples treated with fig milk extract during storage periods at (±5(

sixth day	Fourth day	First day	Storage period / Extract concentration
± Standard Error Mean			
14.8 ±317 a	4.7 ±78 a	2.5±36	control
0.36 ±9 c	0.28 ±7 c	1.2±21	100%
2.8±22 bc	0.76 ±18 c	1.5±23	75%
2.8±48 b	2.3±39 b	1.6±27	50%
28.854 *	19.552 *	15.04 NS	L.S.D. value

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•The results in one column are averages of three replicates.

•Probability (P≤ 0.05.(

-4

9Sensory Evaluation of Grilled Chicken Kofta

1-9-4Tenderness

The tenderness evaluation results showed a significant difference at the significance level (p≤ 0.05) between the grilled kofta samples treated with a 100% concentration, which reached 5.1, compared to the 50% treatment, which reached a tenderness ratio of 6.2, and the control (untreated) sample, which reached a tenderness ratio of 6.3. Meanwhile, the 75% treatment showed a difference between the 50% treatment and the control sample, but the differences did not reach significance (p≥ 0.05). This result is consistent with the results of the study by [2,3] who indicated the effectiveness of plant extracts in preserving food during storage. 4-9-2 Juiciness

The results of the juiciness evaluation showed a significant difference at the significance level (p≥0.05) between the 100% kofta grilled samples treated with a concentration of 5.4, compared to the 50% treatment and the control (untreated) sample, which reached a tenderness ratio of 6.3. Meanwhile, the juiciness results for the 75% treatment showed a difference of 5.5 compared to the 50% treatment and the control sample, which reached 6.3. However, the differences did not reach significance (p≥0.05). Zaki et al. (2018) confirmed that the burger with added plant extracts scored the highest juiciness score compared to the control sample, which scored the lowest. The increase in juiciness of the burgers with added plant extracts may be attributed to the higher moisture content of the camel meat burger, which increases the water-holding capacity of the meat and reduces the loss of leaching fluid during thawing [4. [

3-9-4Flavor

The sensory evaluation results for flavor showed a significant difference at the significance level (p≤ 0.05) between the grilled kofta samples treated with 100% and 75% concentrations, which reached 3.8 and 4.9, compared to the 50% treatment, which reached 6.1, and the control sample (untreated), which reached a tenderness percentage of 6.3. The 50% treatment showed no difference compared to the control sample. This is due to The difference in sensory evaluation (flavor) due to the effectiveness of lipase, protease, phenolic compounds, and flavonoids in fig milk extract, which increases with increasing concentration, may be one of the main reasons for explaining our results, and for protecting and preserving the pericarp from oxidation during cold storage [4]. These results are consistent with the results of the study by [4], who indicated the effectiveness of plant extracts in preserving food during storage. 4-9-4 Color

The statistical results of the sensory evaluation of color showed a significant difference at the probability level (p≥0.05) between the grilled chicken kofta samples treated with 100% and 75% concentrations, which reached 3.5 and 4.4, compared to the 50% treatment, which reached 5.3, and the control (untreated) sample, which reached a tenderness ratio of 6.3. The statistical differences did not reach significance when treated with 50% concentrations (p≥0.05) compared to the control sample not treated with fig milk extract (Table 4-11). Our results differed from the results of Zaki's (2018) study, which evaluated color changes in manufactured camel bircher with different concentrations of

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chia seeds during cold storage at 4°C for 12 days. The control (untreated) sample showed a higher color change, while no significant differences were found between the samples prepared during cold storage. Meanwhile, the bircher treated with chia seeds showed a 1% increase. and 5% significant increase after 6 days of storage and no significant differences were found after 9 and 12 days. This was almost in agreement with the results obtained by Mukhtar et al. (2014) who reported that a slight increase in color was found in beef patties after 6 days of storage and no significant differences were found after 12 and 15 days of storage at 4°C.

5-9-4General Acceptance

The results of the general acceptability test revealed a significant difference at ($p \leq 0.05$) between the 100% and 75% concentrations of grilled chicken kofta samples, which reached 5.1 for each, compared to the 50% fig milk extract sample, which reached 6.1, and the control (untreated) sample, which reached 6.3. However, the results of the 50% concentration treatment did not show any significant difference compared to the control sample. These results, in turn, are consistent with the results of [4] in his study on plant extracts and their effect on extending the shelf life of refrigerated fish balls, with increased sensory values during refrigerated storage. The sensory evaluation results of the different concentrations of fig milk extract showed that the 50% extract concentration gave better results than the rest of the concentrations, as it obtained the highest sensory evaluation scores for the criteria (freshness, juiciness, flavor, color, and general acceptability) and reached 6.2, 6.3, 6.1, 5.9, and 6.1 compared to the rest of the other concentrations (100, 75) that obtained evaluation scores (5.1, 5.4, 3.8, 3.5, and 5.1), (5.9, 5.5, 4.9, 4.4, and 5.1), respectively, which indicates that not every high concentration is necessarily the optimal concentration for effectiveness, i.e. there must be a balance in the content of active compounds in the extract, both quantitatively and qualitatively. While [13] yielded the highest sensory evaluation results for the 100-g Beef Burger Meat treatment, which achieved the highest color percentage (7.3), overall acceptability (7), and appearance (6.6). The 100-g Burger Truffles treatment achieved the lowest sensory evaluation indices, with significant differences ($P \leq 0.05$). [15] reported that adding low concentrations of chitosan significantly improved the sensory properties and quality of quail meat.

Table (4-11). Sensory evaluation of treatments with different concentrations of fig milk extract for grilled chicken meat kofta samples.

General Acceptance	Color	Flavor	Juicy	Tenderness	Attribute
Mean ± Standard Error					
6.3 ±0.34 a	6.3 ±0.34 a	6.3 ±0.34 a	6.3 ±0.34 a	6.3 ±0.34 a	Control
5.1 ±0.25 b	3.5 ±0.21 b	3.8 ±0.16 b	5.4 ±0.25 b	5.1 ±0.22 b	00% Extract
5.1 ±0.25 b	4.4 ±0.12 b	4.9 ±0.17 b	5.5 ±0.28 ab	5.9 ±0.31 ab	75% Extract
6.1 ±0.30 a	5.9 ±0.26 a	6.1 ±0.28 a	6.3 ±0.32 a	6.2 ±0.34 a	50% Extract
0.937 *	1.077 *	1.194 *	0.802 *	0.873 *	LSD value
Means with different letters within a column are significantly different from each other.) *P≤0.05.(					

Where ((7) Excellent (very acceptable), (6) Very good (acceptable), (5) Good (slightly acceptable), (4) Average, (3) Slightly unacceptable (weak), (2) Unacceptable (poor), (1) Very unacceptable (very poor.(

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