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Study of The Bioactivity and Antioxidant Activity of Dried Fig Puree and Its Effect on The Shelf Life of Ice Cream

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Abstract

Dried figs were mashed, to assess the DPPH radical scavenging capacity, at concentrations of 0, 5, 10, and 15 mg/ ml, comparison with 5 mg ml ascorbic acid. Ice cream was made and supplemented with dried fig puree, at four replacement ratios (0, 1, 3, and 6%) symbol by T0, T1, T2, and T3 respectively. Physical and sensory tests were performed after 0, 3, 7, and 10 days.

The solubility of the dried fig puree extract ranged from 85.97-42.51%, pH value (6.33-5.06%), the acidity value (0.14-0.27%), the spread ability (15.11-11.26%), the solubility (35.25-26.32%), the taste (19.39-13.02%), the aroma (18.35-12.01%), and the overall acceptability (19.35-11.09%).

The active compounds of the aqueous and alcoholic dried fig extracts were identified by GC-MS, using an Agilent Technologies 7890B GC system, the aqueous extract yielded 10.172, 16.119, and 26.3148% area percentages, respectively, for the compounds 4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-, 8-(2-Phenylethyl)-1-oxa-3,8-diazaspiro[4,5]decan-2-one, and methane-diethoxy, while the alcoholic extract yielded 6.931% area percentages, 11.002% area percentages, and 11.0542% area percentages, for the compounds Dimethyl 2,5-thiophenedicarboxylate, Dimethyl 2,51-Methyl-5-fluorouracil, and 1,3,5,7-Tetroxane. This indicates that adding dried plant extracts to ice cream, led to improved composition and physicochemical, biological, and sensory properties.

Keywords: DPPH, Ferrous ion, GC-MS, pH, Titratable acidity.

I. Introduction

Fresh fruits contain biological compounds, such as antioxidants called flavonoids and carotenoids, that shield the body from the harmful effects of free radicals, which can cause chronic illnesses and early aging (Yulianto et al., 2024). Dried fruits are filled with essential vitamins, minerals, fiber and antioxidants that support general health and improve physical function (Murawska et al., 2023). Innovative drying techniques have been introduced to quickly address fruit problems and create nutritious products that are long and durable. These methods focus on extracting water and concentrating it on essential nutrients (Salvadóetal., 2020). An important feature of dried fruits is its high nutritional content. They are many vitamins, minerals, carbohydrates, fiber and antioxidants (Alasalvar et al., 2020). The fibers found in dried fruits can support digestion by improving intestinal movement and reducing the risk of constipation (Stojanovska et al., 2023). According to Zhang et al. (2023), dried fruits are loaded with beneficial vitamins such as retinol and ascorbic acid, along with minerals such as potassium, magnesium and iron that promote all heart, bone and eye health and strengthen the immune system.

According to Debib and Menadi (2023), dry figs play an important role in improving bone and dental health, regulating blood pressure, and promoting metabolism. Furthermore, the fibers determined in these figures. 1 and 2 help to relieve constipation and symptoms of irritable bowel syndrome and treat digestion by improving overall colon health (Gençdağetal., 2021). Furthermore, the presence of flavonoids and phenolic compounds in dried fruits helps to combat free radicals and reduces oxidative damage to cells (Sandhu et al., 2023). According to Samaras et al. (2019) represent

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that dried figures 9%, 12%, 0.5% or it's 3%. In other respects, ice cream is one of the most popular dairy products in the world. It consists of ingredients such as milk, sugar, emulsifiers, stabilizers, color agents, flavors, ice crystals, fats, and airbags (Alizadeh et al., 201). Not only is ice filled with natural ingredients, it also offers biological, physiological and sensory benefits, including antioxidant properties that help protect the body from chronic dissatisfaction (Kamel et al., 2023).

Recent research focuses on improving the biological, conservation, physical and microbiological properties of ice by keeping it (Gatidou et al., 2019). This process contains nutritious plant ingredients such as dried fruit, and some fats and sugar are replaced by recipes (Legassa, 2020). Dried fig or fig puree is an example of an additional vegetable that improves sensory experience, nutritional benefits, and overall ice quality, while also expanding its durability (Aylan et al., 2021). Figure-pure is a healthy choice packed with fiber, vitamins and minerals, which greatly contributes to the fixed content of ice cream. Furthermore, it effectively functions as a natural sweetener, emulsifier, and adhesive (Hasan et al., 2020).

The health benefits of dried fig puree include promoting digestion, while simultaneously conveying a distinctive taste and taste (Aylan et al., 2021). This study strives to reduce trust in chemical additives and artificial substances, particularly in accordance with current trends in the milk industry, to maintain a clean and sustainable environment while simultaneously providing healthy food options for consumers. The aim is to fish for fats, carbohydrates, emulsifiers and thickeners, develop nutritious, sustainable ice cream, thereby supporting further development of this sector.

II. Materials and Methods

Preparation of Dried Fig Puree

We bought dried figs from a nearby market in the Basra region of Iraq. After cleaning the figs, they were soaked in water for 12 hours and then stored in the fridge at 5 °C until we were ready to test them. A German Silver Crest blender was used to grind them (Andreu et al., 2024).

Estimation of the Free Radical Scavenging Capacity of Dried Fig Puree

As stated by Imdakim et al. (2012), the capacity of dried fig puree to scavenge free radicals was evaluated using the 0.1 mM DPPH free radical scavenging method. The extracts were prepared in distilled water with 95% methanol at concentrations of 0, 5, 10, and 15 mg/ml. A standard sample was prepared by mixing 2 ml of distilled water with 2 ml of DPPH as a control sample. Ascorbic acid was used at a 5 mg/ml. Absorbance was measured after 30 minutes in the dark. At laboratory temperature at a of 517 nm, the DPPH radical capture capacity was estimated based on the equation:

$$DPPH\ radical\ capture\ \% = \frac{\text{Absorbance of control sample} - \text{Absorbance of the sample}}{\text{Absorbance of control sample}} \times 100$$

Determination of Active Compounds in Dried Fig Puree Using GC-MS

Active compounds and active ingredients of aqueous and alcoholic dried fig extract were found. Gas chromatography–mass spectrometry (GC-MS), using an Agilent technology 7890B GC system, coupled with an Agilent technology 5977A MSD, with an EI signal detector, using a HP-5MS column containing 5% phenyl and 95% methyl siloxane. Split injection at a ratio of 1:30 at a pressure of 57.4 kPa and a temperature of 40°C for 5 minutes. Elevated to 300°C for 20 minutes at a 1 mL/min helium flow rate , and a volume of 1 microliter. Mass spectrometry was used at 230°C and a mass range of 44–750 m/z. Data were processed through NIST 2014 to confirm the identities of the compounds, according to Dawra et al. (2023) method.

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Production of Dried Fig Purée-Enriched Ice Cream

Ice cream was prepared with some modifications based on the method used by Tarakçı & Durak (2020) with some modifications. The ice cream ingredients were mixed according to the proportions listed in Table (1). The mixture of ice cream was pasteurized at 75-80°C for 10-12 minutes. The mixture was pasteurized and then aged at 4°C for 12 hours. Ice cream was enriched with dried fig puree at four substitution ratios: T0, T1, T2, and T3. It was produced using a meal-serve ice cream machine (II Gelataio ICK5000, Delonghi, Italy). The ice cream was stored at -20°C after being packaged. Physical and sensory tests were performed after 0, 3, 7, and 10 days (Görgüç et al., 2021).

Table (1) Ingredients of ice cream mixture using different substitution ratios of dried fig puree.

Treatments	%Milk	Fig puree%	Sugar%	Stabilizer%	Emulsion%
T0	98.5	0	0.5	0.5	0.5
T1	97.5	1	0.5	0.5	0.5
T2	95.5	3	0.5	0.5	0.5
T3	93.5	6	0.5	0.5	0.5

Estimating the Physical Properties of Ice Cream

Estimating pH and Titratable acidity

The pH and Titratable acidity of ice cream was determined using a German pH meter (Sartorius A.O.A.C., 2008). Titrification was performed using 0.1 N NaOH with phenolphthalein as an indicator (Zhang, 2015).

Estimating Spread ability

Fiol et al. (2017) method was followed by filling ice cream into a plastic cup. It was frozen for 3 hours, and a 2 x 2 cm piece was taken. It was placed on a 30 cm metal ruler. 100 gm weight was placed on top of the piece. The spread area was measured in millimeters every two minutes, this process lasted between 2 and 10 minutes at 22°C.

Melting Rate Estimation

The melting rate was estimated using a 25 gm sample of ice cream. It was fixed to a metal fastener (sieve) placed over a funnel and a beaker, then, the funnel, the beaker, and the sample were weighed together using a sensitive balance, and the weights of the funnel and beaker were subtracted, for different time periods: 10, 20, 30, 40, and 50 minutes, in an incubator at 22°C (Fiol et al., 2017).

Sensory Evaluation

Ice cream enriched with dried fig puree extract was evaluated by 10 expert evaluators, in the University of Basrah, College of Agriculture, Department of Food Sciences. The test included evaluations of taste, aroma, and overall acceptability (Noviatri et al., 2020).

Statistical Analysis

Data were analyzed statistically using CRD. ANOVA and LSD tests were used to calculate significant differences between the means of the coefficients at a probability level of 0.05 using Genstat version 12.1.

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III. Results and Discussion

Free Radical Scavenging of Dried Fig Puree

Figure (1) shows the ability of dried fig puree samples to DPPH radical scavenging capacity at 0, 5, 10, and 15 mg/ml, and compare it with 5 mg/ml ascorbic acid. The statistical analysis showed significant differences P≤0.05 in the DPPH radical scavenging capacity of the extracts compared to ascorbic acid. The concentration rose ,the extracts' solubility rose as well of dried fig puree and decreased with increasing concentration, compared to ascorbic acid at 0, 5, 10, and 15 mg/ml, the solubility was 4.45, 26.36, 31.49, and 42.51, respectively, compared to ascorbic acid, the solubility of the DPPH radical was 85.97. The reason dried fig extract possesses DPPH radical scavenging activity is because its high concentration of phenolic compounds, including chlorogenic acid, gallic acid, and epicatechin, as well as many other biologically active compounds (Thomaidis et al., 2019). A spectrophotometer was used to measure the absorbance at 500-700 nm, which changes when free radicals gain electrons from antioxidants, resulting in a color change from purple to yellow (Stasinakis et al., 2019). Dried figs are characterized by their content of many compounds that are effective against free radicals, which play important roles in combating diseases, by reducing oxidative stress and scavenging free radicals (Edirisinghe et al., 2023).

*Different letters indicate the presence of significant differences, and similar letters indicate no significant differences between the treatments at the level of probability (P<0.05).

Figure (1) The ability of dried fig puree to absorb the free DPPH radical

Determination of Active Compounds in Dried Fig Puree Using GC-MS

GC-MS was used to identify the active compounds in the alcoholic and aqueous extracts of dried fig puree. Different functional and sensory properties resulted from the observation of several alcohols, phenols, organic acids, fatty acids, ketones, colorants, and sugars were also detected.

Table (2) and Figure (2) indicate the active compounds in the aqueous dried fig puree extract, their retention time (RT), and area %. It was observed that the compounds with the highest area concentrations were 4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-, 8-(2-Phenylethyl)-1-oxa-3,8-diazaspiro[4,5]decan-2-one, and methane-diethoxy, with concentrations of 10.172, 16.119, and 26.3148%, respectively.

The results of Table (3) and Figure (3) show that the compounds' highest concentrations were Dimethyl 2,5-thiophenedicarboxylate, Dimethyl 2,51-Methyl-5-fluorouracil, and 1,3,5,7-Tetroxane, with concentrations of 6.931, 11.002, and 11.0542%, respectively.

The biologically active compounds in dried figs have antioxidant activity. Phenolic compounds are reducing agents, which have the ability to scavenge free radicals and regulate cell division. They are rich in vitamins, minerals, and fiber, improve health, bone and teeth development, growth, metabolism, and blood pressure control (Andreou et al., 2021). Dried figs contain higher levels of polyphenols, flavonols, anthocyanins, and proanthocyanidins. They also contain biological substances with antioxidant activities used in disease prevention (Bey & Louaileche, 2015). Dried figs also contain organic acids, including succinic acid, used as an acidity regulator in the food and beverage industry. It is also a food flavoring agent (Slatnar et al., 2021).

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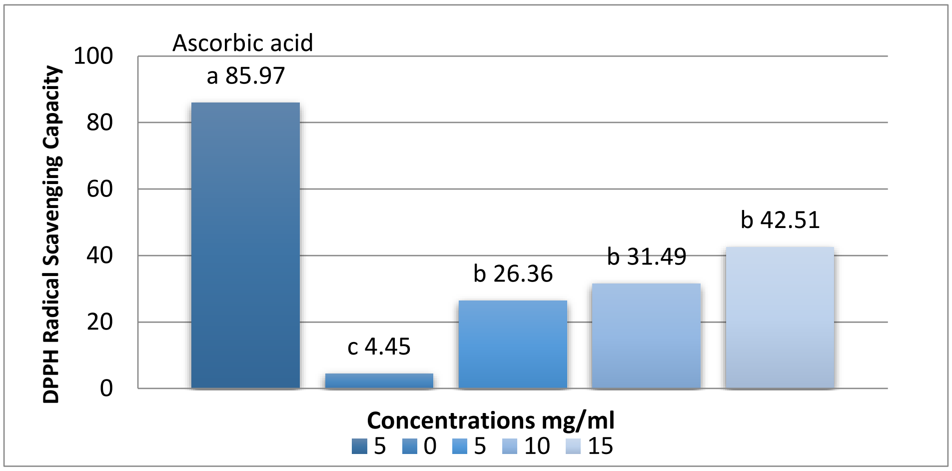

Table (2) Active compounds in the aqueous extract of dried fig puree

RT	Name	Area%
6.12	Propanoic acid, butyl ester	0.50
6.82	3-Furaldehyde	0.47
7.42	Methylenecyclopropanecarboxylic acid	0.34
7.99	Thiophene, tetrahydro-2-methyl-	1.13
9.62	2-Furancarboxaldehyde, 5-methyl-	0.38
9.94	2,4-Dihydroxy-2,5-dimethyl-3(2H)-furan-3-one	0.28
10.29	2H-Pyran-2,6(3H)-dione	0.57
10.97	(S)-(+)-2-Amino-3-methyl-1-butanol	0.49
11.23	Methanol, TBDMS derivative	1.63
11.29	3,3-Dimethoxy-2-butanone	3.06
11.87	Methane, diethoxy-	26.31
11.91	2-Furancarboxylic acid, hydrazide	0.40
12.06	2,4,5-Trihydroxypyrimidine	0.27
12.26	1-Propanol, 2-(2-hydroxypropoxy)-	3.63
13.27	Methyl 2-[methoxy(methyl)amino]-2-methylpropanoate	0.56
13.41	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-	10.17
13.89	4H-Pyran-4-one, 3,5-dihydroxy-2-methyl-	0.52
14.03	2H-Pyran, 3,4-dihydro-	0.78
14.14	Silicon tetrafluoride	0.50
14.33	2,4-Dithiapentane 2,2-dioxide	0.56
14.91	Disulfide, propyl 1-(propylthio)ethyl	0.39
14.97	Thiazolidine, 3-methyl-	0.44

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15.56	1,2-Benzenediol, O-(5-chlorovaleryl)-O-(2-methylbenzoyl)-	0.42
15.91	.beta.-Naphthyl myristate	1.26
16.26	Silane, ethenylethoxydimethyl-	0.32
16.84	Succinic acid, tridec-2-yn-1-yl 2-methylbutyl ester	0.30
18.01	Succinic acid, but-3-yn-2-yl propyl ester	0.45
18.09	1,3-propanediol, 1,3-dimethoxy-, diacetate	0.73
18.44	Octanoic acid, 2-methyl-	0.60
20.01	.beta.-l-Arabinopyranoside, methyl	0.34
20.38	Bis(4-methylcyclohexyl) ethylphosphonate	5.08
20.41	2-Acetyl-5-methylthiophene	5.28
20.42	8-(2-Phenylethyl)-1-oxa-3,8-diazaspiro[4.5]decan-2-one	16.11
21.84	3-Cyano-5,5-dimethoxycarbonyl-N-methylisoxazolidine	0.26
22.75	n-Hexadecanoic acid	0.95

Figure (2) Chromatogram of aqueous dried fig puree extract

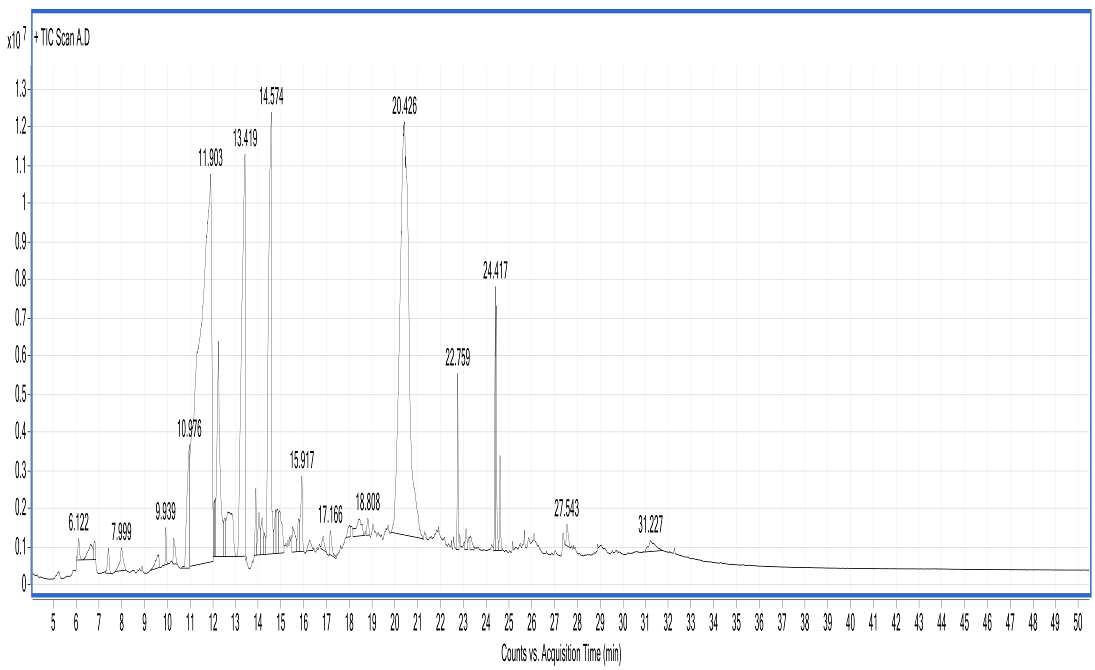

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Table (3) Active compounds in alcoholic dried fig puree extract

RT	Name	Area%
4.96	1H-Pyrazole, 4,5-dihydro-3-methyl-1-propyl-	0.20
6.23	1,3-Propanediol, 2-methyl-, dipropanoate	6.09
6.52	3-Furaldehyde	2.13
6.86	Vinyl trans-cinnamate	0.34
7.40	Methylenecyclopropanecarboxylic acid	0.25
8.02	Thiophene, tetrahydro-2-methyl-	2.04
8.57	Thiophane, propyl-	0.40
8.68	2(5H)-Furanone	0.15
8.82	Cyclobutane, 1,2:3,4-di-O-ethylboranediyl-	0.20
8.97	6-pentylpiperidin-2-one	1.67
9.38	Ethyne, chloro-	0.26
9.58	2-Furancarboxaldehyde, 5-methyl-	0.67
9.92	2,4-Dihydroxy-2,5-dimethyl-3(2H)-furan-3-one	0.72
10.18	Methyl(methyl-4-deoxy.beta.l-threo-hex-4-enopyranosid)uronate	0.20
10.32	2H-Pyran-2,6(3H)-dione	1.66
10.36	1,3-Dioxolane, 2-(2,4-dimethylphenyl)-2,4,5-trimethyl-, (2.alpha.,4.alpha.,5.beta.)-	0.18
10.67	2-Propenal	0.15
10.74	Aminomaleimide	0.26
11.02	Silane, (2-methoxyethyl)trimethyl-	1.29
11.07	Benzeneacetaldehyde	0.49
11.25	Valproic Acid	0.50
11.45	1-Butanol, 3-methoxy-	2.52
11.67	2,4,5-Trihydroxypyrimidine	0.31
11.76	2-Methylvaleric acid, 4-methoxyphenyl ester	0.13
11.87	2-Furancarboxylic acid, hydrazide	1.05
11.98	1-Propanol, 2-(2-hydroxypropoxy)-	0.29
12.11	Thymine	0.17
12.19	1,3-Cyclohexanedione, 2-methyl-	0.35
12.38	d-Proline, N-methoxycarbonyl-, heptyl ester	0.60
12.62	Cyclohexane, ethoxy-	0.13
12.75	1,3,5,7-Tetroxane	11.05
12.95	Methyl 2-[methoxy(methyl)amino]-2-methylpropanoate	0.45

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13.11	1-Methyl-5-fluorouracil	11.00
13.65	2(5H)-Furanone	1.17
13.70	4H-Pyran-4-one, 3,5-dihydroxy-2-methyl-	1.27

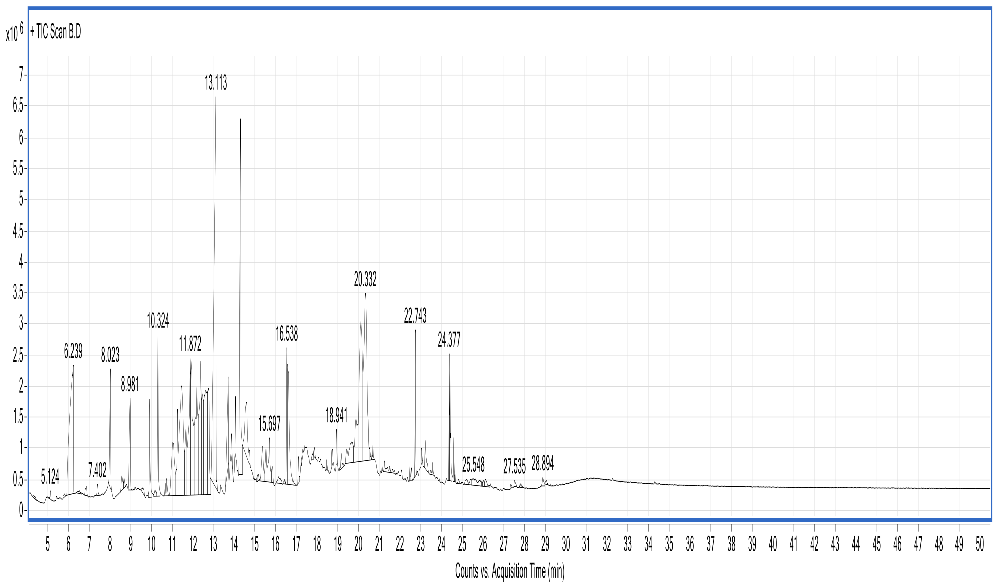

Figure (3) Active chromatogram of alcoholic dried fig puree extract

Estimation of Physical Properties of Ice Cream

pH and Titratable acidity

Figure (4) shows the pH values of ice cream enriched with dried fig puree at concentrations of 0, 5, 10, and 15 mg ml, for treatments T0, T1, T2, and T3, respectively, and for storage periods of 0, 3, 7, and 10 days. The results showed that pH was inversely proportional to pH. pH decreased and pH increased with increasing concentration and longer storage periods. At the probability level, the statistical analysis's findings revealed no discernible variations of P<0.05 in pH depending on the concentration of the treatments. pH decreased with increasing concentration, with values for treatment T0 reaching 6.33, 6.29, 6.26, and 6.2, respectively, while values for treatment T1 reached 5.71, 5.65, 5.57, and 5.45. Values decreased with increasing concentration, with treatment T3 recording 5.61, 5.19, 5.11, and 5.06 for storage periods of 0, 3, 7, and 10 days.

The reason for the decrease in pH value, with increasing concentration and storage periods is the acidic nature of dried figs, which may persist during storage. In addition, the slow oxidation reactions of natural sugars. It contains some mineral salts, such as potassium and calcium, which have a basic effect, which neutralize some of the organic acids, leading to a decrease in pH (Shamshad et al., 2023). Minor microbial and enzymatic activity, due to the growth of

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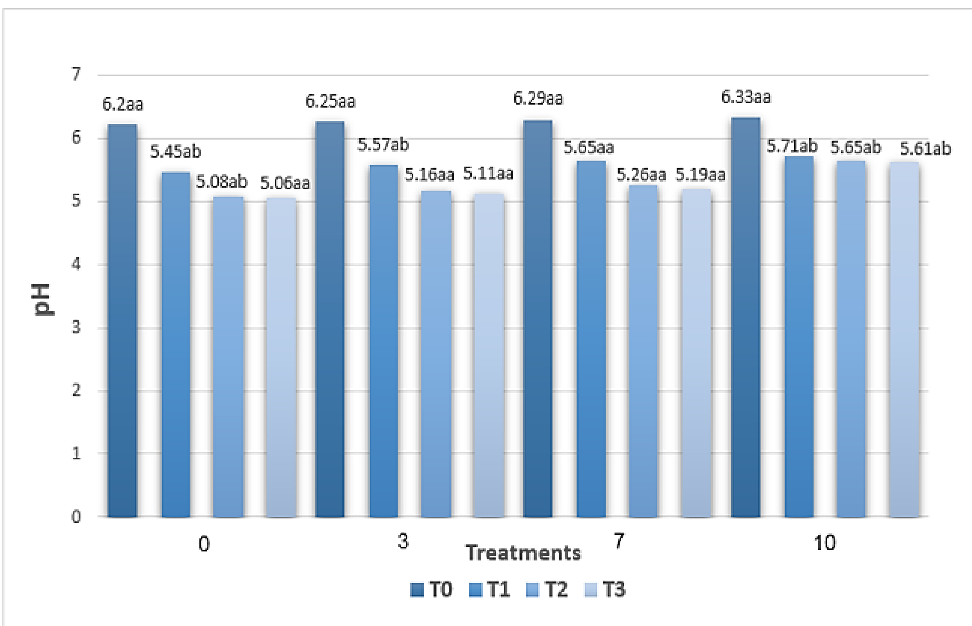
bacteria or microorganisms, reduces pH and increases acidity. Fermented storage of sugars produces organic acids, such as lactic acid (Butt et al., 2023).

Figure (5) shows the acidity profile of ice cream enriched with dried fig puree at 0, 5, 10, and 15 mg/ml for treatments T0, T1, T2, and T3, respectively, for storage periods of 0, 3, 7, and 10 days. The statistical analysis's findings of the titratable acidity indicated that there were no discernible variations of P≤0.05. A rise in acidity occurred with increasing concentration. The values for treatment T0 were 0.14, 0.16, 0.18, and 0.21, respectively, while the values for treatment T1 were 0.13, 0.15, 0.19, and 0.22. The values increased with increasing concentration. T3 recorded 0.15, 0.18, 0.23, and 0.27, for storage periods of 0, 3, 7, and 10 days.

The increase in pH, with increasing concentration, during storage is due to the figs' content of organic acids, such as malic and citric acid, resulting from the fermentation of sugars and enzyme activity (Çakmakçı et al., 2016). The reason for the high acidity of dried figs is attributed to the ability of fermenting microorganisms, such as lactic acid bacteria to decompose sugars, including pectin, and produce bioactive organic acids (Topdaş et al., 2016).

*Different letters In columns indicate the presence of significant differences, and similar letters indicate no significant differences between the treatments at the level of probability (P<0.05).

Figure (4) pH value of ice cream enriched with dried fig puree



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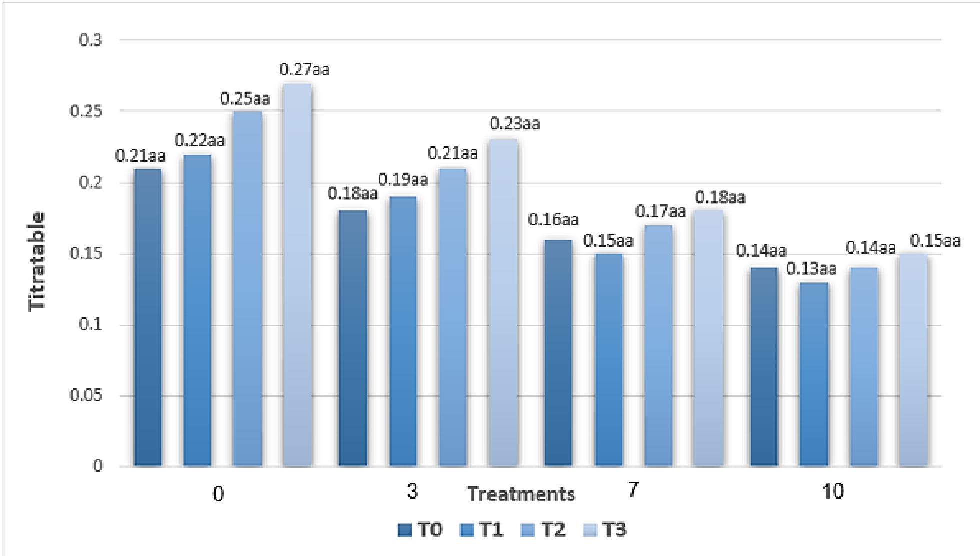

*Different letters In columns indicate the presence of significant differences, and similar letters indicate no significant differences between the treatments at the level of probability (P<0.05).

Figure (5) Titratable acidity value of ice cream enriched with dried fig puree

Spread ability Estimation

Table (4) shows the spread ability values of ice cream enriched with dried fig puree, measured in milliliters, at 0, 5, 10, and 15 mg/ml for treatments T0, T1, T2, and T3, respectively, for storage periods of 0, 3, 7, and 10 days, significant differences were shown by the statistical analysis's results P≤0.05, between concentrations and no differences between storage periods. Diffusion capacity decreased with increasing concentration. The values for treatment T0 were 15.25, 15.21, 15.16, and 15.11 mm, respectively, while the values for treatment T1 were 13.12, 13.17, 13.19, and 13.23 mm. They decreased significantly with decreasing concentration. T3 recorded values of 5.61, 5.19, 5.11, and 5.06 mm for storage periods of 0, 3, 7, and 10 days.

The decrease in density with increasing concentration is due to the interaction between insoluble components, such as cellulose, which leads to increased density and viscosity, thus decreasing spread ability (Gabbi et al., 2018). In addition, increasing concentration increases the proportion of non-fat solids in ice cream, such as natural sugars, pectin, and minerals, which results in a denser, firmer texture. The ability to spread decreases (Bajwa et al., 2018). The increase in spread ability during storage is due to the degradation of sugars, especially pectin and soluble fiber, by enzymes produced by microorganisms present in dried figs (Sipple et al., 2022).

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Table (4) Spread ability values of ice cream enriched with dried fig puree

	Treatments	Day1mm	Day3mm	Day7mm	Day10mm
Spread ability	T0	15.11^{aa}	15.16^{aa}	15.21^{aa}	15.25^{aa}
	T1	13.12^{ba}	13.17^{ba}	13.19^{ba}	13.23^{ba}
	T2	12.14^{ba}	12.18^{ba}	12.24^{ba}	12.28^{ba}
	T3	11.16^{ba}	11.17^{ba}	11.23^{ba}	11.26^{ba}

*Different letters In columns indicate the presence of significant differences, and similar letters indicate no significant differences between the treatments at the level of probability (P<0.05).

Melting rate

Table (4) shows the melting rate percentage of ice cream enriched with dried fig puree, at 0, 5, 10, and 15 mg/ml, for treatments T0, T1, T2, and T3, respectively, and for storage periods of 0, 3, 7, and 10 days. Significant differences were shown by the statistical analysis's results P≤0.05. There were no differences between concentrations and storage. Melting rate decreased with increasing concentration. The values for treatment T0 were 35.25, 35.29, 35.36, and 35.41%, respectively, while the values for treatment T1 were 31.12, 31.14, 31.22, and 31.27%. They decreased sharply with decreasing concentration. T3 recorded values of 26.17, 26.23, 26.28, and 26.32% for storage periods of 0, 3, 7, and 10 days.

The decrease with increasing concentration is attributed to the increased amount of sugars, act as solvents for ice, lowers the melting point of ice cream, and increases the melting rate. The relative fat content in the mixture decreases, due to the replacement of some of the basic ice cream ingredients (Danesi, 2022). Physical changes, that occur due to increased concentration, such as increased fiber, viscosity, and high density create an internal gelatinous network, which prevents the flow of liquid water during melting and stabilizes the water, thus reducing the melting rate (Goraya et al., 2018). The increased melting rate during storage periods, due to the increased amount of sugars such as fructose and glucose, as well as the increased percentage of solids, leads to emulsion stability (Racette et al., 2022).

Table (5)

	Treatments	Day1%	Day3%	Day7%	Day10%
Meltdown	T0	35.25^{aa}	35.29^{aa}	35.36^{aa}	35.41^{aa}
	T1	31.12^{aa}	31.14^{aa}	31.22^{aa}	31.27^{aa}
	T2	28.15^{aa}	28.19^{aa}	28.24^{aa}	28.29^{aa}
	T3	26.17^{aa}	26.23^{aa}	26.28^{aa}	26.32^{aa}

Meltability values of ice cream enriched with dried fig puree

*Different letters In columns indicate the presence of significant differences, and similar letters indicate no significant differences between the treatments at the level of probability (P<0.05).

Sensory Assessment

Table (6) shows the results of the sensory evaluation of the taste of ice cream enriched with dried fig puree, at concentrations of 0, 5, 10, and 15 mg ml, for treatments T0, T1, T2, and T3, respectively, for storage periods of 0, 3, 7, and 10 days. No significant differences were found in the statistical analysis of taste P≤0.05, between concentrations, but there were significant differences between storage periods. A decrease in flavor was observed with changes in

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concentration and over storage periods. The values for treatment T0 were 15.29, 15.27, 14.34, and 14.28, respectively, while the values for treatment T1 were 19.39, 18.36, 18.24, and 17.12. These values decreased with decreasing concentration, with treatment T3 recording 16.18, 14.15, 14.06, and 13.02 for storage periods of 0, 3, 7, and 10 days.

The reason for the change in taste with increasing concentration and prolonged storage periods is attributed to increased sweetness, or the appearance of an undesirable fermented taste, and the color of the ice cream turning dark brown. The appearance of unpleasant side flavors, which negatively affects the product (Sacchi et al., 2019). Oxidation reactions occur, which affect the taste quality, especially if the product is not stored under ideal conditions, or some aromatic compounds decompose, leading to a decrease in the quality of the sensory evaluation (Caporaso et al., 2019).

Table (7) shows the results of the sensory assessment of aroma in ice cream enriched with dried fig puree, at 0, 5, 10, and 15 mg/ml, for treatments T0, T1, T2, and T3, respectively, and for storage periods of 0, 3, 7, and 10 days. Significant differences were shown by the statistical analysis of odor P≤0.05 among concentrations. There were no significant differences across storage periods. The results showed a decrease in values with increasing concentration. The decrease occurred across storage periods, with values for treatment T0 reaching 17.25, 17.21, 16.18, and 16.15, respectively, while values for treatment T1 reached 18.35, 18.29, 17.31, and 17.25. These values decreased significantly with decreasing concentration. T3 recorded values of 13.18, 12.13, 16.07, and 15.04 for storage periods of 0, 3, 7, and 10 days.

The presence of volatile compounds in dried figs, such as aldehydes, ketones, and furfural, which give off an unpleasant fruity odor at higher concentrations, is also associated with the appearance of unnatural odors resulting from chemical reactions between fig components and proteins or fats in ice cream (Sikdar et al., 2020). Interactions between fig components, such as carbohydrates and amino acids, and ice cream can lead to a change in odor over time (Nath et al., 2020).

Table (8) shows the results of the sensory assessment of the overall acceptability of ice cream enriched with dried fig puree, at concentrations of 0, 5, 10, and 15 mg ml, for treatments T0, T1, T2, and T3, respectively, and for storage periods of 0, 3, 7, and 10 days. The results of the statistical analysis of the overall acceptability trait also indicated notable variation P≤0.05 among across concentrations, but no differences across storage periods. As concentration increased and storage duration increased, while the readings dropped. 18.25, 18.22, 17.27, and 17.19 were the values for treatment T0, whereas 19.35, 19.31, 18.28, and 17.33 were the values for treatment T1. As the concentration dropped, these values drastically dropped. Treatment T3 recorded values of 12.26, 11.34, 11.18, and 11.09 for storage periods of 0, 3, 7, and 10 days.

Small dried fig seeds change their creamy flavor. This also affects how they look and darkens them (Scodereelli et al., 2019). If ice is kept for a long time, the fat can crystallize, affect its texture, reduce creaminess, create a strange aftertaste, and reduce its freshness (Bandyopadhyay et al., 2020).

Table (6) Sensory Evaluation of Ice Cream Fortified with Dried Fig Puree (Taste).

	Treatments	**Day1**	**Day3**	**Day7**	**Day10**
Taste	**T0**	15.29^{aa}	15.27^{ab}	14.34^{ac}	14.28^{ab}
	T1	19.39^{aa}	18.36^{aa}	18.24^{aa}	17.12^{aa}
	T2	18.17^{aa}	16.12^{ab}	16.07^{ab}	15.04^{ab}
	T3	16.18^{aa}	14.15^{ab}	14.06^{ac}	13.02^{ab}

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*Different letters In columns indicate the presence of significant differences, and similar letters indicate no significant differences between the treatments at the level of probability (P<0.05).

Table (7)

	Treatments	Day1	Day3	Day7	Day10
Aroma	**T0**	17.25aa	17.21aa	16.18aa	16.15aa
	T1	18.35aa	18.29aa	17.31aa	17.25aa
	T2	16.27aa	15.24ab	15.17aa	15.12aa
	T3	13.18ab	12.13ac	12.06ab	12.01ab

Sensory Evaluation of Ice Cream Fortified with Dried Fig Puree (Aroma).

*Different letters In columns indicate the presence of significant differences, and similar letters indicate no significant differences between the treatments at the level of probability (P<0.05).

Table (8) Sensory Evaluation of Ice Cream Fortified with Dried Fig Puree (General Acceptance).

	Treatments	Day1	Day3	Day7	Day10
General Acceptance	**T0**	18.25aa	18.22aa	17.27aa	17.19aa
	T1	19.35aa	19.31aa	18.28aa	17.33aa
	T2	16.37ab	15.32ab	14.25ab	14.17ab
	T3	12.26ac	11.34ac	11.18ac	11.09ac

*Different letters In columns indicate the presence of significant differences, and similar letters indicate no significant differences between the treatments at the level of probability (P<0.05).

IV. Conclusion

Dried figs contain many essential nutrients, including vitamins, fiber and minerals, which actively contribute to health and support physical function. This test showed that dried fig puree serves a great source of favorable connections that improve health and provide benefits such as durability, antioxidant properties and antibacterial effects. This indicates that it can be used in the production of a variety of dishes, including ice cream. By adding dried fig puree, the ice cream's diet profile can be improved along with its overall festival and sugar. Further research is essential to developing functional foods with new health benefits. This includes studying the interaction between important food ingredients and the adaptation of added nutrients. Such studies are important because there is a possibility of

V. References

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