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Assessing the Effectiveness of Adding Various Plant Extracts in Extending the Shelf - Life of Soft Cheese

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Abstract

The study aimed to prepare various plant extracts and estimate their effectiveness in improving certain chemical properties and prolonging the shelf life of soft cheese during a storage period of 14 days at a temperature ranging from 5-7°C. Three treatments (T1, T2, T3) were implemented by adding 5% volume/volume of oil extracts (fenugreek, cinnamon, black seed) respectively to the milk used in the enzymatic preparation of soft cheese, in addition to the control treatment (without addition).

The results showed the effectiveness of adding oil extracts in supporting the quality of soft cheese stored under refrigeration, which contributed to reducing the logarithmic growth in the number of bacteria types. The control treatment samples recorded a significant increase in the total number of bacteria (total bacteria, coliform bacteria, lactic acid bacteria, psychrophilic bacteria, and fungi) compared to the samples from T1, T2, and T3 during the storage period. The T3 treatment samples obtained the best results, as they recorded the lowest increase in the total number of bacterial types under study.

Additionally, the results indicated the role of plant extracts in maintaining the quality characteristics of soft cheese during the storage period. The control treatment samples exhibited the lowest results compared to the other treatments, recording a significant decrease in the percentage of moisture, which reached 60.07%, while the T1 sample achieved the best results with a moisture content of 61.43%. The control sample also showed a significant increase in the percentage of total acidity, which reached 0.91%, while the T3 sample recorded an acidity percentage of 0.51%. There were no notable differences in the protein percentage at the end of all treatments.

Keyword: Shelf life, Fenugreek, Cinnamon, Black seed, Plant extracts.

I. Introduction

Enhancing the quality of foods by adding natural plant components that increase the nutritional value or serve as vital enhancers has become a requirement for many consumers today. Certain plants are characterized by containing effective compounds and secondary metabolites that can improve the nutritional value, qualitative characteristics, and storage longevity of many foods (Ugo et al., 2021).

Food enhancement industries such as dairy products frequently add plant-derived oily extracts because of their beneficial nutritional content. The compositions found in these extracts deliver chemical compounds and secondary metabolites that deliver functional nutrients and medicinal benefits to consumer health while also acting as agents for preventing food degradation. (Dagdelen et al., 2015).

Black seed contains many active compounds such as thymoquinone, nigellimine, and nigellidine, along with essential fats, which exhibit antibacterial, antioxidant, anti-inflammatory, antifungal, and other therapeutic properties (Munawar et al., 2024). Cinnamon oil also contains chemical compounds such as

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cinnamic acid, cinnamyl acetate, cinnamaldehyde, and eugenol, which possess effective biological properties as antioxidants and antibacterial agents, in addition to antifungal and therapeutic effects (Peter et al., 2018). The medical application of Fenugreek exists due to its natural antioxidant benefits which help protect against multiple harmful bacteria. (Zgham et al., 2024).

White cheese dominates dairy markets across the Middle East especially in Iraq because its nutritional composition features large amounts of protein as well as lactose and fat. You can prepare and store it easily so it serves well as food (Z. Miloradovic et al., 2018). Soft white cheese lets many types of bacteria and fungi grow easily because it contains different nutrients and stays moist. The medium pH level in this food increases the risk of contamination that speeds up spoilage according to Fobiola and team (2017). To solve the storage problem we need to both protect the cheese from microbes and extend its shelf life. Our team discovered that plant extracts improve cheese because their natural biological traits boost nutrition and maintain cheese quality during all handling phases (Roghieh et al., 2022).

I. . Materials and Methods

2.1 Preparation of Extracts

From markets in Kut near Baghdad we bought one kilogram each of black seed, fenugreek seeds, and cinnamon and processed them first with distilled water and then an electric mixer. After following Ishraf et al. (2024) guidelines we prepared oil extracts of black seed, fenugreek and cinnamon through the Soxhlet extraction procedure with basic changes. Specifically, 100 g of the extraction powder was taken separately and placed in the extraction device (Soxhlet), to which 600 mL of hexane was added. The device was operated for 5 hours at 65-70°C. The extraction mixture was then filtered using Whatman filter paper No. 1. The filtrate was transferred to a rotary evaporator to remove the hexane. Finally, the oily extracts were collected and stored in separate plastic containers in the refrigerator until use.

2.2 Preparation of Soft Cheese Samples

Fresh cow's milk was obtained from the farms of the Tigris pastures (south of the city of Kut). The soft cheese curd was prepared using an enzymatic method according to Mahmuod et al. (2012) with some simple modifications. The milk achieved a temperature of 70°C for two minutes before reaching 40°C right away. Three sets of milk batches T1 T2 and T3 got 10 liters each during distribution. The study used 10 liters for each of the three test milk batches and poured 5% oil extract from fenugreek, cinnamon and black seed while T0 received no extract following Atif et al. (2020) protocol. Five hundred milligrams of rennet entered every liter of milk. The samples stayed refrigerated between 5-7°C for two weeks and experienced temperature testing weekly with three identical tests done for each treatment.

3.2 Microbial Assays

The study measured microbial levels by mixing 10 g of soft cheese with 90 mL of sterile peptone water and blending it with an electric mixer. The research group prepared six dilutions by transferring 1 mL from the soft cheese mixture into 9 mL of peptone water following Laid et al. methodology from 2004.

Research staff counted soft cheese microbes through the pour plate procedure. To measure total bacteria the research team poured nutrient agar plates and put them into a 32°C incubator for two days based on Houghtby et al. (1992) guidelines. According to De Man et al. (1960) samples were tested for lactic acid bacteria with M.R.S agar and incubated at 32°C for 48 hours. Scientists counted psychrophilic bacteria by preparing nutrient agar and letting it develop. Following Houghtby et al. (1992) methods we placed plates in 10°C conditions for two days. They used PDA to count yeast and mold colonies by placing samples at 25°C for 5 days of growth (Marshall, 1992).

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4.2 Chemical Tests:

We followed AOAC (2007) standards to measure fat, protein, moisture and total acidity in each treatment and the control. The team placed 2 grams of cheese in aluminum dishes for moisture evaluation before heating them at 130°C until weight remained stable. To measure total acidity researchers mixed 10 g of cheese with 100 mL distilled water before filtering the solution through Whatman filter paper No. 1 using an electric mixer. We added two phenolphthalein drops to 25 mL of our filter solution for titration using 0.1 M NaOH. To measure the fat content we performed Soxhlet extraction and to find protein levels we performed the Kjeldahl analysis on the samples.

5.2 Sensory Evaluation:

Two dozen students and instructors from Wasit University's Agriculture Faculty assessed the sensory qualities of cheese samples. The evaluators used a nine-level scale to rate the samples with score 1 meaning very poor quality and score 9 meaning very good quality. Our research team gave each sample a random number while testing their flavor quality plus texture consistency alongside color and consumer acceptance ratings using Huda et al. (2014) standards.

3.5 Statistical Analysis:
We processed our findings in SPSS software. The research team used ANOVA testing to investigate significant variation between mean values. The researchers performed Duncan's test after their initial analysis. Our study results are presented as mean value plus or minus standard deviation.

4.2 Chemical Tests:

AOAC 2007 protocols served as the standard method for testing protein, fat, moisture and acidity levels in all sample groups. We placed 2 g of cheese into aluminum dishes and heated them at 130°C until they reached stable weight to measure moisture content. The total acidity in 10 grams of cheese samples was measured after blending the cheese with 100 milliliters of distilled water then straining the mixture through Whatman filter paper No. 1. Our team added 2 drops of phenolphthalein to 25 milliliters of filtered liquid before titrating it with 0.1 M sodium hydroxide. Our team measured fat by performing Soxhlet extractions and analyzed protein content using the Kjeldahl procedure.

5.2 Sensory Evaluation:

The Faculty of Agriculture at Wasit University Iraq used twenty faculty and student panelists to test the sensory characteristics of cheese samples. We used a nine-level assessment tool where participants rated samples from highly undesirable at level 1 to highly desirable at level 9. The research team allocated random numbers to the samples then tested their flavor tone plus textural feel color appearance and how appealing they were to eat following Huda et al. (2014) standards.

3.5 Statistical Analysis:

The researchers processed their data with SPSS. The team used ANOVA to test if the mean values showed meaningful differences. The team used Duncan's test to analyze mean differences. The research results appear as average values with their standard deviation measurements.

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Microbe	Treatment.	Total count Log (CFU)		
		Day	Day 7	Day 14
TOTAL WORD COUNT	Control	6.44 ± 0.01^{a}	7.31 ± 0.08^{a}	7.88 ± 0.02^{a}
	T1	6.33 ± 0.09^{ab}	6.45 ± 0.08^{b}	6.68 ± 0.04^{b}
	T2	6.28 ± 0.08^{b}	6.35 ± 0.04^{b}	6.33 ± 0.16^{c}
	T3	6.19 ± 0.09^{b}	6.25 ± 0.07^{bc}	6.26 ± 0.13^{c}
Coliform	Control	1.88 ± 0.04^{a}	3.02 ± 0.05^{a}	4.13 ± 0.04^{a}
	T1	1.56 ± 0.06^{b}	2.27 ± 0.06^{b}	3.83 ± 0.04^{b}
	T2	1.35 ± 0.06^{c}	2.05 ± 0.06^{c}	3.60 ± 0.03^{c}
	T3	1.37 ± 0.07^{c}	2.23 ± 0.07^{b}	3.51 ± 0.04^{d}
Lactic acid bacteria	Control	2.75 ± 0.12	3.32 ± 0.04	4.04 ± 0.03^{a}
	T1	-	-	2.09 ± 0.04^{c}
	T2	-	-	2.22 ± 0.05^{b}
	T3	-	-	2.01 ± 0.07^{d}
Psychrophili Bacteria	Control	3.10 ± 0.17	3.26 ± 0.15	4.10 ± 0.05^{a}
	T1	-	-	1.77 ± 0.06^{b}
	T2	-	-	1.66 ± 0.04^{c}
	T3	-	-	1.60 ± 0.05^{c}
Yeasts and molds	Control	1.67 ± 0.09	2.20 ± 0.03	3.70 ± 0.1^{a}
	T1	-	-	1.49 ± 0.06^{b}
	T2	-	-	1.55 ± 0.04^{b}
	T3	-	-	1.35 ± 0.05^{c}

Chemical Analysis of Soft Cheese:

Our test results in Table 2 show decreased humidity levels in all cheese samples during storage because moisture evaporated off the cheese surface when environmental humidity differed from that of the cheese. At the end of storage the control sample lost more humidity than the other treatments and reached 60.07% moisture content. T1 samples stored best with only 61.43% moisture loss followed by T2 with 61.41% and T3 with 61.19%. When researchers Sarra Mohammed and Basem Al-Abdullah (2023) tested flax oil in soft cheese storage it reduced moisture loss just as soft cheese mixed with oily extracts does.

Our results showed the control sample had a higher protein percentage of 18.66% compared to all treatment groups by the end of storage time. The protein content went up in the control sample because moisture levels fell and the remaining solids including protein rose. All treatment methods produced cheese with higher fat content than the control sample which achieved only 16.28% fat. The addition of oils from fenugreek, cinnamon, and black seed raised fat percentages in all treatment samples more than the control sample although moisture content reduced significantly in both. According to Huda and team's 2014 research soft cheese enhanced with flaxseed oil showed both higher fat content and less protein than the untreated control sample.

Regarding the total acidity percentage in the soft cheese samples under study, there was a significant increase in the control sample compared to the other treatments, recording 0.91%. This increase may result from the ability of the oily extracts from the plants used to inhibit lactic acid bacteria, which aligns with the results obtained in Table 3. The cheese samples from the T3 treatment showed a significant advantage over the other treatments, recording the lowest total acidity percentage at the end of the storage period, which was 0.51%. This finding is consistent with the results of Ali and Abd-El-Galeel (2018),

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which indicated that the addition of rice germ extracts, field pistachios, and potato peels contributed to slowing the deterioration of soft cheese samples during cold storage compared to the control (without addition).

Table 2. Chemical characterizations evaluation of white cheese under different treatments over 14 days

Chemical characters	STORAGE days	White cheese treatments			
		Control	T1	T2	T3
Moisture (%)	0	62.98± 1.1^{ab}	63.18± 0.9^{a}	63.25± 0.8^{ab}	63.03± 1.3^{ab}
	7	62.28± 0.6^{d}	62.19± 1.0^{cd}	62.11± 1.0^{d}	62.1± 1.0^{d}
	14	60.07± 0.8g	61.43± 1.0^{e}	61.19± 0.8^{f}	61.41± 1.3^{c}
Protein (%)	0	18.32± 1.0^{b}	18.14± 0.6^{a}	17.83± 1.5^{b}	17.98± 1.2^{b}
	7	18.52± 1.4^{c}	18.39± 1.0^{b}	18.16± 1.0^{b}	18.15± 0.6^{b}
	14	18.66± 0.6^{bc}	18.58± 0.6^{b}	18.92± 0.8^{b}	18.53± 0.9^{b}
FAT%	0	16.31± 0.8^{b}	16.34± 0.4^{a}	16.35± 0.8^{b}	16.32± 1.1^{b}
	7	16.18± 1.0^{bc}	16.78± 0.4^{a}	16.77± 0.6^{b}	16.91± 0.6^{b}
	14	17.28± 1.1^{bcd}	17.09± 0.6^{b}	17.12± 0.4^{cd}	17.25± 0.8^{bc}
% Acidity	0	0.33± 0.8^{b}	0.35± 0.4^{a}	0.36± 0.8^{b}	0.37± 0.8^{b}
	7	0.78± 0.9^{bcd}	0.54± 1.0^{bc}	0.61± 1.0^{bcd}	0.47± 0.8^{d}
	14	0.91± 0.7^{e}	0.66± 1.0^{bc}	0.75± 0.9^{cd}	0.51± 0.7^{e}

Sensory Evaluation

Through Table 3, we note that all soft cheese treatments, including the control sample, received a good degree of evaluation and acceptability regarding sensory values (flavor, texture, color, and overall acceptance). The results indicated a non-significant superiority of the control sample in terms of flavor, color, and general acceptance of the soft cheese samples during the storage period. However, the color of the control samples exhibited a significant superiority compared to the other treatments. This can be attributed to the presence of oily extracts in the soft cheese, which added new tastes and flavors. Conversely, there was a significant decrease in the evaluation of the texture of the soft cheese compared to the other treatments, due to the contribution of the oily extracts in improving the texture of the soft cheese.

Table 3. Sensory evaluation of white cheese under different treatments over 14 days

Sensory attribute	STORAGE days	White cheese treatments			
		Control	T1	T2	T3
Flavor	0	8.1 ± 0.9^{a}	7.2 ± 1.1^{ab}	7.2 ± 0.8^{bc}	7.1 ± 1.3^{bc}
	7	8.1 ± 1.0^{a}	6.2 ± 0.6^{cd}	7.1 ± 1.0^{bc}	6.2 ± 1.0^{d}
	14	7.1 ± 1.3^{bc}	6.3 ± 1.0^{cd}	7.1 ± 0.8^{bc}	6.5 ± 0.8^{bcd}
Mat texture	0	7.1 ± 1.0^{b}	8.1 ± 0.6^{a}	7.2 ± 1.5^{b}	7.1 ± 1.2^{b}
	7	6.1 ± 1.4^{c}	7.1 ± 1.0^{b}	7.0 ± 1.0^{b}	7.1 ± 0.6^{b}
	14	6.5 ± 0.6^{bc}	7.1 ± 0.6^{b}	7.0 ± 0.8^{b}	7.2 ± 0.9^{b}
Color	0	8.7 ± 0.4^{a}	8.1 ± 0.8^{b}	8.1 ± 0.8^{b}	8.1 ± 1.1^{b}
	7	8.7 ± 0.4^{a}	7.5 ± 1.0^{bc}	8.0 ± 0.6^{b}	8.1 ± 0.6^{b}
	14	8.1 ± 0.6^{b}	6.5 ± 1.1^{d}	7.2 ± 0.4^{cd}	7.8 ± 0.8^{bc}
	0	8.6 ± 0.4^{a}	7.7 ± 0.8^{b}	7.7 ± 0.8^{b}	7.8 ± 0.8^{b}

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Overall acceptability	7	7.7 ± 1.0^{bc}	7.2 ± 0.9^{bcd}	7.1 ± 1.0^{bcd}	7.2 ± 0.8^{d}
	14	7.7 ± 1.0^{bc}	6.1 ± 0.7^{e}	7.2 ± 0.9^{cd}	7.1 ± 0.9^{cd}

II. Conclusions:

The oily extracts of the plants (fenugreek, cinnamon, and black seed) were effective in reducing microbial growth in soft cheese, thereby slowing the deterioration of its quality during storage.

The addition of plant extracts contributed to maintaining the qualitative characteristics (moisture, protein, fat, total acidity) of soft cheese throughout the storage period.

All treatment samples demonstrated good acceptability during sensory evaluations conducted throughout the storage period.

III. References:

1) Akankasha Srivastava , Zoomi Singh ,Vandana Verma and Teshi Choedon .2020.Potential Health Benefits of Fenugreek with Multiple Pharmacological Properties. In book: Ethno pharmacological investigation of Indian Spices.(pp.137-153).Dio :1.4018/978-1-7998-2524-1.ch011
2) Ali A.A.Abd El-Galeel and Kahled M. El-Zahar .2018. Production of White Soft Cheese fortified with natural antioxidants as a functional dairy food. Zagazig journal of agricultural research .dio:10.21608/ZJAR.2018.49186
3) Amal Bakr , Yeoh Shin and Ahmad Salihin .2022. ScienceDirect. Volume 159.April 2022,113218. Dio: 10.1016/j.lwt.2022.113218
4) AOAC(2007).Association of official analytical chemistis- official method of analysis (18Ed.),Benjamin Franklin Station Washinton,DC,USA.
5) Ashfaq Hamid , Pir Mohammed ,Saghir Ahmad , RafeeyaShams, Kshirod Kumer, Ayaz Mukarram and Kovacs Bela. 2024 . Optimization of ultrasound-assisted extraction of of Nigella sativa seed oil for enhancement of yield and antioxidant activity .Discover Applied Science(2024) 6:104 .dio:10.1007/s42452-024-05714-7.
6) Dagdelen, S .2015. Volatile composition ,antioxidantand antimicrobial activities of herbal plants used in the manufacture of van herby (OTLU)cheese. Journal of food processing and preservation, V38,p.1716-1725. Oct,22,215. Dio:10.1111/jfpp.12134.
7) De Man M.C.,Rogosa M.and Sharp M.E.1960.Amedium for the cultivation of lactobacilli.J.Appl.Bacteriol.,23,130-136 . Doi:10.1080/87559129.2021.1874411
8) Fabilo dos Santos ,Amauri Rosenthal and Elisa da Rocha .2017.Plant extract and essential oils as antimicrobial to cheese :A review. Ciencia Rural journal ,V47;08,2017. doi 10.1590/0103-8478 cr 2060908
9) Gabriella Gani , Mayara Pataluch , Monica Regina ,Jane Mattha and Graton Mikecha .2019.Effect of an edible coating with essential oil to improve the quality of a fresh cheese. Acto scientiarum technology ,v.14.e 36402.2019.
10) Houghtby G.A.,Maturin L.J.and Koenig E.K.1992. Microbiological count method. in :Marshal R.T.(ed).Standard methods for the examination of dairy product(16 ed).Ameri-j.agric sci., (27),2019.
11) Huda Mahrous ,Rehab A.Mostafa, Wedad M .El-Khly.2014. Manufacturing of White Cheese-Like Product using Flaxseed oil and Skim Milk.Alex.j.fd.sci.& techol vol.11,No1,pp.61-69,2014.
12) I.V .Mironova , A.A .Nigmatyanov ,A.A. Va rivoda and M.V.Temerbaeva .2020.Soft Cheese with Flax seeds .IOP Conference series Earth and Environmental science 613(1):012084. DIO:10.1088/1755-1315/631/1/012084.

ISSN Onlin:2708-9347, ISSN Print: 2708-9339 Volume 13, Issue 2 (2024) PP 691-697

https://jam.utq.edu.iq/index.php/main *https://doi.org/10.54174/utjagr.v13i1.323*

13) Mahmoud Abd El- Aziz , Sahar H.S.Mohmed andFaten L.Seleet.2012.Production and Evaluation of Soft Cheese Fortified with Ginger Asa Functional Dairy Food.pol.j.Food Nutr. SCI., 2012,Vol. 62, No.2,pp.77-83.dio:10.2478/v10222-01-00-6-0.

14) Marshall R.T.1992. Standard Methods for the Examination of Dairy products .Am.publ.Health Assoc.(APHA),Washinton ,DC.USA.

15) Munawar Abbas, Mayank Anand, Amjad Ali, Sakeena Bajwa, Rafia Hassan,Syeda Wajiha and Mahreen Imam .2024. Antimicrobial Properties and Therapeutic Potential of Bioactive Compounds in Nigella Sativa :AReview. Molecules 2024,29(20) ,4914.Dio 10.3390/molecules29204914

16) Peter Knauth ,Zaira Loez, Gustavo Javira and Treresa Espino .2018. Cinnamon Essential Oil:Chemical Composition and Biological Activity.Nova science publisher,inc.new york.

17) Roghieh Sadat , Leila Nateghi and Jinous Asgarpanah .2023. j.fd. measr.and charac. volume 17,pages 1651-1661,(2023).

18) T.Bintsis and P.Papademas .2017.Microbiological quality of white-cheeses: a review. international journal of dairy technology 55(3) ,113-120(2017).

19) Ugo Picciotti ,Alessandro Massaro, Angelo Galiano and Francesca Garganese.2021. Cheese Fortification :Review and Posssible Improvements.Food Reviews International .2021.37(1):1-27.

20) Zargham Faisal, Rushba Irfan, Noor Akram et al .2024.The multifaceted potential of fenugreek seeds:From health benefits to food and nanotechnology application .Food sci Nutr.2024 jan 10;12(4):2294-2310.dio:10.1002/fsn.3959.