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Research Article

Improving the nutritional value, qualitative and sensory qualities of soft white cheese by adding walnut powder

[1,]Ahmed A. Hussein [2,]Ruqaea Sh Jabber [3,]Aqeel H. Atallah

[1,2,3,]Food Science Department, College of Agriculture, University of Karbala, Iraq.

Article Info
Article history:
Received 27 -12-2025
Received in revised form 16-2-2025
Accepted 10-3-2025
Available online 13 -4 -2025
Keywords : walnut powder, white cheese, Cheese texture, fat, protein

Abstract

In this study, the effect of adding powder and nuts at concentrations of (2, 4 and 6) % in soft white cheese was studied to increase the nutritional value of dairy products, during 30 days of refrigerated storage at a temperature of 6 ° C. The treatments were numbered as follows: control sample T1 and the remaining concentrations were T2, T3 and T4. The physical, chemical and sensory properties were studied, and the new product was compared with the control sample (soft white cheese). According to the results , we note adding different concentrations of walnut powder to the treatments, the percentage of fat increased significantly, as it differed from each other and from the control sample, as the concentration of walnut powder in the treatments increased, the percentage of fat also increased significantly, also the amount of protein, we note an increase in the amount of protein with an increase in the percentage of adding walnut powder, but this increase is not significant compared to fat.

Corresponding Author E-mail : aqeel.h@uokerbala.edu.iq
Peer review under responsibility of Iraqi Academic Scientific Journal and University of Kerbala.

Introduction

Cheese is a highly nutritious dairy product that is widely consumed in the world, as calcium is one of the main components of the diet in our country, 5 percent of the daily energy intake of each person is provided by milk and its products [1], dairy fats are one of the main components in it and it is a food whose presence in milk is somewhat desirable, however, excessive consumption is harmful, especially saturated fats, and may cause obesity, chronic cardiovascular diseases, high blood pressure and atherosclerosis, and recent statistics indicate that due to the high consumption of fats, a high percentage of people suffer from these diseases [2] , [3]. The use of grains, such as walnuts and vegetable oils in dairy products (cheese) improves its nutritional value as one of the beneficial products, as walnut oil contains different amounts of linoleic acid, oleic acid and palmitic acid, which are essential fatty acids that the body cannot manufacture and must always be taken with food to treat some other disorders such as depression, insanity and especially Alzheimer's disease [4] , [5]. Research confirms that the food chain of life Healthy There is a special relationship between the high consumption of walnuts and the reduction of cholesterol in the human body associated with vegetable protein, unsaturated fatty acids, plant sterols and dietary fiber, as well as nutritional compounds such as tocopherol [6], due to the presence of vitamin E (creates tocopherol) in an amount of (600) mg in walnut oil, which is considered a barrier and defense against damage caused by free radicals, and the presence of unsaturated fatty acids as well as lecithin in walnut oil increases the concentration of acetylcholine in the brain and improves memory [7]. Similar research has been conducted, such as the effect of adding safflower and walnut powder [8] and adding walnut and mint powder to butter [9] yogurt with walnut powder [10] and olive oil with cheese [11], and the effect of adding rapeseed oil to cheese and cheese fats [12] and also the production of soft white cheese low in cholesterol using sunflower oil [13] and the production of low-fat cheddar cheese rich in omega-3 [14], and studying the sensory qualities and physical properties of yogurt produced with rapeseed oil and olive oil [15]. The use of cheese concentrate and canola oil as a substitute for fat in the production of fresh white cheese [16], examining the effects and quantity of fat on the texture of cheddar cheese [17], examining the quality of mozzarella, cheddar and fresco cheeses rich in plant and animal sources of omega-3 [18], studying the effect of xanthan gum and casein ate as a substitute for fat and its effect on the sensory qualities and structural properties of low-fat cheddar cheese [19], because dairy products contain essential fatty acids that are not rich in antioxidant compounds [20], and the amount of these compounds in dairy products can be increased by adding walnut powder. This study seeks to produce a new product to correct the damage of high-fat cheese and increase essential unsaturated fatty acids and antioxidants in the diet. The aim of this research is to study the addition of walnut powder at concentrations of 2%, 4% and 6%, some source rich in unsaturated fatty acids and antioxidant compounds, on the chemical and physical composition and sensory evaluation of cheese during 30 days of refrigerated storage at a temperature of 6 °C, in order to obtain a dairy product with a higher nutritional value. And a more suitable consistency as a dairy product that is beneficial to the consumer.

Methods and materials

In this research, raw fresh cow's milk was purchased from Sadat Al-Hindiyah, walnuts from northern Iraq (Sulaymaniyah), cheese starter from Hansen Company, and powdered cheese yeast from the markets. The total tests of milk and cheese samples were performed in the laboratory of the College of Agriculture / University of Karbala, which are (the amount of solids without fat, lactose, protein, fat, density, and pH).

White soft Cheese preparation

To manufacture cheese, the fresh milk is pasteurized for 15 seconds at (72°) degrees Celsius, after which the pasteurized milk is directly cooled to reach a temperature of 38 degrees Celsius, after which the cheese yeast is added (after dissolving it in a quantity of sterile water for a period of 15 minutes to activate) to the milk in an amount of 0.08 grams per 5 kg of liquid milk, and the starter at a rate of 1 gm per 100 kg of milk (according to Hansen Company specifications). At that temperature [21], the milk is left until it solidifies in the form of a semi-solid gel. The formed curd is cut into small cubes (approximately 1 cm^3) to extract the whey water from the cheese, and it is left for 35 minutes to complete the process of separating the whey liquid from the cheese, then filtering to extract the rest of the whey liquid and separate it from the cheese. At this stage, the nuts are ground in a grinder for one minute, in the required quantities that were practically determined, and then applied to the transactions 2%, 4% and 6%, and it was Adding it to the cheese curd and placing the curd in molds under a pressure force of 8 kg for 2 hours, and after removing it from the molds, it was placed in plastic bags emptied of air and stored in the refrigerator at a temperature of 6^{C° for 30 days [22]. The aforementioned tests were conducted on the cheese treatments on days 0, 10, 20 and 30 days.

Total solids measurement

5 grams of cheese sample were weighed, then the sample was placed in an oven at 102^{C° for 24 hours, then cooled and weighed [23].

Cheese texture measurement

The cheese texture hardness was measured using the English Instron device. The cheese samples were taken out of the refrigerator immediately before the test and after being cut into dimensions (20 × 20 × 20) mm, they were compressed by the device, and the cheese hardness was measured according to Newton [24].

Fat measurement

The Gerber method is a widely recognized technique for determining fat content in cheese samples. In this method, a 5-gram homogeneous cheese sample is placed in a Sensitive scale, followed by the addition of approximately 2 ml of distilled water to prevent burning. Subsequently, 10 ml of 90% sulfuric acid and 1 ml of alcohol are added, and the mixture is incubated in a water bath at 70 degrees Celsius until fully dissolved. Afterward, a centrifuge is utilized to separate the fat at 1200 rpm for 5 minutes, allowing the fat content to be read directly [25].

Protein measurement

The amount of total protein of cheese samples was measured by the Kjeldahl method according to the AOAC method [26].

PH measurement

The PH of cheese samples was measured by a PH meter.

Statistical analysis

SAS .(2012). Statistical Analysis System. Users Gide Statistical.Verion 9. 1th ed.SAS. Institute Incorporated Cary. N.C. USA.

Results and Discussion

According to the results of Table 1, we note the examination of changes in the amount of fat in white cheese samples during the cold storage period, after adding different concentrations of walnut powder to the cheese, the percentage of fat increased significantly, as it differed from each other and from the control sample, as the concentration of walnut powder in the treatments increased, the percentage of fat also increased significantly, as the percentage of fat in the T1 sample was 23% compared to the control sample, which was 15%. There is a significant difference, and the reason for the increase in the percentage of fat in the samples is that walnuts contain a greater amount of fat, about (55-72 %) of the seed weight [27]. The production of white cheese using canola oil and olive oil increased from the first day, and the percentage of fat in the treated samples increased compared to the control sample, which was consistent with the results of the current study [11]. In previous

research similar to this research, and according to the results of the fat content in cheeses containing vegetable oils, it was higher than the control sample [28]. As for the amount of protein, we note from Table 1 an increase in the amount of protein with an increase in the percentage of adding walnut powder, but this increase is not significant compared to fat, and the reason is due to the protein content of the walnut powder used in this study confirmed the results of Chen et al. (2008) who reported that the amount of protein in the walnut powder was 14.9 % [27]. In another study, milk fat was replaced with vegetable oils such as corn oil and palm oil. According to the results of chemical tests, the protein content in the samples containing vegetable oils was higher than the control sample, which is consistent with the results of this study [28]. Therefore, with the increase in the concentration of walnut powder, the protein percentage was also significant compared to the control sample. In a study on the production of soft white cheese using sunflower oil, by adding certain proportions of sunflower oil to the cheese, these two samples showed a significant increase compared to the control sample, which was similar to the results of the current study [13].

Table 1: shows the percentages of protein% and fat% during cold storage during the first day.

Treatment	Protein %	Fat %
T1 : Control	25.02	15.17
T2 : 2% Walnut	26.87	17.02
T3 : 4% Walnut	27.67	20.31
T4 : 6% Walnut	28.33	23.27

From Table 2, Results showed note the changes in the results of cheese hardness for the four treatments. There is a significant difference between the hardness of the cheese samples during 30 days of refrigerated storage. The results showed that with the increase in the concentration of walnut powder, the hardness of the cheese samples decreased. The highest value of cheese hardness was for sample T1 (control sample) on day 0, and the lowest value was for treatment T4 (6%) on day 30. Therefore, there is a significant difference. The reason is that sample T1 contains saturated fats, unlike sample T4, which contains unsaturated fats. This may be related to the high percentage of walnut fat and thus the low hardness of the sample [29]. The other reason that occurs during cheese ripening that reduces the hardness of the cheese is the decomposition of fats, during which the fats in the cheese are broken down. This phenomenon is also effective in softening the texture of the cheese [30]. A study showed that with the increase in the percentage of saturated fats in the cheese samples, the degree of hardness of the cheese increases, which is consistent with the results of the current research [24]. Another study produced different types of cheeses with vegetable oils and announced that processed cheese Its hardness decreases, which is consistent with the results of this research [31]. The most important thing during the cheese ripening period is the protein-degrading reactions through which casein is broken down and converted into small components such as amino acids. The hardness of cheese tissues is related to the protein network formed, especially casein. Therefore, with the breakdown of protein and its continuation during cold storage, the protein network is broken and finally the

texture of the cheese becomes softer [30]. As for the dry matter of cheeses during the cold storage period.

Table 2: Hardness and consistency of cheese (in Newton's) during refrigerated storage period of 30 days at 6°C.			
Treatment	1 day	15 day	30 day
T1 : Control	17.11 ± 0.65 A	15.74 ± 0.39 E	13.23 ± 0.57 I
T2 : 2% Walnut	13.19 ± 0.49 B	9.62 ± 0.71 F	5.48 ± 0.58 J
T3 : 4% Walnut	8.43 ± 0.38 C	5.84 ± 0.50 G	3.97 ± 0.44 K
T4 : 6% Walnut	7.53 ± 0.69 D	5.38 ± 0.38 H	3.02 ± 0.36 L

Different letters refer to a significant ($p \leq 0.05$) differences between treatments

According to the results of Table 3, on the first day of the experiment, the percentage of total solids of the treatments had a significant difference with each other. We note that the lowest amount of dry matter was associated with the control sample T1 on the first day, and the highest amount of dry matter was associated with the sample T4 on day 30 of cold storage. Therefore, increasing the concentration of walnut powder increases the amount of dry matter of the final product. The reason is due to the high percentage of dry matter in the walnut powder, and therefore increasing its amount in the samples has a significant effect on the total increase in solids of the cheese. The reason for the high percentage of solids in sample T4 on day 30 was also related to the high amount of fat in its composition, and therefore the amount of solid matter in the sample increased [8]. There is also another reason related to the decrease in moisture by adding salt, which is done in the final stages of cheese production. Due to its moisture-absorbing nature, salt absorbs the moisture in it as soon as it is added [32]. The chemical reactions that also occur during cheese ripening are protein-degrading reactions, and thus caseins are broken down and converted into small components, which causes the production of free amino acids. By increasing these interactions, the absorption of water in the cheese increases, and the decrease in water causes wars, which in turn increases the solid matter [30]. Increasing the percentage of sunflower oil in white cheese increases the dry matter of the cheese [13], [29].

Table 3: Total solids during 30 days refrigerated storage at 6°C				
Treatment	1 day	10 day	20 day	30 day
T1 : Control	40.17 ± 0.52 A	41.23 ± 0.59 C	42.29 ± 0.66 G	43.20 ± 0.64 K
T2 : 2% Walnut	44.50 ± 0.52 A	47.38 ± 0.66 D	50.42 ± 0.41 H	53.57 ± 0.41 L
T3 : 4% Walnut	45.61 ± 0.58 A	48.27 ± 0.78 E	51.71 ± 0.40 I	54.11 ± 0.55 M
T4 : 6% Walnut	46.78 ± 0.57 B	49.48 ± 0.69 F	52.39 ± 0.70 J	55.21 ± 0.46 N

Different letters refer to a significant ($p \leq 0.05$) differences between treatments

The results shown in Table 4 showed that the trend of changes in the pH of the treatments was decreasing during the ripening and cold storage period. The highest pH value was for the T4 sample on the first day, and the lowest value was for the control sample on day 30. The reason is due to the decrease in the amount of acid (lactic acid) over time, and the reason is due to the increase in the percentage of fat in the samples. It was found that the small increase in acidity production was associated with a decrease in the activity of the starter in converting lactose to lactic acid in high-fat environments [30], [33]. In another study, researchers replaced vegetable oil with animal fats and obtained a similar result in the produced samples, the increased in fat, the production of acid (lactic acid) produced during the ripening period decreased [29], [32].

Table 4: Changes in pH values during 30 days of refrigerated storage at 6°C

Treatment	1 day	10 day	20 day	30 day
T1 : Control	5.31 ± 0.06 A	5.22 ± 0.06 C	5.10 ± 0.04 F	5.02 ± 0.06 H
T2 : 2% Walnut	5.38 ± 0.07 A	5.27 ± 0.02 C	5.21 ± 0.02 F	5.10 ± 0.08 H
T3 : 4% Walnut	5.49 ± 0.02 A	5.40 ± 0.05 D	5.34 ± 0.04 F	5.23 ± 0.03 I
T4 : 6% Walnut	5.55 ± 0.03 B	5.46 ± 0.03 E	5.39 ± 0.02 G	5.34 ± 0.02 J

Different letters refer to a significant ($p \leq 0.05$) differences between treatments

The results of Table 5 show that the highest scores were associated with the T4 sample and the lowest score was associated with the low-fat control sample T1. The reason for this is due to the direct effect of fat on the taste and texture of cheese. Since most of the factors that affect taste are found in fat, and with the reduction of fat, the sensory properties will decrease, the sample rich in fat obtained the highest scores in sensory properties. There is a similar study conducted by Fathi and colleagues (2012) [30] by replacing the fat in milk with walnut powder and checking its sensory properties. They stated that adding these powders to cheese has a positive effect and did not leave negative effects on its sensory properties, but in general, the high-fat samples obtained a higher score [8], [13]. Al-Rashidi and colleagues (2016) [19] prepared samples of low-fat cheeses and evaluated their sensory properties. The results showed a decrease in sensory properties with the reduction of their fat content [24], [31].

Table 5: Sensory properties during refrigerated storage at 6°C for 30 days

Treatment	Taste	Odor	Color	Texture	General Acceptance
T1 : Control	7.11 ± 0.09	7.23 ± 0.32	7.45 ± 0.02	8.21 ± 0.05	7.32 ± 0.17
T2 : 2% Walnut	8.56 ± 0.11	8.25 ± 0.21	8.34 ± 0.06	9.44 ± 0.03	8.57 ± 0.25
T3 : 4% Walnut	9.01 ± 0.15	9.12 ± 0.31	8.22 ± 0.05	9.31 ± 0.12	9.18 ± 0.31
T4 : 6% Walnut	9.89 ± 0.12	9.76 ± 0.17	9.69 ± 0.09	9.55 ± 0.16	9.88 ± 0.28

Different letters refer to a significant ($p \leq 0.05$) differences between treatments

Conclusion

The results of this study proved that using walnut powder and adding it to cheese in certain proportions increases its nutritional value with suitable quality and is full of essential unsaturated fatty acids that can be positive for the health of consumers who suffer from obesity, cardiovascular diseases and cholesterol.

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