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(Original Article)

Characteristics of Soft Cheese Fortified by *Moringa oleifera* and *Mentha piperita* Leaves

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Abstract

The current study aimed to evaluate the chemical, microbiological, and organoleptic characteristics of functional soft cheese fortified with *Moringa oleifera* (MO) and *Mentha piperita* (MP). Dried leaves of MO and MP were crushed into small parts by rubbing them to be used in the manufacture of soft cheese with different ratios. The addition of MP was to enhance the Moringa flavor. The treatments were: control (C); 0.25% MO (T1), 0.25% MO+MP (T2), 0.5% MO (T3), 0.5% MO+MP (T4), 0.75% MO (T5), 0.75% MO+MP (T6). Subsequently, the chemical, microbiological and sensory properties were determined during two weeks of storage at 5±1°C. The results indicated that integrating Moringa separately or with Mentha did not significantly affect moisture, ash, salt, and protein/DM. However, cold storage resulted in a small decline in the second week, although results did not express any significant differences, only protein/DM attributed significant variation at P<0.05 during different storage periods with the previously mentioned trend. Potassium showed significant differences compared to control, while cold storage achieved a significant increase in iron. Addition of MO and MP did not significantly affect the total bacterial and yeasts & molds counts. A significant decrease in total bacterial and yeasts & mold count was recorded after 14 days of cold storage. Owing to organoleptic properties, it was found that the best treatment that fortified with 0.25% MO+MP, fortifying cheese with MO caused considerable changes in chemical, nutritional, microbiological, and sensory characteristics.

Keywords: *Soft Cheese, Moringa oleifera, Sensory evaluation, Chemical composition*

Introduction

Food fortification involves the addition of essential nutrients such as vitamins and minerals to improve the nutritional value of foods. In most cases, fortification can lead to improvements in the micronutrient status of the food at a reasonable cost (Olson *et al.*, 2021). Also, the fortificant should be readily available, accessible and well absorbed into the food without causing a significant change in the sensory attributes of the fortified food (Allen *et al.*, 2006).

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The use of nutrient-rich plant in fortifying foods is getting much attention. In many parts of the world including Africa, the use of *Moringa oleifera* as a food fortificant is on the increase (Oyeyinka and Oyeyinka, 2018). For instance, both fresh and dried Moringa leaves are included in meals in African countries such as Ghana, Nigeria, Ethiopia, East Africa and Malawi. Many studies have shown the potential use of different parts of *M. oleifera* in food applications such as in making soups, weaning foods, herbal biscuits, bread, cake, yoghurt and cheese (Agbogidi and Ilondu, 2012).

Moringa oleifera is an important nutritional supplement with high concentrations of proteins, vitamins, minerals, and a variety of medicinal properties some of which include antimicrobial, antioxidant, hypoglycemic, radioprotective, hypocholesterolemic, hepatoprotective and cardioprotective effects besides regulation of thyroid hormone and activity (Milla *et al*., 2021; Peñalver *et al*., 2022). For example, Moringa leaves are said to contain more vitamin A than carrots, more calcium than milk, more iron than spinach, more vitamin C than oranges, and more potassium than bananas, and the protein quality of Moringa leaves rivals that of milk and eggs (Singh *et al*., 2018).

On another hand, milk and dairy products continue to play an important role in the nutrition of people in many parts of the world. The use of *Moringa oleifera* in fortifying dairy products such as yoghurt and cheese at varying concentrations of up to about 3% has been reported in the literature (Hekmat *et al*., 2015; Kuikman and O'Connor, 2015; Salem *et al*., 2013). The fortified yoghurt with 0.5% *Moringa oleifera* and 5% sugar was reported to be acceptable to taste panel members (Hekmat *et al*., 2015). However, when *Moringa oleifera* was added at 1% concentration the yoghurt samples were found to have a strong undesirable flavor. Some studies try to enhance the acceptability of Moringa yoghurt by adding fruits like banana, sweet potato and avocado (Kuikman and O'Connor, 2015).

Another dairy application of *Moringa oleifera* is in cheese fortification. The nutrient content such as fat, ash, protein, and carbohydrates of cheese produced from buffalo milk fortified with *Moringa oleifera* was found to increase with increasing levels of added *Moringa oleifera* generally (Salem *et al*., 2013). Similarly, the antioxidant properties of the fortified cheese substantially increased with the increase in *Moringa oleifera* concentration. Also, cheese fortified with 3% *Moringa oleifera* showed higher (three times) antioxidant properties than the control cheese. Up to 1–2% *Moringa oleifera* was recommended for use in cheese fortification by the authors since these levels of *Moringa oleifera* had comparable sensory properties with the control. Further, the *Moringa oleifera* fortified cheeses were reported to have good and comparable sensory quality with the control after three weeks of storage (Salem *et al*., 2013).

Although the study on *Moringa oleifera* fortified cheeses showed comparable quality with the control cheese, Salem *et al*. (2013) also pointed out that the acceptability of the fortified cheeses was influenced by the fact that the taste panel members were accustomed to *Moringa oleifera* and other herbal green leaves. Hence, it is imperative to emphasize that the use of *Moringa oleifera* in dairy products such as cheese and yoghurts may depend on the norms and cultural acceptance of herbal leaves (Peñalver *et al*., 2022).

With this demand to manufacture these types of cheese, more studies are required to study the effect of Moringa fortification on the chemical composition and nutritional properties of this cheese with guidance to increase awareness of the health benefits and try to improve the sensory properties of the cheese produced.

This research aimed to study the effect of adding *Moringa oleifera* to soft cheese and improve the sensory acceptance of Moringa cheese by adding Mentha as one of the medicinal herbs acceptable to consumers and investigate the effect of its addition on the nutritional, chemical, microbial and sensory properties of cheese.

Materials and Methods

Materials and preparation of Moringa and Mentha leaves

Fresh cow's milk (3.5% fat, 2.84% protein, 0.18% acidity and 4.83% lactose) was obtained from the farm of the Department of Animal Production, Faculty of Agriculture, Assiut University.

Moringa oleifera and *Mentha piperita* leaves were obtained from the Medicinal and Aromatic Plants Unit of the Department of Floriculture of the Faculty of Agricultural, Assiut University. Moringa (MO) and Mentha (MP) leaves were dried (under the shade at 30°C for 2 weeks) and crushed into small parts by rubbing them and stored in plastic containers. The chemical composition of Moringa and Mentha leaves are presented in Table 1.

Table 1. Chemical composition of Moringa and Mentha leaves (in dry matter)

Herbs type	Protein %	Ash %	Fe mg/kg	Zn mg/kg	K mg/kg	Ca mg/g	Mg mg/g
Moringa	29.22	14.53	110.5	8	1550	20	12
Mentha	21.87	11.90	110.5	7	2150	19	21.5

Preparation of experimental soft cheese

A preliminary sensory experiment of soft cheese fortified with different MO and MP leaf ratios was prepared. Soft cheese was manufactured as the method of Mohammed *et al*., (2016) with some modifications at the laboratory of dairy products in the Faculty of Agriculture, Assiut University. Milk was pasteurized at 73 °C for 15 s, cooled to 40 °C and salted with sodium chloride at 5% (w/w). Then, microbial rennet (Caglio Star, Spain) was added (3 ml/L) and mixed thoroughly. The milk was maintained at 40 °C until coagulation. After that, the curd was scooped into cheesecloth, drained for 24 hours in a cooler at 5 °C, and then the cheese was taken out of the cheesecloth and weighed. Control soft cheese was made without leaf addition. Treated soft cheese was made with the addition of different ratios of dried MO and MP leaves as follows: T1: 0.25%

MO, T2: 0.25% MOMP (3:1), T3: 0.5% MO, T4: 0.5% MOMP (3:1), T5: 0.75% MO, T6: 0.75% MOMP (3:1), T7: 1% MO, T8: 1% MOMP (3:1), T9: 1.5% MO, T10: 1.5% MOMP (3:1). Herbal leaves were added to the milk after curing and before the process of separating the whey, by scattering them over the curdled milk and stirring gently.

Sensory evaluation

The resultant soft cheese was evaluated by a panel of 15 staff members at the Department of Dairy Science, Faculty of Agriculture, Assiut University using a scoring test with the aid of a nine-point hedonic scale (where 9=like extremely, 5=neither like nor dislike, and 1=dislike extremely) to determine the cheese's acceptability. The sensory attributes of appearance, texture, flavor, color, and overall acceptability were examined as described by Mehaia (2006). Cheese samples were randomly coded and presented to each panelist at 20 °C. Data collected from panelists were subjected to statistical analysis.

Sensory evaluation was conducted to choose the best ratios, then the best ratios were stored for two weeks at 5±1°C and analyzed microbiologically and some chemical analyses were performed.

Chemical composition

Total solids, total nitrogen (TN) and ash contents of herbal and cheese samples were estimated (AOAC, 2016). Total protein content was calculated as TN×6.38 in cheese case while as TN×6.25 in herbs case (Strang, 1988). Titratable acidity content was estimated in cheese by using titration (AOAC, 2016). Salt content in cheese was determined by using the Mohr method (Nielsen, 2010).

For the determination of elements in herbs and cheese treatments, the samples were digested with a mixture of 350 ml H_2O_2, 0.42 g selenium powder, 14 g Li $SO_4.H_2O$ and 420 ml concentrate H_2SO_4 (Parkinson and Allen, 1975). The concentrations of elements in cheese samples were obtained after the dilutions in the flame photometer (Faculty of Agriculture, Assiut University).

Microbiological analysis

Total bacterial count was determined using the standard plate count technique as described by Marshall (2004). Enumeration and counts of yeasts and molds were carried out in the samples using the media of potato dextrose agar as the method recommended by Awad *et al*. (2010).

Statistical analysis

The obtained data were subjected to statistical analysis using the SPSS package (SPSS, 1998). Means were compared using L.S.D. test and the significance of variations in cheese treatments was compared using F-test (Steel and Torrie, 1980).

Result and Discussion

Introducing novel flavors to processing becomes necessary to face competition, especially when these flavors emerge from natural sources that mean extra nutritional and functional value. Classical soft cheese was manufactured by salting before adding rennet, incorporating Moringa as a medicinal herb separately or with Mentha to acquire the resultant cheese more acceptable taste and flavor transforming classical soft cheese into the category of functional dairy products. For this purpose, different gradual ratios from selected herbs were tested to be used in the manufacturing of soft cheese and judging for their sensory acceptability.

Preliminary sensory evaluation for cheese samples

Results in Table (2) of sensory evaluation scores indicate that the best scores were given to T1 for color which was 7.87±1.19, where T2 achieved the best evaluation of flavor and overall acceptability (7.80±1.15 and 7.93 ±1.03, respectively). Concerning appearance and texture, T3 was the favorable treatment 7.73±0.96 and 7.60±1.45. Figure (1) displays the different treatments of soft cheese fortified with Moringa and Mentha.

Table 2. Sensory scores of fresh soft cheese (mean ±SD) with added different levels of Moringa (MO) and Mentha (MP) leaves

Treatments	Treatment abbreviation	Appearance	Texture	Color	Flavor	Overall Acceptability
Control	C	7.73^{a}±1.39	7.87±1.25	8.40^{a}±0.91	7.67^{ab}±2.19	8.27^{a}±1.10
0.25% MO	T1	7.60^{ab}±1.24	7.47±1.41	7.87^{a}±1.19	7.07^{abcd}±1.91	7.53^{ab}±1.36
0.25% MOMP	T2	7.67^{ab}±1.23	7.47±1.46	7.80^{a}±1.15	7.80^{a}±1.15	7.93^{a}±1.03
0.5 % MO	T3	7.73^{a}±0.96	7.60±1.45	7.73^{a}±1.10	7.00^{abcd}±1.36	7.20^{abc}±1.21
0.5 % MOMP	T4	7.20^{abc}±1.15	7.07±1.44	7.33^{ab}±1.29	7.53^{abc}±1.19	7.40^{ab}±0.99
0.75% MO	T5	6.80^{abc}±1.15	6.93±1.28	7.13^{abc}±1.51	6.13^{bcd}±2.00	6.73^{cd}±1.28
0.75% MOMP	T6	6.40^{bcd}±1.24	6.67±1.29	6.40^{bcd}±1.59	5.87^{d}±2.00	6.73^{cd}±1.28
1% MO	T7	6.67^{abcd}±1.72	7.00±1.89	6.40^{bcd}±1.76	6.47^{abcd}±1.51	6.40^{cd}±1.18
1% MOMP	T8	6.20^{cd}±1.97	6.73±2.05	6.00^{cd}±2.04	6.40^{abcd}±2.23	6.60^{cd}±1.99
1.5% MO	T9	6.47^{abcd}±1.96	6.73±1.79	6.47^{bcd}±1.85	6.00^{cd}±1.69	6.13^{d}±1.41
1.5% MOMP	T10	5.47^{d}±2.36	6.60±2.06	5.67^{d}±2.23	5.80^{d}±2.57	6.40^{cd}±1.92

Means with different superscript letters within columns are significantly different ($P \leq 0.05$); n = 15

Adding higher concentrations of Moringa and Mentha corresponding with lower acceptability that appeared as low organoleptic scores, T10 was the most unacceptable sample and recorded 5.47±2.36, 6.60±2.06, 5.67±2.23, 5.80±2.57 and 6.40±1.92 in appearance, texture, color, flavor and overall acceptability, respectively. Treatments from T7 to T10 were excluded from further experiments due to their low acceptability.

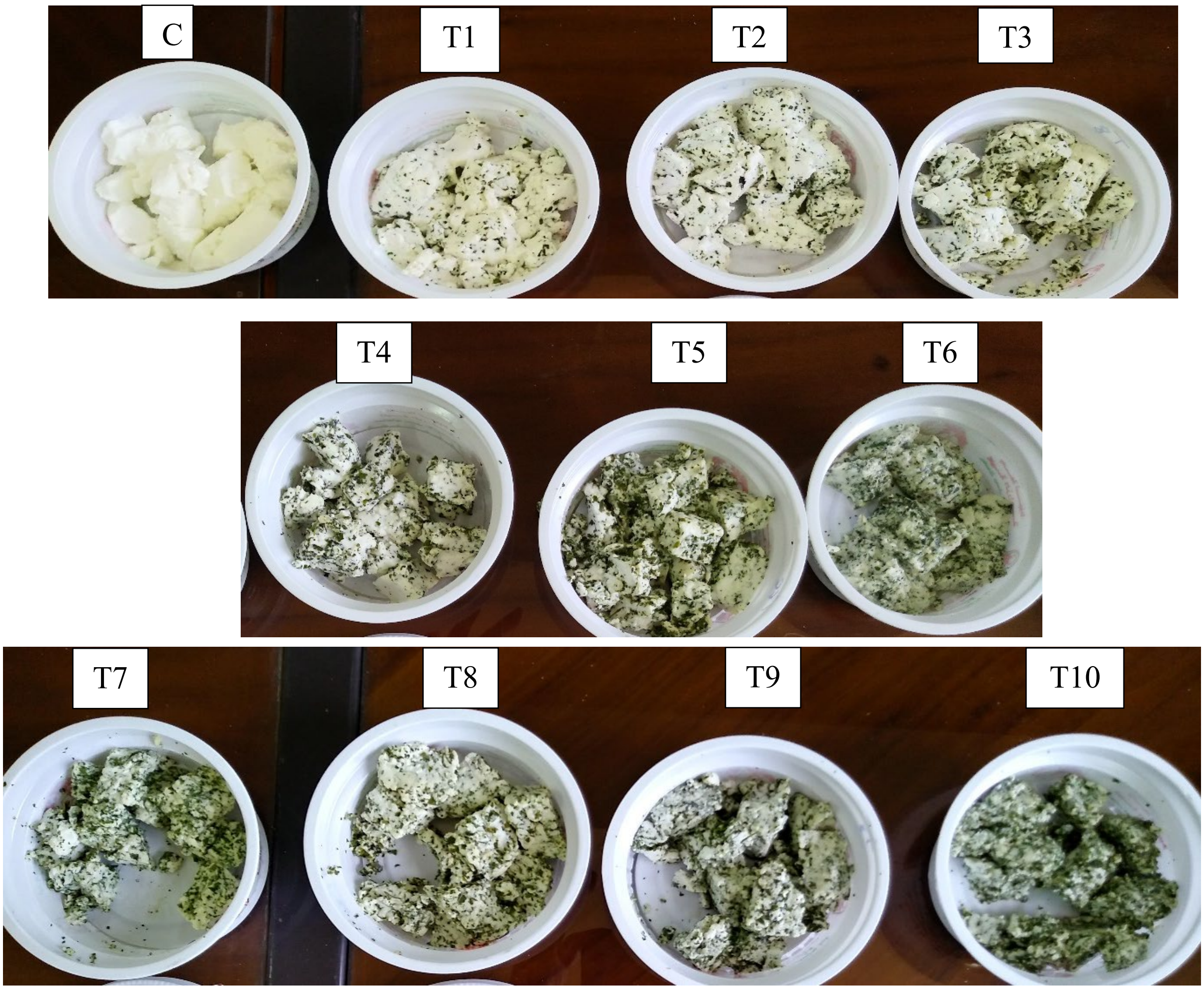

Fig 1. Soft cheese with added different levels of Moringa and Mentha leaves. For treatments explanation see Table 1.

Hassan *et al*., (2016) recommended 0.5% Moringa as the best ratio and gained the highest score for flavor as well as taste in yoghurt production. Bermudez-Beltrán *et al*. (2020) suggested that the addition of 2% MO to Cape Gooseberry Petit Suisse cheese is convinced with low acceptability.

Chemical composition of soft cheese

The chemical composition of cheese is summarized in Table (3). There was an increase in acidity as expressed in % lactic acid by the addition of Moringa and Mentha compared to the control, but the variation did not statistically differ. Moisture content varied from 66.34±2.76 in T1 to 70.43±0.32 in T6, consideration of ash % different ratios of Moringa did not mitigate statistical differences in cheese. Salt as % ranged between 2.72±0.13 to 2.98±0.102 in control, Integrated Moringa separately or with Mentha did not significantly affect moisture, ash, salt and protein/DM. However, an increase can be observed in the treated cheese regarding the protein/DM value.

Table 3. Changes in the chemical composition of soft cheese made with different ratios of Moringa (MO) and Mentha (MP) leaves

Treatments	Acidity%	Moisture%	Ash%	Salt%	Protein%	Protein/DM%
C	0.36±0.22	66.68±3.21	3.79±0.14	2.98±0.10	15.77±1.73	47.47±4.7
T1	0.60±0.58	66.34±2.76	4.00±0.52	2.80±0.15	17.35±0.97	51.75±4.8
T2	0.69±0.38	67.04±4.82	3.60±0.44	2.74±0.05	16.34±0.39	50.25±6.9
T3	0.73±0.57	68.79±1.09	3.96±0.17	2.72±0.13	15.92±0.68	51.11±3.8
T4	0.73±0.62	67.57±0.44	3.69±0.13	2.76±0.14	15.32±0.68	47.25±1.5
T5	0.77±0.68	68.99±2.80	3.83±0.37	2.82±0.09	16.59±1.48	53.52±1.1
T6	0.66±0.42	70.43±0.32	3.58±0.54	2.93±0.01	16.12±0.57	54.51±2.4

Results are expressed as means ± SD. C control, T1: 0.25% MO, T2: 0.25% MOMP, T3: 0.5% MO, T4: 0.5% MOMP, T5: 0.75% MO and T6: 0.75% MOMP. DM: Dry Matter

In a study by Elgamal *et al*. (2018), the authors made Moringa–fortified Halloumi cheese from cow milk with 0 % (T1), 3% MO leaves powder extraction in milk (T2) and added 3% MO leaves powder in weight curd cheese before pressed (T3). Results revealed that treatment (T2) had a higher TS, protein, ash, and Iron content.

Salem *et al*., (2013) emphasize that raising % MO at up to 3% in labneh cheese resulted in a higher percentage of TS, protein, fat, carbohydrates and ash compared with the control.

After two weeks of storage acidity developed statistically compared to fresh cheese samples (1.21±0.31 vs 0.29±0.08), storage for a week at the refrigerator temperature did not cause considerable differences compared with fresh samples. Slight variations were observed in salt content during 2 weeks of storage at 5ºC, results did not differ statistically. Regarding moisture, ash, and protein, values recorded a snub increase during the first week of storage followed by a small decline in the second week of storage, although results did not express any significant differences, only protein/DM attributed significant variation at P≤0.05 during different storage periods with the previously mentioned trend (Table 4).

Table 4. Changes in the chemical composition of soft cheese made with Moringa (MO) and Mentha (MP) during storage for two weeks

Storage time	Acidity%	Moisture%	Ash%	Salt%	Protein %	Protein/DM
F	0.29±0.08^{b}	67.95±2.55	3.65±0.31	2.81±0.11	16.24±1.30	50.83^{b}±4.38
W1	0.44±0.11^{b}	69.25±2.73	4.65±1.99	2.8±0.16	16.33±0.83	53.35^{a}±3.85
W2	1.21±0.31^{a}	66.73±2.39	3.89±0.52	2.86±0.08	16.04±1.17	48.32^{c}±3.60

Results are expressed as means ± SD, F: fresh W1: one week and W2: two weeks, means with different superscripts within the same column have significant differences (P≤0.05).

Similar results were found by El-Siddig *et al*. (2018) who studied the effect of storage for 4 months on Moringa-fortified white cheese and found that acidity increased significantly. Total solids, ash, and protein were decreased.

In addition, in a study designed to incorporate 0.5% MO leaves powder in the production of yoghurt, treatments showed higher content of TS, and TP, and lower pH than the control (Hassan *et al*., 2016). The addition of 2% MO leaves extract in yoghurt exerts iron concentration of 1.457±0.208, and 2.450±0.023 for 4% MO leaves extract in yoghurt and 3.953±0.025 for 6% MO leaves extract in Yoghurt (Nduti *et al*., 2018).

Hassan *et al*. (2018) found that storage of Moringa oil-fortified white cheese at 1.5% for 2 weeks caused acidity development from 0.20, 0.19 and 0.22 % for fresh, 1 week and 2 weeks and TS recorded 37.2, 37.5 and 37.7, respectively. Mohamed et al. (2018) indicated that storing cream cheese fortified with 2, 4 and 6% MO extract at 5±1C for 4 weeks led to elevating in TS from (31.32 to 33.17), (31.39 to33.77), (31.61 to 33.79) and acidity from (1.1 to 1.72), (1.10 to 1.76) (1.10 to 1.85), respectively. MO leaf powder Improved the nutritional value of cape gooseberry Petit Suisse cheese, the addition of 2% MO to the formulation increased ash, protein, fat, and fiber contents but corresponded with lower sensory acceptance (Bermudez-Beltrán *et al*., 2020).

Effect of Moringa and Mentha on cheese minerals content

Table (5) presents the concentrations of minerals (mg/kg) or (mg/g) in cheese samples manufactured with different ratios of Moringa and Mentha, T5 showed the highest value of iron concentration followed by T4, however, T1 was superior in zinc concentration at 14.16±3.21 mg/kg, T6 composed the highest level of magnesium as 15.16±5.34 mg/g. Iron, zinc and magnesium concentrations did not appear to have any significant variation.

On the other hand, potassium as mg/kg achieved the highest concentration on T6 350.0±50 mg/kg and was significantly different from the control, with an increment rate more than twice to control. T4 recorded 21.66±5.77mg/g of calcium, which did not differ from control 19±1.73, but differed statistically from T3.

Table 5. Changes in mineral contents in soft cheese made with Moringa (MO) and Mentha (MP)

Treatments	Fe (mg/kg)	Zn (mg/kg)	K (mg/kg)	Ca (mg/g)	Mg (mg/g)
C	55.33±2.36	11.66±1.15	133.30±28.86^{c}	19.00±1.73^{ab}	10.33±2.36
T1	55.50±2.78	14.16±3.21	183.33±76.37^{bc}	11.33±3.21^{bc}	14.00±7.54
T2	59.16±6.82	13.16±1.04	150±0^{bc}	18.00±7.54^{ab}	10.50±4.27
T3	57.66±5.61	12.83±0.76	250±0^{ab}	10.00±2.51^{c}	14.83±2.75
T4	61.33±6.00	12.83±1.75	250±100^{ab}	21.66±5.77^{a}	8.50±9.96
T5	61.83±4.25	13.50±1.32	200±50^{bc}	18.66±2.08^{ab}	8.83±2.36
T6	59.66±5.96	11.50±0.86	350±50^{a}	15.00±7.21^{bc}	15.16±5.34

Results are expressed as means ± SD. C: control, T1: 0.25% MO, T2: 0.25% MOMP, T3: 0.5% MO, T4: 0.5% MOMP, T5: 0.75% MO and T6: 0.75% MOMP. Means with different superscripts within the same column are significantly different (P≤0.05).

Gopalakrishnan *et al*. (2016) indicated that MO leaves contain minerals such as Calcium, Magnesium, Phosphorus, potassium, Copper, and iron. Hassan *et al*. (2016) reported that MO leaves involve high amounts of potassium and iron. Elgamal *et al*. (2018) confirmed that the addition of 3% MO in milk significantly increased the minerals content of Halloumi cheese of Calcium, Iron, Zinc, Phosphorus, Potassium, and Magnesium comparing to the control cheese.

Microbial examination of manufactured soft cheese

As shown in Table (6), it was observed that the addition of Moringa and Mentha together encouraged the bacterial growth however Moringa only matched with slightly lower values than Moringa and Mentha. Control recorded the lowest total bacterial load, it was worthwhile to mention that results did not differ statistically.

Yeasts & Moluds count has also been studied. The effect of Moringa and Mentha on yeasts and molds count was variable, and results did not differ statistically at $p \leq 0.05$.

Table 6. Microbial evaluation (log CFU/g) of soft cheese made with Moringa (MO) and Mentha (MP)

Treatments	Total counts	Yeasts & Moulds
C	6.62±0.94	4.4±0.37
T1	6.99±0.70	5.06±0.30
T2	7.63±1.27	5.17±0.55
T3	7.03±1.77	2.87±2.54
T4	7.43±1.10	4.76±1.05
T5	7.17±0.48	4.13±0.78
T6	7.23±0.27	3.39±2.94

Results are expressed as means ± SD. C: control, T1: 0.25% MO, T2: 0.25% MOMP, T3: 0.5% MO, T4: 0.5% MOMP, T5: 0.75% MO and T6: 0.75% MOMP.

Storage of soft cheese at refrigerator temperature for 1 wk triggered a slight reduction in total bacterial count of 7.59±0.62, more decline in bacterial number was observed after 2 wk of storage at 5ºC, which was 6.18±0.69 results significantly differed at $p \leq 0.05$. The same trend was also observed in the case of yeasts and molds (Table 7). It can be said that storage of soft cheese at refrigerator temperature can diminish total bacterial and yeasts & molds count with considerable differences. Coliform group bacteria that marks unhygienic practices in processing was not detected in either fresh or during storage.

Table 7. Microbial evaluation of soft cheese made with Moringa (MO) and Mentha (MP) during storage for two weeks

Storage time	Total counts	Yeasts & Moulds
F	7.7 ± 0.59^{a}	5.01 ± 0.7^{a}
W1	7.59 ± 0.62^{a}	4.67 ± 0.49^{a}
W2	6.18 ± 0.69^{b}	3.08 ± 2.19^{b}

Results are expressed as means ± SD. Means with different superscripts within the same column have significant differences ($P<0.05$). F: fresh, W1: one week and W2: two weeks.

El-Siddig *et al*. (2018) reported that the highest count of TBC (5.85±0.61) was recorded in the control sample at the 4th storage period, while the lowest count of TBC (3.63±0.46) in the treated sample was recorded at the 1st storage period. They also did not detect coliform in the manufactured cheese during any storage period. Salem *et al*. (2013) did not detect yeast & mold and coliform bacteria in Labneh fortified with dry leaves MO when fresh and till the end of storage.

Conclusion

Fortifying soft cheese with Moringa and Mentha correlated with improvement in nutritional value, mineral content, protein and protein /DM and sensory properties. This may transform classical cheese into the category of functional dairy products.

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خصائص الجبن الطري المدعم بأوراق المورينجا والنعناع

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الملخص

تهدف هذه الدراسة إلى تقييم الخصائص الكيميائية والميكروبيولوجية والحسية للجبن الطري المدعم بالمورينجا والنعناع. تم فرك الأوراق المجففة من الأعشاب المضافة إلى أجزاء صغيرة لاستخدامها في صناعة الجبن الطري بنسب مختلفة. كانت إضافة النعناع لتعزيز نكهة المورينجا. وكانت المعاملات كالتالي: C: الكنترول، T1: 0.25 %مورينجا، T2: 0.25 % مورينجا ونعناع، T3: 0.5 % مورينجا، T4: 0.5 % مورينجا ونعناع، T5: 0.75 % مورينجا، T6: 0.75 % مورينجا ونعناع. تم تقدير الخصائص الكيميائية والميكروبيولوجية والحسية خلال أسبوعين من التخزين عند درجة حرارة 5 ± 1 درجة مئوية. أشارت النتائج إلى أن اضافة المورينجا بشكل منفصل أو مع النعناع لم يؤثر بشكل كبير على نسبة الرطوبة والرماد والملح والبروتين/ المادة الجافة ومع ذلك، أدى التخزين بالتبريد إلى انخفاض طفيف في الأسبوع الثاني. على الرغم من أن النتائج لم تعبر عن أي فروق ذات دلالة إحصائية، إلا أن البروتين/ المادة الجافة فقط هو الذي اظهر تباينًا كبيرًا خلال فترات التخزين المختلفة. زاد البوتاسيوم والحديد بزيادة نسب إضافة المورينجا، وأظهر البوتاسيوم فروقاً معنوية مقارنة بالكنترول. لم تؤثر إضافة المورينجا والنعناع على إجمالي أعداد البكتيريا والخمائر والفطريات. تم تسجيل انخفاض معنوي في إجمالي عدد البكتيريا والخمائر والفطريات بعد 14 يومًا من التخزين بالتبريد.

نظرًا للخصائص الحسية، فقد وجد أن أفضل معاملة كانت 0.25% مورينجا ونعناع، كما قد أدى تدعيم الجبن الطري بأوراق المورينجا الى تغيرات ملحوظة في الخصائص الكيميائية والغذائية والميكروبيولوجية والحسية.