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Improvement of the Properties of Goat's Milk Labneh using some Aromatic and Vegetable Oils

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ABSTRACT

Many consumers do not prefer goat's milk and its products because of its flavor in spite of its benefits. The purpose of this study is to improve the properties of the Labneh (concentrated fermented milk) by the addition of some aromatic oils to goat's milk and replacement of goat's milk fat with corn or sunflower oils. Thyme oil, black cumin oil, Fennel oil, mint oil and chamomile oil were added, separately, to whole fresh goat's milk. 4% of corn or sunflower oils were added to skimmed fresh goat's milk. All treatments were standardized, homogenized, heated, cooled to 40°C then inoculated with ABT culture (lactic acid bacteria). Samples of Labneh were kept in refrigerator. During that, titratable acidity, total solids, fat contents, acetaldehyde, diacetyle, total bacterial count, psychrotrophic bacteria, mould and yeast, lactic acid bacteria counts and organoleptic properties were determined. Yield of Labneh with aromatic oils and vegetable oils were 29.5 and 29%, respectively. Samples with chamomile or thyme oils were the preferable treatments, they had higher levels of acetaldehyde, diacetyle and therapeutic bacteria counts, they recorded the lowest level of total viable, psychrotrophic, molds and yeasts count. Organoleptically, aromatic oils and replacement of milk fat with vegetable oils improved flavor of goat's milk Labneh. Accordingly, chamomile or thyme oil is recommended to improve the flavor of goat's milk Labneh.

Key words: Goat's milk, labneh, chamomile oil or thyme oil, sunflower oil, organoleptic properties

INTRODUCTION

World production of goat's milk in a steady increase, depending on the statistics of Food and Agriculture Organization (FAO) the output reached about 12,8 MT in 2008 (FAO, 2011), There are growing demands for ovine milk by consumers. This is due to the increasing number of children suffering from intolerance to cow's milk (Zweifel *et al*., 2005), it has higher digestibility, certain therapeutic value in medicine and human nutrition (Haenlein, 2004). The national U.S. dairy products judging procedures list "goaty" as one of the four odor characteristics of bad versus good milk and dairy products. Well-produced and well-handled goat's milk is indistinguishable in taste and odor from quality cow milk. Although fat of goat's milk has a higher content of the strong smelling caproic, caprylic and capric acids than cow's and buffalo's milk (Park *et al*., 2007). Goat's milk fat normally has 35% of medium chain fatty acids (C6-C14) compared to cow milk fat 17 percent and three strong smelling are named after goats: Caproic (C6), Caprylic (C8), Capric (C10), totaling 15% in goat milk fat versus only 5% in cow milk fat. These volatile acids liberate with improper producing and handling because of thinness and friable fat globule membrane of goat's milk which is easily broken and then enzymes are liberated that can produce odors (Haenlein, 2002).

Actually, the composition of goat milk fat differs significantly from the composition of cow milk fat under average feeding conditions. Besides having more short chained fatty acids goat milk fat also contains low arotic acid which is important in coronary heart disease prevention (Haenlein, 1992). Goat's milk has more Calcium, Vitamin A, Vitamin B6, sodium and niacin compared to cow's milk (Haenlein, 1999).

Concentrated yogurt, known as Labneh in the Middle East, is a semisolid fermented dairy food produced by removing part of the whey from yogurt until total solids levels between 23 and 25 g/100 g, of which 8-11 g/100 g is fat, are reached (Tamime and Robinson, 1999). The homogenization of traditional and UF Labneh made from goat and sheep's milk produced a smoother texture, but markedly decreased the firmness more when compared with Labneh made from cow's milk. Also, the microstructure of goat's and sheep's Labneh were similar to each other and less uniform than Labneh made from cow's milk (Tamime *et al*., 1991a).

Firmness and microstructure of Labneh made from different types of milk i.e., cow's, goat's and sheep's milk and different methods and treatments were extensively investigated (Tamime *et al*., 1991b). Several studies have been to replace part or all of the cow's milk fat with vegetable oils (Taha *et al*., 1997; Hefnawy *et al*., 1992) to reduce production costs. Nonetheless, very few studies were carried out on effect of aromatic oils on goat's dairy products for improving its odor.

Therefore, the present study was carried out to investigate the effect of addition of some aromatic oils and replacement of goat's milk fat with some vegetable oils on acceptance and improving the quality of Labneh.

MATERIALS AND METHODS

Fresh goat's milk was obtained from the herds of Serew Station, Animal production Research Institute, Ministry of Agriculture, Egypt. Milk was analyzed and has following results: Acidity 0.17-0.18, fat 3.2, specific gravity 27.8/60°F, lactose 4.2 and pH 6.10-6.13. Spray dried skim milk powder, low heat and of France origin was used. Fresh cream and vegetable oils were obtained from local market; Aromatic oils were obtained from Kato Aromatic, Egypt. Sodium chloride was obtained from El- Naser Company for salt, Egypt. ABT-culture (*Lactobacillus acidophilus*; *Bifidobacterium bifidium* and *Streptococcus salivarius* subsp. *thermophilus*) was obtained from Chr. Hansen-(Denmark).

Two treatments of labneh were prepared from goat's milk as well as different mixtures of them as following: Milk fat was separated (by separator) and replaced with corn or sunflower oil at level 4% (v/v) then, the milk was standardized to 14% T.S.using skim milk powder. At the same time whole fresh goat's milk was standardized to 4% milk fat and 14% T.S) using fresh cream 50% fat and skim milk powder and divided into six equal portions one of them as a control, one ml of thyme, black cumin, fennel, mint and chamomile oil separately were added to each of the five other portions (1 mL km^{-1} standardized milk). Table 1 explains the mixture contents.

All milk samples were heated at 95°C/15 min; homogenized at 250 kg cm^{-2} cooled to 40°C then inoculated with 3% ABT- culture and incubated at 40°C until pH 4.8, fermented milks from all treatments were cooled to 10°C overnight, mixed and put into sterilized cloth bags, hanged in refrigerator room at 6-8°C to allow whey drainage for 12 h, 0.5% NaCl was added to the contents of bag, the resultant labneh was filled into plastic containers and stored at 6-8°C for 30 days. Samples of Labneh were analyzed chemically, microbiologically and organoleptically when fresh and after 10, 20 and 30 days.

Table 1: Treatments of goat's milk to manufacture of Labneh

Treatments	Ingredients
A	Control - (Fresh standardized goat's milk(14%T.S and 4% fat))
B	A+ 1 mL thyme oil / km milk
C	A+ 1 mL black cumin oil / km milk
D	A+ 1 mL Fennel oil / km milk
E	A+ 1 mL mint oil / km milk
F	A+ 1 mL chamomile oil / km milk
G	Replacement goat's milk fat with corn oil (14%T.S and 4% fat)
H	Replacement goat's milk fat with sunflower oil (14%T.S and 4% fat)

Chemical analysis: Titratable acidity (T.A %), total solids (T.S. %) and fat contents were determined according to Ling (1963), acetaldehyde was determined as given by Lees and Jago (1969), diacetyle was determined as described by Westerfeld (1945) and lactose content was colorimetrically determined according to the method reported by Nickerson *et al.* (1976). Tyrosine and tryptophan (mg/100) contents were determined according to Vakaleris and Price (1959). Total volatile free fatty acids (T.V.F.F.A expressed as ml. 0.1 N NaOH/10 gm) were estimated as described by Kosikowski (1982).

Microbiological analysis: Total bacterial count was determined according to (APHA, 1978). The count of spore-forming bacteria was determined according to Chalmer (1962). Counts of coliform bacteria were enumerated using the method described in the stranded methods for the (APHA, 1960). Mackonky agar was prepared as described by Oxoid (1982). Counts of psychrotrophic bacteria count was estimated by using PCS medium (Bridson, 1990). Potato dextrose agar recommended by the Oxoid (1962). was used for the enumeration of moulds and yeasts. Staphylococcus medium No.110 (DIFCO, 1974) was used to count and detect staphylococci.

Bifidobacterium bifidium was enumerated according to Dave and Shah (1996) using modified MRS agar supplemented with 0.05% L-cystein and 0.3% lithium chloride. *L. acidophilus* was enumerated according to Gilliland and Walker (1990) using modified MRS agar supplement with 0.2% Oxagal. *St. theromophilus* count was determined using M17 agar (Terzaghi and Sandine, 1975).

Organoleptic properties: All Labneh samples were sensory evaluated [flavouer (60), "body and texture" (30) and appearance (10)] according to Ahmed and Ismail (1978).

RESULTS AND DISCUSSION

Chemical analysis

Yield, total solids and F/DM: Eight batches of Labneh were made by traditional method from fresh adjusted goat's milk (14%T.S and 4% fat), data presented in Table 2 explain that yield, T.S and F/DM of fresh Labneh didn't effect by adding aromatic oils or replacement of milk fat with corn or sunflower oils, excepting slight decrease in resultant Labneh with vegetable oils. These findings are in agreement with the Egyptian Organization for Standardization Quality Control. Egyptian Standards (Egyptian Standards, 2000) T.S and fat contents should not less than 26 and 10%, respectively).

Table 2: Yield, total solids (T.S) and fat in dry matter (F/DM) of fresh Labneh made from different goat's milk treatments

Treatments (%)	A	B	C	D	E	F	G	H
Yield	29.5	29.5	29.5	29.5	29.5	29.5	29.0	29.0
T.S.	26.2	26.3	26.3	26.3	26.3	26.3	26.2	26.2
F/DM	38.0	38.0	38.1	38.0	38.0	38.1	37.6	37.8

Titratable Acidity (TA): Other chemicals properties of fresh and stored Labneh were summarized in Table 3a-b, which show that Titratable Acidity (TA) in fresh Labneh was 0.8% in control and with aromatic oils but it was 0.9% when replacement milk fat with the vegetable oils. Therapeutic culture (ATB) has a mild acidic (Kurmann *et al*., 1992) this might explain these findings. The (TA) gradually increased in all samples during storing, corn and sunflower oils caused slight increasing of TA, this agrees with Al-Kadamany *et al*. (2002). Control has the lowest T.A through the storage period. Vegetable oils samples had more acidity than aromatic oils samples. These results might be due to a direct impact on the acidity.

Acetaldehyde content: Production of flavor compounds (acetaldehyde and diacetyle) depends on the activity of type used starter and circumstances of fermentation. Table 3a-b show that the acetaldehyde content of samples was affected by the type of aromatic oil used. Chamomile oil yielded the highest content of acetaldehyde followed by thyme oil, fennel oil, black cumin oil, mint oil then control. Corn and sunflower oils yielded the lowest levels of acetaldehyde, though sunflower oil was better than corn oil in this way.

In all samples, acetaldehyde increased with progress the storage period, on twentieth day acetaldehyde content sharply decreased and the decreasing was continued until the end of cold storage period. Control and all treatments with aromatic oils recorded 280 μ mol/100 g at zero time except chamomile oil treatment which yielded 290 μ mol/100 g, however, sunflower and corn oils produced 250 and 230 μ mol/100 g, respectively. At the end of storing period, the levels of acetaldehyde were 140, 130, 130, 130, 120, 120, 110 and 110 μ mol/100 g for chamomile, thyme, Fennel, sunflower, black cumin, mint oil, control and corn oil, respectively. These results correspond with El-Nemer *et al*. (2003) who reported that acetaldehyde content increased in Karish cheese by adding (0.4%v/v) Tolue balsam extract.

Diacetyle content: Concerning diacetyle, data presented in Table 3a and b exhibit that its production approximately took the same trend of acetaldehyde production after 10 days of cold storage. Labneh with chamomile oil contained the highest level of diacetyle equally at zero or during cold storage period followed by thyme oil, fennel oil, black cumin oil, mint oil, control, sunflower oil then corn oil. Aromatic oils were better on production of diacetyle than both vegetable oils. On the other hand, sunflower oil was superior to corn oil in this way. Yield of diacetyle decreased in all samples after 10 days of storage. The maximum level was 140 μ mol/100 g for chamomile and thyme in fresh labneh, the minimum levels (60 μ mol/100 g) was obtained from corn oil at the end of storage.

Lactose content: Results in the same Table 3a and b show clearly that the lactose content reflected the culture activity; the changes in acidity depend on the changes in lactose which plays a great role. As expected, the aromatic oils had a role in reducing the lactose content of Labneh more the control samples; all fresh samples contained 3.1% lactose at zero time, this quantity gradually decreased along with the storage period to reach between 1.8-1.9% at the end of cold storage. Whilst samples treated with vegetable oils contained highest quantity of lactose,

Table 3a: Some chemical composition of Labneh made from different goat's milk treatments

	Treatments																									
	A (control)							B (thyme oil)							C (black cumin oil)							D (Fennel oil)						
Storage period (days)	TA	Ac	D	L	Tyr	Tryp	TV	TA	Ac	D	L	Tyr	Tryp	TV	TA	Ac	D	L	Tyr	Tryp	TV	TA	Ac	D	L	Tyr	Tryp	TV
0	0.8	280	120	3.1	16.5	93	1.3	0.8	280	140	3.1	17	93	1	0.8	280	120	3.1	16.5	93.2	1.2	0.8	280	120	3.1	16.5	93	1.1
10	1	300	100	2.5	32.5	77.5	1.7	1.1	330	120	2.4	33.5	77.9	1.3	1.1	300	100	2.4	32.3	77.7	1.5	1	310	100	2.3	32.2	77.5	1.5
20	1.2	130	90	2.1	42.2	53.7	1.9	1.3	150	110	2.2	42.5	54.5	1.5	1.3	140	100	2.3	42.2	53.5	1.6	1.4	140	100	2.4	42	53.7	1.7
30	1.4	110	70	1.9	45.5	43.2	2.1	1.5	130	80	1.8	46.2	43.6	1.7	1.5	120	80	1.8	45.5	43	1.8	1.5	130	80	1.9	45.3	43.2	1.7

TA: Titratable acidity, Ac: Acetaldehyde, D: Diacetyle, L: Lactose, Tyr: Tyrosine, Tryp: Tryptophan, TV: Total volatile free fatty acids. The results are the average of three replicates

Table 3b: Some chemical composition of Labneh made from different goat's milk treatments

	Treatments																									
	E (mint oil)							F (chamomile oil)							G (cron oil)							H (sunflower oil)						
Storage period (days)	TA	Ac	D	L	Tyr	Tryp	TV	TA	Ac	D	L	Tyr	Tryp	TV	TA	Ac	D	L	Tyr	Tryp	TV	TA	Ac	D	L	Tyr	Tryp	TV
0	0.8	280	120	3.1	16.2	93.2	1.3	0.8	290	140	3.1	17	93.5	1	0.9	230	90	3.3	16.5	93	0.85	0.9	250	100	3.3	16.5	93	0.7
10	1	300	100	2.5	32.3	77.2	1.5	1	360	130	2.4	33.5	77.9	1.3	1.2	270	80	2.6	32.2	77.2	0.6	1.2	280	90	2.6	32.3	77.5	0.5
20	1.4	140	90	2.4	42	53.5	1.7	1.3	170	120	2.1	42.9	54.2	1.3	1.5	120	70	2.5	42.2	53.5	0.4	1.4	140	90	2.4	42.2	53.5	0.32
30	1.5	120	70	1.8	45.2	43.2	1.9	1.5	140	90	1.8	46.5	44	1.4	1.6	110	60	2	45.5	43.2	0.3	1.6	130	70	1.9	45.3	43	0.25

TA: Titratable acidity, Ac: Acetaldehyde, D: Diacetyle, L: Lactose, Tyr: Tyrosine, Tryp: Tryptophan, TV: Total volatile free fatty acids. The results are the average of three replicates

meanwhile, the same samples contained a higher acidity than the others, this confirms that the acidity of these samples was not all come from fermentation of lactose but a part of which was from vegetables oils. Lactose content was 3.35% in fresh Labneh (Abu-Jdayil and Mohameed, 2002). These results somewhat different from those reported by Taha *et al.* (1997). They reported that sunflower oil didn't increase the activity of starter to produce acidity compared to olive oil.

Tyrosine and tryptophan content: It is clear from the results (Table 3a and b) that tyrosine content in all samples gradually increased as the age of the Labneh produced. Similar results were reported by Ammar El-Tahra (1995). The tyrosine contents of fresh Labneh ranged from 16.2 to 17.0 mg/100 g and increased at a variable rate to reach 45.2 to 46.5 mg/100 g after a month in refrigerator. Noticeablely, chamomile and thyme had greatest effect on soluble tyrosine content compared with control and the other samples.

As for tryptophan content, it appears that it was slightly affected by treatments, tryptophan content ranged between 93.0 and 93.5 mg/100 g at zero time and took decreasing direction with storage period to reach 43.0-44.0 mg/100 g at the end of storage period. Increases which associated aromatic oils particularly chamomile oil and thyme oil might be due to effect of them on culture activity. It is well known that therapeutic bacteria have little proteolytic ability on protein compared with yoghurt culture. These results are similar to those of Amer *et al.* (1998). Vegetable oils had negligible effect on soluble tyrosine and tryptophan content.

T.V.F.F.A content: From the same Table 3a and b, the total volatile free fatty acids (T.V.F.F.A) content were affected by substitution milk fat with vegetables, Labneh with corn and sunflower oils contained lowest quantity of (T.V.F.F.A). These findings might be back to removal goat's milk fat which possess rather high ratio of volatile fatty acids namely caproic, caprylic and capric acid whereas T.V.F.F.A which, after 30 days, were 0.7 and 0.85 in fresh Labneh and 0.25 and 0.30, with sunflower and corn oils, respectively. All used aromatic oils clearly reduced T.V.F.F.A levels, especially chamomile oil and thyme oil whether in fresh or stored Labneh. Aromatic oils decreased T.V.F.F.A but less than chamomile and thyme oils. Control samples recorded the highest T.V.F.F.A levels because of highly content of volatile fatty acids namely caproic, caprylic and capric acid. Labneh with chamomile oil samples had 1.0 and 1.4 of T.V.F.F.A at zero time and after 30 days.

Microbiological analysis

The total viable count: Microbiological properties of Labneh which was made from either goat's milk with addition some aromatic oils or replacement of milk fat with sunflower or corn oils are shown in Table 4a and b. The Total Viable Count (TVC) decreased in the presence of aromatic oils compared with replacement milk fat with vegetables oils and control. Noteworthy, both corn and sunflower oils enriched bacterial growth, this appeared by increasing in TVC in both fresh Labneh and throughout storage period, corn oil Labneh gained the greatest numbers (159×10^6) but sunflower oil samples had 149×10^6 in fresh Labneh. These findings might be due to absence the volatile free fatty acids and its antibacterial role. On the other hand, chamomile oil addition clearly decreased TVC (120×10^6) followed by thyme oil (123×10^6), fennel oil (125×10^6), black cumin oil (129×10^6) then mint oil (133×10^6) in fresh samples. Control sample recorded 142×10^6. These results probably because of the antibacterial impact of aromatic oils, during cold storing. Total viable count increased then decreased until the end to reach 105×10^6, 117×10^6, 127×10^6, 132×10^6, 133×10^6, 141×10^6, 148×10^6 and 153×10^6 for chamomile oil, thyme oil, fennel oil, black cumin oil, mint oil,

control, sunflower oil and corn oil, respectively. Al-Kadamany *et al.* (2002), reported that counts of total aerobes increased in stored Labneh at 5 and 15°C. Total aerobic mesophilic bacterial counts decreased during storage (Sahan *et al.*, 2004).

Count of lactic acid bacteria: Table 4a and b illustrate that counts of *Bifidobacterium bifidum L. acidophilus* and *St. theromphilus* increased in the presence of all aromatic oils compared with replacement milk fat with corn, sunflower oils or control. El-Nemer *et al.* (2003) confirmed that *Bifidobacterium* spp. increased in the presence of (0.4%v/v) Tolue balsam extract.

These bacteria increased during the first ten days of cold storage then decreased till the end. Addition of chamomile oil yielded the greatest numbers of lactic acid bacteria (39×10^6, 41×10^6 and 45×10^6) and (37×10^6, 37×10^6 and 34×10^6) at zero time and at the end of stage period, for *Bifidobacterium bifidum L. acidophilus* and *St. theromphilus* respectively. On the contrary, slight differences were detected between the control and vegetables Labneh samples in counts of lactic acid bacteria. Labneh with sunflower recorded the lowest lactic acid bacteria number among all samples.

Counts of *Staph. aureus*, Coliform group and spore forming bacteria (data not shown): Both of *Staph. aureus* and Coliform group were not detected whether in fresh or stored Labneh, this might be due to the efficient heat treatment of milk (95°C for 15 min) and high sanitation conditions during manufacture and storage the obtained results agreed with Ammara (2000).

Aerobic spore forming bacteria could be detected in all of examined treatments whether fresh or after storage. It's clear that the counts are close to each other. This indicates that there is a common source of these organisms and the kind of treatment was not effective on their growth, the source of these spore-forming bacteria should be the raw milk Lin *et al.* (1998). Since these organisms aren't affected by the heat treatment used in pasteurization, they survive and remain in all samples. Aromatic oils had a worthless effect on these bacteria. However, vegetable oils had not any influence on them.

Count of molds and yeasts: It is clear from Table 4a and b that molds and yeasts were not detected in Labneh with the addition of chamomile oil or thyme oil whether in fresh or stored. However, moulds and yeasts detected and counted at the end of storage period (30th day) when addition fennel, black cumin and mint oils, their counts were 7×10^2, 12×10^2 and 8×10^2, respectively. These results might be back to the antiseptic and antimicrobial effects of aromatic oils which absent in vegetables oils.

The presence of corn oil and sunflower oil produced higher numbers of molds and yeasts compared with control and other treatments, colonies of these organisms appeared after 20 days and increased to reach 22×10^2, 25×10^2 and 29×10^2 at the end of storage for the control, corn and sunflower oils, respectively. This corresponded with the high acidity that enhancing the growth of molds and yeasts which naturally occur in air. The results are online with those reported by Al-Kadamany *et al.* (2002) who stated that psychrotrophic yeasts increased in stored Labneh at 5 and 15°C. Results of this work are important to avoid chemical preservatives, Mihyar *et al.* (1997) confirmed that more than 400 mg kg^{-1} of sodium benzoate were needed to limit the counts of *S. cerevisiae Cryptococcus curvatus, Pichia farinosa, Candida blankii, Debaryomyces hansenii* and *Trichosporon brassicae* to =105 cfu/g after 14 days at 5°C; 150 and 300 mg kg^{-1} were needed for *Geotrichum candidum* and *Trichosporon cutaneum*, respectively. But 100 - >400 mg of potassium sorbate is needed to inhibit the same yeast in Labneh.

Table 4a: Microbiological analysis of Labneh made from different goat's milk treatments.

	Treatments																							
	A (control)						B (thyme oil)						C (black cumin oil)						D (Fennel oil)					
Storage period (days)	T.C	B	L.C	S.T	M.Y	Psy	T.C	B	L.C	S.T	M.Y	Psy	T.C	B	L.C	S.T	M.Y	Psy	T.C	B	L.C	S.T	M.Y	Psy
0	142	27	33	41	ND	ND	123	33	37	43	ND	ND	129	33	35	42	ND	ND	125	30	37	42	ND	ND
10	158	31	35	43	ND	ND	150	37	41	44	ND	ND	151	32	36	43	ND	ND	153	32	39	41	ND	ND
20	152	25	31	38	15	10	128	35	36	40	ND	ND	140	30	33	37	3	ND	133	30	35	39	ND	ND
30	141	22	23	28	22	15	117	32	34	35	ND	7	132	26	32	29	12	10	127	26	35	32	7	11

T.C: Total count $\times 10^6$, B: *Bidobacterium bifidium* $\times 10^6$, L.C: *Lactobacillus acidophilus* $\times 10^6$, S.T: *Streptococcus thermophilus* $\times 10^6$ M.Y: Molds and yeasts $\times 10^2$, Psy: Psychrotrophic bacteria $\times 10^2$, ND: Not detected. These results are the average of three replicates

Table 4b: Microbiological analysis of Labneh made from different goat's milk treatments

	Treatments																							
	E (mint oil)						F (chamomile oil)						G (corn oil)						H (sunflower oil)					
Storage period (days)	T.C	B	L.C	S.T	M.Y	Psy	T.C	B	L.C	S.T	M.Y	Psy	T.C	B	L.C	S.T	M.Y	Psy	T.C	B	L.C	S.T	M.Y	Psy
0	133	32	33	38	ND	ND	120	39	41	45	ND	ND	159	29	30	42	ND	ND	149	26	30	42	ND	ND
10	149	35	41	40	ND	ND	139	43	43	49	ND	ND	175	33	35	43	ND	ND	159	32	33	40	ND	ND
20	141	32	38	37	ND	ND	122	39	39	45	ND	ND	158	26	33	31	18	11	155	23	31	34	20	8
30	133	28	30	30	8	14	105	37	37	34	ND	5	153	21	24	22	25	32	148	18	22	25	29	24

T.C: Total count $\times 10^6$, B: *Bifidobacterium bifidium* $\times 10^6$, L.C: *Lactobacillus acidophilus* $\times 10^6$, S.T: *Streptococcus thermophilus* $\times 10^6$ M.Y: Molds and yeasts $\times 10^2$, Psy: Psychrotrophic bacteria $\times 10^2$, ND: Not detected. These results are the average of three replicates

Table 5a: Organoleptic properties of Labneh made from different goat's milk treatments.

Storage period (days)	Treatments															
	A (control)				B (thyme oil)				C (black cumin oil)				D (Fennel oil)			
	Flavor (60)	Body and texture (30)	Appearance (10)	Total (100)	Flavor (60)	Body and texture (30)	Appearance (10)	Total (100)	Flavor (60)	Body and texture (30)	Appearance (10)	Total (100)	Flavor (60)	Body and texture (30)	Appearance (10)	Total (100)
0	50	28	9	87	57	28	9	94	54	28	9	91	57	28	9	94
10	47	28	9	84	54	28	9	91	50	27	9	86	51	28	9	88
20	42	21	8	70	51	21	7	79	46	21	7	74	48	21	7	76
30	34	20	7	61	47	20	7	74	41	20	7	68	45	20	7	72

Table 5b: Organoleptic properties of Labneh made from different goat's milk treatments.

Storage period (days)	Treatments															
	E (mint oil)				F (chamomile oil)				G (corn oil)				H (sunflower oil)			
	Flavor (60)	Body and texture (30)	Appearance (10)	Total (100)	Flavor (60)	Body and texture (30)	Appearance (10)	Total (100)	Flavor (60)	Body and texture (30)	Appearance (10)	Total (100)	Flavor (60)	Body and texture (30)	Appearance (10)	Total (100)
0	52	28	9	89	59	28	9	96	58	27	9	94	58	27	9	94
10	48	27	9	84	58	28	9	95	55	26	9	90	55	26	8	89
20	44	21	8	73	55	22	8	85	47	20	7	72	50	20	7	77
30	40	20	7	67	50	20	7	77	43	20	7	70	45	20	5	70

Count of psychrotrophic bacteria: Since samples of Labneh were stored in refrigerator, it is necessary to detect the presence of psychrotrophic bacteria. Psychrotrophic bacteria may release heat-resistant proteases and lipases, these enzymes will not be totally inactivated and may give rise to off-flavours (Tamime, 2009). Sahan *et al.* (2004) reported that the number of psychrotrophic bacteria significantly decreased after 60 days in the samples stored at refrigeration temperature and to a smaller degree decreased in the samples stored at room temperature. From Table 4a and b, aromatic oils influenced psychrotrophic bacteria growth more than vegetable oils. These bacteria were detected in few numbers on thirtieth day of storage. Labneh with chamomile, thyme, fennel, black cumin and mint oils recorded 5×10^2, 7×10^2, 11×10^2, 10×10^2 and 14×10^2, respectively. Nevertheless, these bacteria were detected on twentieth day of cold storage and their counts increased to reach 15×10^2, 24×10^2 and 32×10^2 in control, corn and sunflower oils samples.

Organoleptic properties: Results given in Table 5a and b show the sensory evaluation of Labneh which was made with addition some aromatic oils or was made by replacing milk fat with corn oil or sunflower oil. For flavor, Labneh with chamomile oil had the highest scoring points whether in fresh or after 10, 20 and 30 days of the cold storage, it gained 59, 58, 55 and 50, respectively. Also these samples were superior and highly judged as the best flavor, followed by those was made from thyme oil which gained 57, 54, 51 and 47, followed by those made from fennel, black cumin and mint oils These findings clarify the effect of aromatic oils on disapproved flavor of goat's milk Labneh. Elimination goat's milk fat and replacement it with corn or sunflower oils also ameliorated flavor of Labneh whereas flavor of Labneh with sunflower gained 58, 55, 50 and 45 at zero, 10, 20 and 30 days, respectively, similar, corn oil gained 58, 55, 47 and 43. Both vegetables oils had no oily off-flavor and had normal appearance and consistency like other treatments.

The flavor of control samples had lowest points 50 from 60 in fresh and decreased to reach 34 in the thirtieth day of storage and was not accepted and rejected by most of the panelists. Certainly this is back to free fatty acids especially Caproic, caprylic and capric (totaling of 15% of goat milk fat).

On the other hand, differences among other properties (body and texture and appearance) were trifles.

CONCLUSIONS

Addition of aromatic oils is recommended to produce high quality Labneh from goat's milk and surmounted undesirable flavor of it with keeping and gaining medical benefit of goat's fat.

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