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# Quality and Shelf Life of Labneh as Affected by Using some Essential Oils

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## ABSTRACT

Improving the keeping quality of labneh by means of using essential oils (EO) was the objective of the present study. Cinnamon, cumin and mint oils were added separtly at level of 0.5, 1.0, and 1.5 % (v/w) to the prepared traditional labneh. Analysis of the fresh and stored labneh during 28 days of cold storage revealed that the use of EO affected with different rates chemical composition, acidity, TVFA, Tur, trpa acetaldehyde, diacetyl and total carbonyls contents of the prepared labneh. Counts of the starts culture were not adversely affected by using EO while coliform and staphylococcus bacteria as well as yeast and moulds were not detected. Organoleptically, the use of EO at 0.5 gave the best results in this respect, while 0.5 % cinnamon was recommended to improve the shelf life of labneh.

**Keywords:** Labneh, essential oils, shelf life.

## INTRODUCTION

Labneh, labaneh, lebneh, labna and other different names are synonyms for concentrated or strained yoghurt made in different regions of the world from different types of milk and microbial culture mainly for extending the shelf life of yoghurat by removing part of its water (Tamime and Robinson , 1999 ; Senel *et al*. 2011). To reach total so1lids ( TS ) around 24g/100 g of wich about 8 -11 g/ 100g is fat ( Hilali *et al*. 2011 ). This product is a semisolid dairy product of creamy white colour, a sikly body, a good spreadability and slightly pleasnt acidic taste (Tamime *et al*. 1978 a ; Tamime and Robinson, 1999 ).

Different methods were published in the literature for making labneh including the traditional one (cloth bags method), mechanical separators and UF (Tamime and Robinson , 1999 ; Nsabimana *et al*. 2005 ; Guler , 2007 ). The main drawbacks of using the traditional method are the unhygienic conditions during the long time required for draining whey from the curd wich affect the quality and reduce the shelf life of the product (Nsabimana *et al*. 2005).

Some trials were given to improve the quality and the use of essential oils (EO) in this respect is quite important since such oils have antimicrobial effect and can be used as flavouring materials (EL-Nawawy *et al*. 1998 ; Burt 2004 ; Khaleel, 2000). Ismail *et al*. (2006) attributed such antimicrobial effect of EO to presence of phenols and polypeptides. Only 7 -10 days in refrigerator are recommended for labneh (Yamani and Abu-Jaber, 1994) while some preservatives such as benzoate and sorbets were also recommended to prevent spoilage due to most of microorganisms (Mihyar *et al*. 1999). However, applying the new techniques is suitable way to produce a good quality labneh with longer shelf-life.

In the present study some EO (Cinnamon, cumin and mint) were used aiming to control the growth of undesirable microorganisms responsible for reduction the shelf-life of labneh. Impact of using such EO on composition, microbiological quality and sensorial attributes of labneh were also taken into consideration.

## MATERIALS AND METHODS

Fresh cow's milk was adjusted to contain to 14% total solids (TS) using an American SMP and used in making labneh as described by Tamime and Robinson, (1999). Tradational yoghurt starter was used for fermentation while cloth bags were used to drain whey from the curd. Salt (0.5%) was mixed with the homogenous curd, whereas EO was added separately with 0.001% Tween-80 to give the treated samples. The control labneh as well as the treated samples (0.5, 1.0 and 1.5% from each EO) were packed into plastic containers and stored as 5 ± 1ºc for 24 days. The samples were taken when fresh and after 8, 16 and 24 days of storage for analysis. Chemical analysis including TS, fat and protein as well as acidity was carried out as given by ling (1963). Acetaldehyde and diacetyl content were measured (Lees and Jago (1969) while the method of Kosikowski (1982) was followed for determination of Total volatile fatty acids (TVFA). Soluble tyrosine (Tyr) and soluble tryptophan (trp) were measured as given by Vakaleris and Price (1959). While the procedure of Berry and Mckerrigan (1995) was followed for measuring carbonyl compounds.

All samples were microbiologically analysed for total bacterial count (APHA,1978) and counts of coliform yeasts and moulds as well as count *Streptococcus thermophilus and Lactobacillus delbrueckii ssp. Bulgaricus* (Marshall.1992). Phosphate buffer (pH 7.2) was used as a diluent except for enumeration of lactic acid bacteria where peptone water (0.1 ml/100 ml) was used. Violet red bile agar was used to check presence of presumptive coliform after incubation of plates at 32 ºC used to check presumptive coliform after incubation of plates at 32˚c for 24 h.

MSA medium (DIFCO, 1974) was used for counting *staphylococc*i while plate count agar was used for yeasts and moulds. *S. thermophilus* was enumerated on M17 selective agar medium as described by Krusch *et al*., (1987) while *L. delbrueckii* ssp. *bulgaricus* was enumerated on MRS agar medium as described by Gruev (1982). Thesis analyses are important from the microbiological point of view.

Flavour, consistency and appearance were evaluated according to Amer *et al*., (1997). to give clear picture for the organoleptic properties.

Statistical analysis was done according to SPSS (1998). Three replicates were carried out to be used in calculating average ± SE.

## RESULTS AND DISCUSSION

Analysis of the fresh and stored labneh (Table1) revealed that the maximum TS content (23.60%) was recorded for the fresh labneh treated with 1.5% cinnamon. This was followed by 23.50% given for the fresh labneh made using 1.5% mint, while the lowest TS content (23.45%) was recorded when 1.5% cumin was used. such trend of results was also noticed in the stored labneh while the values are in the range given by Tamime (1978 a and b) and Mehaia

and El Khadragy (1999) being 22-26%. Loss of some moisture during storage was responsible for the recorded increase in TS during storage of all labneh samples. In general, TS, FDM and protein contents were not affected (P≤0.05) by treatment with EO. This agrees with the finding of Mutlage and Hassan (2008) who mentioned that no differences were recorded in TS and FDM of labneh made using EO. The resulted of protein are in agreement with those published by Mutlage and Hassan (2008) who mentioned that protein content of labneh made using the prementioned EO significantly increased during storage period. However, as shown in Table (1) the maximum protein contents (12.02-12.08%) were given for labneh containing 1.5% of cumin or cinnamon.

It is well known importance of acidity in determining the keeping quality of any food. In the present study acidity of labneh (Table 1) was affected by using EO and advancing storage period. Labneh containing 0.5% cumin or cinnamon had the maximum acidity suggesting the enhancing impact of the used EO on the starter culture used in making labneh this agrees with the conclusion given by Abou-Dawood (2002), while the differences of acidity and pH should be taken into consideration in this respect (Guler, 2007 ; Senel *et al.,* 2011).

**Table 1. Chemical composition (%), acidity (%) of fresh and stored labneh as affected by using different essential oils.***

| Property | Storage period (days) | Control | Essential oil additions (%) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Mint | | | Cumin | | | Cinnamon | | |
| | | | 0.5 | 1.0 | 1.5 | 0.5 | 1.0 | 1.5 | 0.5 | 1.0 | 1.5 |
| Total Solids | 0 | 23.30 ±3.37d | 23.40 ±3.35c | 23.45 ±3.46 b | 23.50 ±3.43 a | 23.35 ±3.23 c | 23.40 ±3.96 b | 23.45 ±3.74 a | 23.40 ±3.78 c | 23.45 ±3.46 b | 23.60 ±3.53 a |
| | 8 | 23.40 ±3.45d | 23.45 ±3.69 c | 23.50 ±3.47 b | 23.55 ±3.59A | 23.40 ±3.74 b | 23.50 ±3.46a | 23.50 ±3.19a | 23.50 ±3.46b | 23.50 ±3.78 b | 23.60 ±3.65a |
| | 16 | 23.50 ±3.75c | 23.53 ±3.78 b | 23.55 ±3.56 b | 23.60 ±3.45 a | 23.50 ±3.29 c | 23.55 ±3.28 b | 23.60±3.3 8 a | 23.60 ±3.36b | 23.55 ±3.26 c | 23.65 ±3.24 a |
| | 24 | 23.55 ±3.18c | 23.60 ±3.45 b | 23.60 ±3.45 b | 23.65 ±3.78 a | 23.60 ±3.25 b | 23.65 ±3.16 a | 23.65±3.4 5 a | 23.70 ±3.86 a | 23.60 ±3.28 b | 23.70 ±3.47 a |
| Acidity | 0 | 1.40 ±0.08d | 1.47 ±0.11c | 1.45 ±0.12b | 1.48 ±0.13A | 1.46 ±0.11b | 1.50 ±0.10a | 1.45 ±0.14B | 1.51 ±0.15b | 1.55 ±0.12c | 1.49 ±0.11a |
| | 8 | 1.57 ±0.11a | 1.57 ±0.13a | 1.51 ±0.14b | 1.57 ±0.12A | 1.50 ±0.10a | 1.51 ±0.11a | 1.46 ±0.08B | 1.55 ±0.14b | 1.58 ±0.12a | 1.53 ±0.14c |
| | 16 | 1.59 ±0.10a | 1.59 ±0.12a | 1.55 ±0.11b | 1.59 ±0.14A | 1.53 ±0.15b | 1.59 ±0.16a | 1.50 ±0.16C | 1.59 ±0.14b | 1.61 ±0.13a | 1.55 ±0.12c |
| | 24 | 1.60 ±0.08a | 1.60 ±0.17a | 1.55 ±0.18b | 1.59 ±0.14B | 1.65 ±0.16a | 1.62 ±0.15b | 1.53 0.14C | 1.65 ±0.16a | 1.64 ±0.12a | 1.60 ±0.18b |
| F/DM | 0 | 35.57 ±1.18c | 35.68 ±1.08b | 35.62 ±1.14 b | 36.05 ±1.12A | 35.95 ±1.17b | 35.95 ±1.18b | 36.05 ±1.28a | 36.00 ±1.15b | 35.85 ±1.24c | 36.25 ±1.21a |
| | 8 | 35.60 ±1.24d | 35.77 ±1.23c | 36.22 ±1.16b | 36.32 ±1.25 a | 36.05 ±1.24 b | 36.05 ±1.42b | 36.65 ±1.28a | 36.33 ±1.25c | 36.45 ±1.28 b | 36.72 ±1.27 a |
| | 16 | 35.69 ±2.08d | 36.00 ±2.11 c | 36.32 ±1.25b | 36.50 ±1.35A | 36.52 ±1.36c | 36.65 ±1.28 b | 36.85 ±2.08 a | 36.37 ±2.05 c | 36.67 ±2.04 b | 36.75 ±2.06 a |
| | 24 | 35.80 ±2.18d | 36.15 ±2.24 c | 36.57 ±2.47b | 36.75 ±2.36A | 36.62 ±2.65 c | 36.85 ±2.84 b | 37.00 ±2.45 a | 36.70 ±2.56 c | 36.77 ±2.38 b | 37.05 ±2.75 a |
| Protein | 0 | 11.12 ±0.08d | 11.28 ±0.08c | 11.50 ±0.08 b | 11.51 ±0.08A | 11.21 ±0.08c | 11.52 ±0.08b | 12.28 ±0.08 a | 10.87 ±0.08c | 11.25 ±0.08 b | 11.69 ±0.08 a |
| | 8 | 11.17 ±1.18d | 11.33 ±1.11c | 11.57 ±1.23 b | 11.61 ±1.43A | 11.24 ±1.22c | 11.65 ±1.23b | 12.01 ±1.24a | 11.27 ±1.42 c | 11.34 ±1.28 b | 11.80 ±1.28a |
| | 16 | 11.27 ±1.48d | 11.37 ±1.24 c | 11.61 ±1.25 b | 11.62 ±1.28A | 11.28 ±1.26c | 11.69 ±1.23b | 12.17 ±1.34a | 11.47 ±1.53 c | 11.60 ±1.43 b | 12.05 ±1.28 a |
| | 24 | 11.33 ±2.11d | 11.37 ±1.18c | 11.68 ±1.23b | 11.71 ±2.24A | 11.41 ±1.16c | 11.75 ±1.14b | 12.02 ±1.15 a | 11.43 ±1.19c | 11.80 ±1.22 b | 12.08 ±1.34 a |

*** Means ±SE with different letters in the same row different significantly (P ≤ 0.05).**

In agreement with the resulted given by Ragab (2002), TVFA content was significantly affected by type and amount of EO used (Tble2). The control labneh had the lowest values in this respect, while the highest concentration of any EO used decreased TVFA content in fresh or stored labneh that may be due to the inhibitory action of EO on the responsible lipolytic bacteria. However, a gradual increase-with different rates-was recorded during storage. This may be due to lipolysis of milk fat with advancing storage period. The corresponding proteolysis during storage all labneh samples was also responsible for the recorded increase in Tyr and Trp. contents (Table 2). This agrees with the results given by Amer *et al*., (1997). However, it seems from Table (2) that labneh treated with cinnamon oil had the highest Tyr and Trp. content when compared with the other EO used. This was true in fresh or stored labneh.

Data presented in Table (3) showed that fresh and stored labneh treated with EO cinnamon had the highest acetaldehyde and diacetyl contents this was followed by that made with cumin oils. The values increased to reach maximum at the end of storage in all treatments. While their concentrations can differ depending on the medium composition, and the specific activity of the bacteria and their enzymes. Degradation of lactose is the main pathway in this respect (Gonzalez *et al.,* 1994) causing aroma required for good quality of product (Helland *et al*., 2004).

Concerning total carbonyl compounds, it is obvious that labneh treated with cinnamon oils had higher content than labneh from the other treatments throughout storage period the recorded values increased. This agrees with Hassan *et al.* (2001).

**Table 2. Influence of essential oils on total volatile fatty acids (TFVA) soluble tyrosine (Tyr) and soluble tryptophan (Trp) in fresh and stored Labneh.**

| Treatments | | TFVA (mL 0.1 N NaOH/100 g labneh) | | | | Tyr (mg/100 g labneh) | | | | Trp (mg/100 g labneh) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Storage period (days) | | | | | | | | | | | |
| | | zero | 8 | 16 | 24 | Zero | 8 | 16 | 24 | zero | 8 | 16 | 24 |
| Control | | 8 ±1.12d | 10 ±1.13c | 20 ±1.78b | 22 ±1.98b | 22.6 ±1.88B | 28.1 ±2.10 b | 30.2 ±2.11 b | 31.8 ±2.18 c | 20.1 ±1.98 d | 21.4 ±1.78 d | 24.2 ±1.23d | 31.5 ±1.18d |
| Mint (%) | 0.5 | 16 ±1.19a | 18 ±1.22a | 22 ±1.32a | 24 ±1.45a | 16.7 ±1.56C | 17.6 ±1.67d | 18.5 ±1.78 c | 29.1 ±2.18 d | 22.6 ±1.38 c | 24.1 ±1.28 c | 25.3 ±1.12c | 30.3 ±1.11c |
| | 1.0 | 14 ±1.12b | 16 ±1.18b | 20 ±1.19b | 22 ±1.28b | 22.2 ±1.30B | 24.8 ±1.48c | 30.2 ±2.11 b | 33.9 ±2.28 b | 25.2 ±2.18 b | 24.6 ±1.48 b | 28.3 ±1.32b | 34.4 ±1.23b |
| | 1.5 | 12 ±1.14c | 14 ±1.16c | 18 ±1.23c | 20 ±1.45c | 30.6 ±1.56A | 32.1 ±1.78 a | 36.2 ±2.18 a | 39.8 ±2.48 a | 28.1 ±1.68 a | 25.4 ±1.45 a | 29.2 ±1.43a | 37 ±1.12a |
| Cumin (%) | 0.5 | 15 ±1.14a | 18 ±1.15a | 20 ±2.11a | 25 ±2.18a | 27 ±2.12C | 29 ±2.15c | 30 ±2.19 c | 34 ±2.38 c | 32 ±2.28 c | 33 ±2.18c | 35 ±2.14c | 36 ±2.14c |
| | 1.0 | 14.0 ±1.68b | 16.0 ±1.88 b | 18.0 ±2.08 b | 22.4 ±2.11 b | 34.8 ±2.21B | 36.0 ±2.22 b | 36.8 ±2.28 b | 38.2 ±2.48 b | 38.0 ±2.38 b | 32.0 ±2.08b | 37.6 ±2.11c | 40.0 ±2.10b |
| | 1.5 | 12 ±1.11 c | 14.0 ±1.15 c | 16.6 ±1.22 c | 18.4 ±1.33 c | 51. 2 ±4.15A | 58.6 ±4.23 a | 60.8 ±4.38 a | 66.0 ±4.58 a | 40.2 ±3.38 a | 41.8 ±2.68a | 42.0 ±2.08a | 45.2 ±2.11a |
| Cinnamon (%) | 0.5 | 20 ±1.13 a | 22 ±1.16 a | 24 ±1.19 a | 26 ±1.22 a | 34 ±1.58 C | 37 ±1.68 c | 38 ±1.78 c | 26 ±1.22 c | 48.7 ±1.98 c | 50 ±1.77c | 52 ±1.68c | 53 ±1.44c |
| | 1.0 | 19.10 ±1.14 b | 20.3 ±1.28 b | 22.2 ±1.38 b | 24.0 ±1.48 b | 40.8 ±1.58 B | 49.4 ±1.18 b | 56.2 ±3.25 b | 34.8 ±1.18 b | 50.4 ±3.18 b | 52.6 ±3.12 b | 53.0 ±1.78 b | 55.6 ±1.68b |
| | 1.5 | 18.2 ±1.28 c | 19.0 ±1.38 c | 20.0 ±1.48 c | 22.4 ±1.68 c | 62.3 ±4.28 A | 74.0 ±4.58 a | 76.8 ±4.68 a | 78.0 ±4.88 a | 52.3 ±3.78 a | 53.2 ±3.58 a | 55.8 ±2.71 a | 60.6 ±2.38 a |

**Means ±standard error. a, b, c Means within the same column with different letters are significantly different ($P \leq 0.05$).**

**Table 3. Influence of EO on acetaldehyde (A) diacetyl (B) and total carbonyl compounds (C) in Labneh during storage period.**

| Treatments | | A(µm/100 gm labneh) | | | | B(µm/100 gm labneh) | | | | C(µmol/100 g labneh) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Storage period (days) | | | | | | | | | | | |
| | | zero | 8 | 16 | 24 | zero | 8 | 16 | 24 | zero | 8 | 16 | 24 |
| Control | | 250 ±8.12d | 255 ±723d | 258 ±622b | 260 ±5.82d | 118 ±4.11d | 116 ±4.02d | 100 ±3.52d | 95 ±2.82d | 48.00 ±6.12d | 52.96 ±5.92d | 68.22 ±5.78b | 116.08 ±6.42d |
| Mint (%) | 0.5 | 320 ±8..96c | 325 ±7..89c | 330 ±6.82c | 342 ±9.12C | 124 ±412c | 120 ±4.12c | 118 ±3.62c | 110 ±2.92c | 62.21 ±3.10c | 65.49 ±3.32c | 70.0 ±3.52c | 165.23 ±5.32c |
| | 1.0 | 345 ±5.22b | 348 ±6.32b | 350 ±7.42b | 352 ±8.32B | 126 ±4.12b | 122 ±4.22b | 120 ±3.82b | 115 ±3.02b | 158.00 ±6.12d | 168.14 ±6.22b | 262.0 ±8.32b | 290.82 ±9.12b |
| | 1.5 | 350 ±5.42a | 355 ±6.62a | 358 ±7.52a | 360 ±8.42a | 128 ±4.62a | 126 ±4.52a | 123 ±3.92a | 120 ±3.52a | 268.00 ±7.32a | 352.96 ±8.52a | 348.22 ±9.42a | 356.08 ±10.12a |
| Cumin (%) | 0.5 | 330 ±5.12c | 335 ±6.02c | 340 ±7.12c | 408 ±9.02C | 126 ±4.32c | 118 ±4.22c | 115 ±3.52c | 112 ±3.62c | 70.22 ±2.52c | 84.36 ±2.72c | 98.07 ±2.92c | 168.80 ±3.02c |
| | 1.0 | 332 ±4.12b | 340 ±5.42b | 348 ±6.32b | 412 ±9.22B | 127 ±4.42b | 120 ±4.32b | 118 ±3.62b | 115 ±3.72b | 182.00 ±5.42b | 194.00 ±5.52b | 269.08 ±6.02b | 280.14 ±6.12b |
| | 1.5 | 341 ±4.52a | 448 ±6.42a | 456 ±9.12a | 460 ±10.02a | 128 ±4.62a | 126 ±4.52a | 120 ±3.72a | 119 ±3.82a | 278.92 ±7.72a | 377.08 ±9.52a | 382.0 ±10.02a | 388.76 ±11.12a |
| Cinnamon (%) | 0.5 | 385 ±3.92c | 390 ±4.22c | 395 ±4.82c | 400 ±5.02C | 130 ±4.72c | 128 ±4.62c | 125 ±4.42c | 122 ±4.32c | 80.46 ±3.32c | 85.73 ±3.42c | 88.24 ±3.52c | 188.90 ±5.02c |
| | 1.0 | 418 ±4.22b | 425 ±4.62b | 430 ±4.82b | 448 ±5.12B | 133 ±5.02b | 130 ±5.12b | 126 ±4.42b | 124 ±4.32b | 195.11 ±6.22b | 220.18 ±6.42b | 272.62 ±5.42b | 304.11 ±5.72b |
| | 1.5 | 420 ±4.19a | 430 ±4.72a | 440 ±4.92a | 450 ±5.42a | 136 ±5.22a | 132 ±5.12a | 130 ±4.82a | 127 ±4.52a | 285.01 ±7.42a | 380.41 ±9.52a | 401.32 ±9.72a | 495.11 ±9.82a |

**Means ±standard error. a, b, c Means within the same column with different letters are significantly different ($P \leq 0.05$).**

Microbiological analysis shown in Table (4) reveals that total bacterial count (TBC) decreased with EO compared with the untreated samples. This finding may be due to antibacterial effect of EO. On the other hand, TBC increased up to the 8th days of storage and then decreased in the control sample, while in the treated labneh the TBC ranged from 60 - 81 *Log* cfu/g for labneh treated with 0.5% and 1.5% of mint and cumin oils, respectively. Sahan *et al.*, (2004) report that, the total aerobic bacteria counts decreased during the storage. Count of *S. thermophilus* and *Lactobacillus delbrueckii* ssp. *bulgaricus* increased gradually up to 8th day of storage in all labneh samples and then decreased thereafter. The highest count of *S. thermophilus* was obtained for labneh treated with 0.5 and 1.0 % of mint and cumin oil on the 8th day of storage, while the lowest counts were observed for labneh containing cinnamon oil (Table 4). In the case of *Lactobacillus delbrueckii* ssp. *bulgaricus*, the highest count was obtained from labneh treated with 0.5 % of mint on the 8th day of storage (68 *Log* cfu/g), while the lowest count (16 log cfu/g) was observed in labneh treated with 1.5% of cinnamon oil at the end of storage (Table 4).

Our results showed that these bacteria increased at the beging of storage and decreased after that while such bacteria were not affected by low concentrations of the used EO, In the literature, addition of some EO to yoghurt and it is related products had enhancing impact on lactic acid bacteria (Abou Ayana and Gamal El Deen, 2011). Moreover El- Khaleel, (2000) mentioned that presence of some herbs, increased the

counts of yoghurt starter compared to untreated samples. Coliform and *Staph. aureus* were, not detected in all labneh prepared with EO. Burt, (2004) found that EO contain phenolic compounds that are responsible for their antimicrobial properties. Yeasts and moulds were not also detected in labneh containing EO (Table 4). Mutlag and Hassan (2008) and Manso *et al.*, (2013) supported our results. Yeasts and moulds were detected only in the control, samples of 16 days old. However, Mihyar *et al.*, (1999) reported that sodium benzoate are needed to control of yeast and moulds . This by its turn not good for the consumer.

**Table 4. Total bacterial counts, and counts of yeasts and moulds, *Streptococcus* and *Lactobacillus (Log CFU/g)* of labneh during 24 days**

| | Storage period (days) | Control | Essential oil additions (%) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Mint | | | Cumin | | | Cinnamon | | |
| | | | 0.5 | 1.0 | 1.5 | 0.5 | 1.0 | 1.5 | 0.5 | 1.0 | 1.5 |
| Total bacterial counts | 0 | 95±1.72a | 90±1.42b | 90±1.52b | 82±1.92 d | 88 ±1.22a | 77 ±1.62b | 44±1.12c | 66±1.12a | 44±1.12b | 33±1.12c |
| | 8 | 110±1.92a | 95±1.62b | 86±1.92c | 72±1.92d | 98±1.42a | 80±1.62b | 40±1.12c | 56±1.12 a | 40±1.12b | 25±1.02c |
| | 16 | 98±1.82a | 91±1.62b | 92±1.72 b | 88±1.82d | 92 ±1.62a | 87±1.52b | 42±1.12c | 60±1.12a | 50 ±1.12b | 28±1.14c |
| | 24 | 92±1.62a | 80±1.72b | 90 ±1.82c | 86 ±1.92d | 85±1.62a | 75±1.42b | 50±1.12c | 70±1.12a | 60±1.12b | 35±1.18c |
| Yeasts and moulds | 0 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| | 8 | ND | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| | 16 | 9±1.82 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| | 24 | 17±1.12 | ND | ND | ND | ND | ND | ND | ND | ND | ND |
| *Streptococcus* | 0 | 68±2.82d | 60±2.72 a | 50±2.62b | 32±2.62 c | 58±2.82a | 47±2.72b | 30 ±2.22c | 40 ±2.12a | 30±2.12b | 27±2.32c |
| | 8 | 98±2.92a | 72±2.63 a | 56±1.72b | 42±2.72 c | 68±2.62a | 50±2.82b | 40±2.62c | 55 ±2.82a | 45±2.92b | 35 ±2.72c |
| | 16 | 78±2.82b | 61±2.25 a | 42±1.42b | 32±2.62c | 52±2.52a | 35±2.72b | 30±2.82c | 50±2.52a | 30±2.62b | 28±2.92c |
| | 24 | 62±2.72d | 50±2.49A | 31±1.22b | 26±2.82c | 45±2.62a | 25±2.82b | 25±2.92c | 40±2.82a | 20±2.82b | 18±2.72c |
| *Lactobacillus* | 0 | 74±1.98a | 68±2.88A | 54±1.42 b | 41 ±2.62c | 55 ±2.72a | 50±2.62b | 38±2.82c | 48±2.62a | 44±2.72b | 32±2.92c |
| | 8 | 68±2.72b | 61±2.72a | 48±1.52 b | 36±2.72 c | 50 ±2.62a | 45 ±2.72b | 32 ±2.72c | 45±2.52a | 41±2.82b | 28±2.42c |
| | 16 | 65±2.72c | 51±2.812 a | 41±1.32b | 30±2.62c | 47±2.72a | 36±2.82b | 25±2.62c | 36±2.72a | 32±2.92b | 22±2.82c |
| | 24 | 58±2.42d | 46 ±2.62a | 37±1.62 b | 25±2.52c | 40±2.82a | 30±2.92b | 20±2.72c | 34±2.82a | 26±2.72b | 16±2.92c |

**ND ,Not Detected. Means ±standard error. a, b, c Means within the same row with different letters are significantly different (P ≤0.05).**

**Organoleptic properties: -**

Concerning the organoleptic properties (Table 5) revealed that the highest scores were recorded for labneh treated with 0.5% EO till the end of storage and decreased with the corresponding an increase in the concentration of the used Eo. The untreated labneh till the 16 days of storage had the lowest scores while decreased also after that. However, the total scores decreased gradually on storage. The control and labneh samples of 1.5% EO had the lowest points in this respect and decreased at the end of storage period. There were differences *(P*≤0.05) in the samples treated with EO as compared with the untreated control. This agrees with Ismail, *et al.*, (2006).

**Table 5. Organoleptic evaluation of fresh and stored labneh**

| Properties | Storage period (days) | Control | Essential oils (%) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Mint | | | Cumin | | | Cinnamon | | |
| | | | 0.5 | 1.0 | 1.5 | 0.5 | 1.0 | 1.5 | 0.5 | 1.0 | 1.5 |
| Flavour (60) | 0 | 50±1.12b | 54±1.12a | 54±1.12a | 48±1.12b | 54±1.12a | 54 ±1.12a | 48±1.12b | 54±1.12a | 54±1.12a | 48±1.12b |
| | 8 | 45±1.12 c | 50±1.12b | 52±1.12a | 46±1.12c | 50±1.12b | 52 ±1.12a | 46±1.12c | 50±1.12b | 52±1.12a | 46±1.12c |
| | 16 | 48±1.12a | 48±1.12a | 48±1.12a | 42±1.12b | 48±1.12a | 48 ±1.12a | 42±1.12b | 48±1.12a | 48±1.12a | 42±1.12b |
| | 24 | 40±1.12b | 41±1.12a | 38±1.12c | 36±1.12d | 41±1.12a | 38 ±1.12c | 36±1.12d | 41±1.12a | 38±1.12c | 36±1.12d |
| Consistency (30) | 0 | 22±1.12d | 25±1.12a | 24±1.12b | 23±1.12c | 25±1.12a | 24 b±1.12 | 23±1.12c | 25±1.12a | 24±1.12b | 23±1.12c |
| | 8 | 20±1.12c | 22±1.12b | 23±1.12a | 22±1.12b | 22±1.12b | 23 ±1.12a | 22±1.12b | 22±1.12b | 23±1.12a | 22±1.12b |
| | 16 | 18±1.12b | 18±1.12b | 19±1.12a | 18±1.12b | 18±1.12b | 19 ±1.12a | 18±1.12b | 18±1.12b | 19±1.12a | 18±1.12b |
| | 24 | 16±1.12a | 16±1.12a | 16±1.12a | 15±1.12b | 16±1.12a | 16 ±1.12a | 15±1.12b | 16±1.12a | 16±1.12a | 15±1.12b |
| Appearance (10) | 0 | 7±1.10c | 8 ±1.17b | 8±1.19b | 8±1.18b | 8±1.19b | 8±1.19 b | 8±1.16b | 9±1.17a | 9 ±1.18a | 9±1.19a |
| | 8 | 5±1.11c | 7±1.19b | 7±1.18b | 7±1.16b | 7±1.15b | 7 ±1.16b | 7±1.17 b | 8±1.18a | 8±1.19 a | 7±1.18 b |
| | 16 | 5±1.16c | 6±1.17 b | 6±1.15b | 6±1.16 b | 6±1.14b | 6 ±1.15b | 5±1.19c | 7±1.17 a | 6±1.18 b | 6±1.16b |
| | 24 | 4±1.17c | 5±1.16b | 5±1.18b | 5±1.17b | 5±1.18b | 5 ±1.19b | 5±1.17b | 6±1.19a | 5±1.18 b | 5±1.19b |
| Total (100) | 0 | 79±3.17d | 87±3.19b | 86±3.19c | 79±3.22d | 87±3.42b | 86±4.62c | 79±4.92d | 88±4.22a | 87±4.72b | 80±4.32d |
| | 8 | 72±3.18d | 81±3.17 a | 79±3.16b | 74±3.72c | 81±3.72a | 79 ±1.42b | 74±3.72c | 81±3.42a | 79±3.82b | 74±3.72c |
| | 16 | 71±3.19 a | 71±3.18a | 69±3.13b | 65±3.82 c | 71±3.42 a | 69 ±3.72b | 65±3.52 c | 71±3.72a | 69±3.72b | 65±3.82c |
| | 24 | 61±3.16a | 61±3.18a | 58±3.15b | 55±3.12c | 61±3.32a | 58 ±3.82b | 55±3.62c | 61±3.82a | 58±3.62b | 55±3.92c |

**Means ±standard error. a, b, c Means within the same row with different letters are significantly different (P ≤ 0.05).**

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## تحسين وجوده و قوه حفظ اللبنة باضافه بعض الزيوت العطرية

**رشاد إبراهيم الأحول ، صلا على النبي إبراهيم و حامد السيد حاتم**

**معهد بحوث الإنتاج الحيواني**

الهدف من هذه الدراسة هو أطاله مده حفظ اللبنة باضا فه الزيوت العطرية ودراسة مدى تأثيرها على التركيب الكيماوي والجودة الميكروبيولوجية والبادئ و الخواص الحسيه خلال فتره التخزين. حيث تم أضافه الزيوت العطرية القرفة و الكمون و النعناع بنسبه 5, -1 -1,5 نسبه مئوية للمنتج النهائي . أظهرت النتائج أن استخدام الزيوت العطرية لم تؤثر على الجوامد الصلبة الكلية و الدهن على المادة الصلبة و البروتين في حين كانت الزيادة تدريجيه خلال فتره التخزين كما زادت الحموضة تدريجيا خلال فتره التخزين. بينما الأحماض الدهنية الكلية الطيارة انخفضت بزيادة تركيز الزيوت العطرية في حين زادت خلال فتره التخزين. بينما زاد كلا من التيروزين و التربتوفان بزيادة نسبه الزيت العطري في حين زاد التيروزين خلال فتره التخزين في حين انخفض التربتوفان .وكانت أعلى نسب التيروزين و التربتوفان لزيت القرفة مقارنه بباقي المعاملات و الكنترول. بينما زادت الاسيتالدهيد و مركبات الكربونيل بزيادة نسب الزيت العطري و كذلك خلال فتره التخزين.في حين انخفض نسبه الداى اسيتيل خلال فتره التخزين في حين زادت بزيادة النسبة المضافة من الزيت وكانت أفضل زيت هو زيت القرفة أعطى اعلي نسبه من الداى اسيتيل. العدد الكلى البكتيري انخفض بزيادة نسبه الزيت العطري مقارنه بالكنترول في حين زاد العدد الكلى حتى اليوم الثامن ثم انخفض تدريجيا حتى نهاية فتره التخزين. بينما في المعاملة بزيت القرفة لم يتواجد اى فطريات أو خمائر مقارنه بباقي المعاملات و الكنترول. اظهر التحكيم الحسي أفضليه اللبنة المضاف إليها الزيت العطري مقارنه بالكنترول وكانت أفضل نسبه هي 5,% لزيت القرفة.