

## POTENTIAL OF MAKING LABNEH FORTIFIED WITH DIFFERENT TYPES OF BASIL AND FENNEL OF HEALTHY BENEFITS

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### ABSTRACT

The aim of this study was to investigate the influence of different types of herbs on chemical, microbiological, and organoleptic properties of labneh during one month of storage. Results showed that no differences in chemical composition between treatments for T.S, protein, fat, and acidity. Labneh with green fennel recorded the highest calcium, iron and potassium contents while green basil samples recorded the highest magnesium content. Folate content of the labneh fortified with green fennel and fennel powder were ( 76 and 72.7  $\mu\text{g}/100\text{g}$ ), respectively, being the highest content of folate in all treatments. Moreover, vitamin A was found to be high in both green fennel and basil oil samples (175 and 177  $\mu\text{g}/100\text{g}$ ). Adding basil oil and fennel powder increased the total unsaturated fatty acids. Lactic acid bacteria ( LAB ) counts increased during the storage period in all treatments. LAB, proteolytic and mould and yeast counts were affected by the addition of herbs, while lipolytic and coliform organisms were not detected in fresh and stored labneh. The sensorial scores of the labneh samples were influenced by the kind of herb added and the storage time. Addition of green fennel and fennel powder to labneh obtained in the highest scores. As general, some types of herbs can be used as a natural preservatives to increase the shelf life of labneh up to 4 weeks of storage at 7 °C with good flavour.

**Keywords:** labneh, preservatives, basil fennel, shelf life

### INTRODUCTION

Concentrated yoghurt, popularly known as labneh in the Middle East (Abou-Donia, 2004). It is a white creamy paste that has a smooth texture, with a taste crossing between sour cream and cottage cheese. Also, it should not be dry or grainy without wheying off. The flavour and consistency of the end product of labneh differ due to the type of milk, the fermenting organisms and the manufacturing method used (El-Samragy *et al.* 1988a, 1988b, Tamime *et al.* 1991 and Abou-Donia *et al.* 1992). Herbs are excellent sources of vitamins, minerals and biologically active compounds for human nutrition (Kidmose *et al.* 2001), and it may provide a health benefit for human and protect him against diseases. Basil is widely used in cooking for its culinary attributes (Hicham *et al.* 2009). Basil is useful for preventing hyperlipidemia, cardiovascular diseases and lower cholesterol (LDL). In addition, basil decreases the occurrence of platelet aggregation and experimental thrombus in mice (Tohti, *et al.* 2006). It is traditionally used for supplementary treatment of stress, asthma and diabetes in India (Duke, James A 2008). Basil is also a good source of magnesium, which promotes cardiovascular health by prompting muscles

and blood vessels to relax, thus improving blood flow and lessening the risk of irregular heart rhythms or spasming of the heart muscle or blood vessel ( Ensminger AH and Esminger M 1986 ). Basil is a good source of vitamin A, which helps to prevent damage of the cells by free radicals. V .A also prevents free radicals from oxidizing cholesterol in the blood stream, preventing the cholesterol from building up in the blood vessels ,initiating the development of atherosclerosis whose end result can be a heart attack or stroke. Basil has shown antioxidant and antimicrobial activities due to its phenolic and aromatic compounds (Gutierrez,*et al* 2008). In addition to the health benefits and nutrients described above , basil also is a very good source of iron , calcium, and a good source of potassium and vitamin C (Musa Ozcan 2005). Scientific studies have established that compounds in basil oil have potent antioxidant , anticancer, antiviral and antimicrobial properties ( Bozin *et al.*2006). Essential oil of basil , obtained from its leaves inhibit several species of pathogenic bacteria (Abdullah *et al* 2008 ). Also fennel is an excellent source of vitamin c and a very good source of fiber, folate and potassium(Ensminger AH ,*et al* 1983) . The bulb , foliage and seeds of the fennel plant are widely used in many of the culinary traditions of the world . Fennel has been shown to have antioxidant and antibacterial activities (Ruberte *et al* 2000 ). The volatile oil is used as bactericidal and antifungal, and has been shown to be effective against *Staphylococcus aureus* and *Candida albicans*. (Itir Dadalioglu and Gulsun A. E. 2004) and is also needed for the proper function of immune system (Guidip Singh *et al* 2006),fennel is recommend for prevention of cancer (Bharat B.2006). The aim of this work was the use of herbs and their essential oils to try develop labneh preservatives and to extent its shelf life .

## **MATERIALS AND METHODS**

Buffalo milk was obtained from the Dairy Technology Unit ,Animal production Research Institute.

Yoghurt culture containing (*Streptococcus thermophilus* and *Lactobacillus delbrueckii sub sp bulgaricus*) was obtained from Chr. Hansens Lab. Copenhagen, Demark.

Two types of herbs and their essential oils namely green basil , basil oil , fennel powder and green fennel were purchased from local market ( Cairo , Egypt ).

Labneh was made by the traditional method as described by EL-Samargy.(1988 a ana b). The labneh curd was divided into five batches, the first batch :used as control ( with out additives ), to the second batch : 2 % green basil ( I ) was added , the third batch : 0.3 % basil oil ( II ) was added , the fourth batch : 1 % fennel powder ( III ) was added , and the fifth batch : 3% fresh fennel (IV ) was added, then they mixed well, salt was added at 0.5 % and mixed well, packed in a plastic container(each 100 g), and stored at 7 °C for four weeks. Microbiological , chemical and organoleptic analysis were carried out on labneh samples when fresh and evry week up to four weeks . Treatments were replicated for 3 times .

The methods of AOAC (1995) were used to determine the total solids ,protein ,fat , and titratable acidity .

The major minerals ( i.e. Ca , K , Mg ) and minor minerals ( Fe ) were determined according to the methods described in A O A C ( 1995 ) with an atomic absorption spectrophotometer (Perkin Elmer Model 460).

Free fatty acids were extracted and determined as explained by Demcin (1964).

**Folate contents were estimated according to Holt et. Al. (1988) by HPLC method .**

Vitamin A was determined according to A O A C ( 1995 ) by HPLC method .

Lactic acid bacteria counts ( LAB ) , proteolytic , lipolytic , mould and yeasts and coliform were determined according to the American Pubic Health Association(1978).

Fresh and stored labneh of all treatments were scored for their sensory attributes by a panel of staff members of the Dairy Department , Animal Production Research Institute. The sensory properties were evaluated for flavour ( 50 points ) , body and texture (30 points),and appearance (20 points).

## RESULTS AND DISCUSSION

### Microbiological analysis

**Table(1): Growth of lactic acid bacteria of labneh fortified with different types of basil and fennel (log cfu /g).**

Itemes	Samples	Storage period (weeks)				
		fresh	1	2	3	4
A	Control	8.4	8.77	9.55	9.44	spoiled
B		ND	ND	ND	2.04	
C		ND	ND	ND	2.76	
A	I	8.55	8.89	9.69	9.57	9.55
B		ND	ND	ND	1.49	1.9
C		ND	ND	ND	ND	1.6
A	II	8.81	8.9	9.79	9.71	9.61
B		ND	ND	ND	1.25	1.69
C		ND	ND	ND	ND	1.47
A	III	8.89	9.23	9.74	9.69	9.60
B		ND	ND	ND	1.34	1.77
C		ND	ND	ND	ND	1.36
A	IV	9.07	9.3	9.73	9.66	9.56
B		ND	ND	ND	1.23	1.47
C		ND	ND	ND	ND	1.11

A:LAB log cfu /g

C: mould and yeast log cfu /g

I: green basil

III : fennel seeds powder

B: Proteolytic bacteria log cfu /g

ND: not detected

II: basil oil

IV: green fennel

Table (1) showed that lactic acid bacteria counts increased with the advanced storage period in all treatments. LAB counts were higher in all treatments than control when fresh and during storage. These results are in agreement with Mostafa *et al.* (1984), who revealed that LAB were relatively resistant to toxic effect of herb. Also Ahmed *et al.* (1999) mentioned that some essential oils had stimulatory effect to LAB. Proteolytic bacteria appeared in all treatments after 2 weeks. Coliform were not detected in fresh labneh and during storage period in control and all treatments, which indicate the good hygienic condition followed in its production. The lipolytic bacteria counts were not detected in fresh labneh and during storage period in control and all treatments. These results are in agreement with Farag *et al.* (1989) and Abu Dawood (2002), who concluded that herbs and some essential oils have an inhibitory effect on lipolytic bacteria. Moulds and Yeasts are one of the most important parameter to evaluate the keeping quality and shelf life of labneh. The moulds and yeasts counts were affected with the addition of different herbs. They were not detected in samples of green basil, basil oil, fennel powder and green fennel when fresh and during storage period until 3 weeks, nevertheless it appeared in control after 2 weeks. These results might be due to the antifungal effect of both basil and fennel (Abdullah *et al.* 2008 & Ruberto *et al.* 2000 and Soylu *et al.* 2007).

**Table (2): Chemical properties of labneh fortified with different types of basil and fennel during storage**

properties	Storage period (week)	Control	I	II	III	IV
Acidity	fresh	1.25	1.25	1.2	1.25	1.2
	1	1.31	1.32	1.30	1.33	1.30
	2	1.4	1.38	1.40	1.40	1.35
	3	1.45	1.45	1.54	1.45	1.42
	4	Spo.	1.52	1.66	1.53	1.52
Total solids	fresh	25.96	26.01	25.97	26.44	26.23
	1	26.19	26.21	26.13	26.56	26.37
	2	26.27	26.31	26.39	26.69	26.47
	3	26.38	26.4	26.44	26.81	26.56
	4	Spo.	26.52	26.53	26.88	26.68
Fat	fresh	10	10.07	10.1	10.08	10.06
	1	10.1	10.11	10.15	10.11	10.1
	2	10.13	10.20	10.19	10.18	10.19
	3	10.27	10.31	10.28	10.26	10.3
	4	Spo.	10.37	10.35	10.37	10.36
Protein	fresh	11.53	11.55	11.54	11.56	11.54
	1	11.57	11.58	11.59	11.6	11.58
	2	11.59	11.60	11.61	11.65	11.62
	3	11.62	11.63	11.68	11.71	11.69
	4	Spo.	11.72	11.77	11.78	11.75

I: green basil  
 II: basil oil  
 III : fennel seeds powder  
 IV: green fennel

Table( 2 )showed the changes in the acidity, total solids (TS), protein and fat % of labneh, while fresh and during storage period . It was clear that no differences were observed in the TS , fat ,protein of labneh between the four treatments and the control, either when fresh or during storage period . The increase of TS , fat and protein contents due to the moisture loss during storage. Total solids ranged between 25.96 to 26.88 % during storage period . Fat and protein contents were similar in all treatments and ranged between 10 to 10.37 % fat . This results agree with Dina Roysdy and EL-Saadany (2007) and 11.53-11.78% forprotein which agrees with EL-Samargy.(1997).. The mean of total solids of the labneh samples were higher than that reported by Ismail *et al* (2006) and Zekai *et al* (2011), and agreed with Kebary *et al* (2007). The same table indicated that titratable acidity (TA) increased in all treatments during storage period. The TA values of all samples were found to be similar and ranged between 1.2-1.66 . These results were in agreement with (Zekai *et al.* (2011) and celik *et al.* 2006).

Table( 3 ) shows the minerals contents of labneh samples when fresh . There were differences in Ca, K, Mg and Fe contents of the samples. The Ca content was found to be higher in the green basil samples as (139mg /100g) and in green fennel (122.7mg/100g) but the lowest Ca content was determined in the control and basil oil samples (109.8 and 110 mg / 100g), respectively. The highest Mg content was found in the green basil samples (17.6 mg/ 100g) , the Mg content of the other samples was found to be similar and ranged from 13 to 15.5 mg/100 g . These results might be due to that the fennel has high amount of Ca, K, Mg ( Ozcan *et al.*, 2008) the most abundant minerals found in fennel were K ,Ca ,Mg, P and Na. The lowest K content was found in the control and basil oil samples as 166-168.1 mg /100g and the highest K content was found in the green fennel(IV) and powder fennel(III) 274-247 mg/100g due to that the basil is a very good source of K Musa Ozcan (2005) . The highest Fe content was found in the green fennel and powder fennel (128.4-125.3 µg/100g), the Fe content of the other samples was found to be similar and ranged from 44.6 to 46 µg /100 g. Zekai Tarkch *et al.*(2011) studied the effect of adding herbs to labneh and found that mineral content increased due to herb species used.

**Table( 3 ) : Minerals contents of labneh fortified with different types of basil and fennel in fresh**

<b>minerals contents</b>	<b>control</b>	<b>I</b>	<b>II</b>	<b>III</b>	<b>IV</b>
Calcium (mg)	109.8	139	110	115.2	122.7
Potassium (mg)	166	173.6	168.1	247	474
Magnesium (mg)	13	17.6	13.5	14	15.5
Iron (µg)	44.6	46	44.9	125.3	128.4

I: green basil

II: basil oil

III : fennel seeds powder

IV: green fennel

**Table( 4 ): Vitamins contents of labneh fortified with different types of basil and fennel in fresh**

vitamins contents	Control	I	II	III	IV
Vitamin A (µg)	135	150	177	163	175
Folat (µg)	34.8	50.5	35	72.7	76

I: green basil

II: basil oil

III : fennel seeds powder

IV: green fennel

Data in Table (4) indicates the folate vitamin A contents in fresh labneh samples, Vitamin A content was found to be higher in the basil oil and green fennel samples (177 and 175 mcg / 100g ) respectively, these resultes could be attributed to the high of vitamin A content in fennel and basil ( Ensminger and Esminger (1986) and Ensminger AH,*et al.*1983),while the lowest folate content was observed in the control sample (135 µg/100g).

Green fennel( III) and powder fennel( IV) recorded the highest values of folate. These values were 76 and 72.65 mcg/100g respectively. These resultes could be attributed to the high content of folate in fennel (Ensminger AH,*et al.*1983),while basil oil labneh was similar to the control labneh (35 and 34.5 µg/100g).

**Table ( 5 ): Fatty acids content of labneh fortified with different types of basil and fennel in fresh**

fatty acids content	Control	I	II	III	IV
C7	9	12.1	4.6	4.1	6
C8	4	2.2	3.3	7	8.5
C10	9.1	3.5	4	5.3	3.7
C12	4.6	1.6	6.4	4.9	6.3
C14	2.7	7	8.4	7	6.5
C15	6.5	9.3	10.1	8.9	8.7
C15:1	3.5	4.5	8.2	5.1	5.4
C16	7.5	7.1	4.8	3.2	4.2
C16:1	3	6.9	3	3	3.2
C17	17.2	16	16	19	17.7
C18	6.3	7.3	3.5	3.3	4.2
C18:1	4.6	1.7	3.0	3.7	3.5
C18:2	6.4	4.6	5	3.6	4.6
C18:3	15	15.9	18	20.8	17.2
C20	0.5	0.3	1.7	1.1	0.3
SFA	67.5	66.4	62.8	63.8	66.1
UNSFAs	32.5	33.6	37.2	36.2	33.9
Odd fatty acids	36	41.9	38.9	37	37.8

I: green basil

II: basil oil

III : fennel seeds powder

IV: green fennel

Table(5) shows the fatty acids content in fresh labneh samples . It was observed that adding basil oil and fennel seeds powder increased the total unsaturated fatty acids in (II,III)than the other samples (37.2-

36.2%unFAS respectively ).The most predominate unsaturated fatty acids present in all treatment was lenolenic ( C18:3 W3 ) this is in agreement with Lillian Barros, *et al* ( 2010 )who mentioned that the polyunsaturated fatty acid were the main group in all fennel parts , linoleic acid ( C18:2 - W6 ) predominated in stems and florescence's while linolenic acid ( C18:3 - W3 ) predominated in leaves, Paul Angers *et al*(1996) and Azhari H. Nour *et al*(2009),who mentioned that the major acylated fatty acids were palmitic (5-13%), stearic (2-3%) olic (6-10),linoleic(12-32%),and linolenic acid (49-75%). On the other hand, addition basil oil and fennel seeds powder decreased the total saturated fatty acids in C17 in (I,II)samples than the other samples. Furthermore, all treatments have highest ratio in (odd numbered). The presence of odd fatty acids ( C15,C17 ) might be raised from the oxidative degradation on some long chain fatty acids (even numbered )by removal of one-carbon atom ,and formation of fatty acids with one less carbon atom than parent acid ( Hefny, *et al* 2002) .

The important parameter to determine the quality and shelf life of labneh is the sensory properties. Data in Table ( 6 )showed that the organoleptic properties of labneh were affected with different types of herbs It was observed considerable differences in flavour of these treatments as compared with that of control. It could also be observed that labneh made with green fennel (IV) and fennel powder( III ) gained the highest score and were more acceptable as compared with control and other treatments during storage period. It was observed an increase in shelf life for 4 weeks at 7 °C with accepted and clean acid flavour with signs of yeast spoilage. On the other hand , control labneh showed inferior properties after 21 days of storage, and became unaccepted totally as it was characterized by its pasty body, weak texture and surface yeast. These results are in line with those obtained with ( Ismail *et al* (2006) , Dina Roushdy and Saadany (2007), and Zekai Tarakcl *et al* (2011), who reported that herbs and essential oils could be used as natural preservatives to increase the shelf life of labneh up to 30 days storage at 7 °C with good flavour.

Calcium in Table ( 7 ) illustrates that ,the contribution made by 100 g of labneh with ( I ) green basil was 17.4 % of daily requirement of male and female and 15.3 % of green fennel labneh . The contribution of magnesium made by 100 g of ( I ) green basil labneh 2.2% and 1.94 % ( IV ) green fennel labneh of daily requirement of male and female. Also the potassium content of labneh treatments showed that the contribution about 14.6 % of ( IV ) green fennel for male and female of daily requirement ( Tannen ,1983). The contribution of iron made by 100 g of (IV) green fennel and ( II ) fennel powder labneh 1.28 % and 1.25% respectively of male and 0.86 % and 0.84 % for female. The contribution of Folate made by 100 g of green fennel labneh 38% of daily requirement of male and 42.2% of female. Also vitamin A of labneh treatments showed that the contribution about 17.5-17.7%of ( IV ) green fennel and ( I ) basil oil for male and 21.9 -22.1 % of ( IV ) green fennel and ( I ) basil oil for female of daily requirement .

**Table ( 6 ) : Organoleptic properties of labneh fortified with different types of basil and fennel**

Storage period(week)	Properties	Treatments				
		control	I	II	III	IV
Fresh	Appearance (20)	18	18	18	18	18
	Body&Texture(30)	28	28	28	28	28
	Flavour (50)	45	45	44	48	47
	Total (100)	91	91	90	94	93
1	Appearance(20)	18	18	18	18	18
	Body&Texture(30)	28	28	28	28	28
	Flavour(50)	46	46	45	48	47
	Total (100)	92	92	92	94	94
2	Appearance(20)	18	18	18	18	18
	Body&Texture(30)	28	28	28	28	28
	Flavour(50)	45	47	46	48	48
	Total (100)	91	93	92	94	94
3	Appearance(20)	18	18	18	18	18
	Body&Texture(30)	28	28	28	28	28
	Flavour(50)	40	43	41	45	44
	Total (100)	86	89	87	91	90
4	Appearance(20)	Sp.	18	18	18	18
	Body&Texture(30)	Sp.	27	27	27	27
	Flavour(50)	Sp.	41	40	44	42
	Total (100)		85	84	89	87

I: green basil

II: basil oil

III : fennel seeds powder

IV: green fennel

**Table (7): Nutritional adequacy of labneh fortified with different types of basil and fennel of healthy benefits**

Nutrients	Contribution in daily requirements of male					Contribution in daily requirements of female					Recommended daily allowance (RDA)	
	control	I	II	III	IV	control	I	II	III	IV	male	female
Minerals	13.7	17.4	13.8	14.4	15.3	13.7	17.4	13.8	14.4	15.3	800	800
Calcium (mg)												
Magnesium (mg)	1.63	2.2	1.7	1.75	1.94	1.63	2.2	1.7	1.75	1.94	800	800
Potassium (mg)	5.1	5.3	5.2	7.6	14.6	5.1	5.3	5.2	7.6	14.6	3250	3250
Iron (mcg)	0.45	0.46	0.45	1.25	1.28	0.30	0.31	0.30	0.84	0.86	10	15
Folate (mcg)	17.4	25.3	17.5	37.4	38	19.3	28	19.4	40.4	42.2	200	180
Vitamin A (mcg)	13.5	15	17.7	16.3	17.5	16.9	18.6	22.1	20.4	21.9	1000	800

Male and female of 19:50 years

U.S.recommended dietary allowances (1989), except K is adequate and safe levels of intake.

I: green basil

II: basil oil

III : fennel seeds powder

IV: green fennel

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**اسماء حسين حسين عزيز  
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يتم دراسة تأثير بعض الاعشاب المختلفة على الخواص الكيماوية والميكروبية والحسية لللبنة اثناء التخزين

**وقد اظهرت النتائج ان :**

لا يوجد اختلافات فى التركيب الكيماوى بين المعاملات فى T.S والبروتين والدهن والحموضة. معاملة اللبنة بالشمرا الاخضر سجلت اعلى نسبة فى محتوى الكالسيوم – الحديد – و البوتاسيوم. وكانت اعلى نسبة لمحتوى الفولات فى اللبنة المدعمة بالشمرا الاخضر والبودر كانت 76-77,7 ميكروجرام/100 جرام عينة لبنة على التوالى . ومحتوى فيتامينA كان اعلى فى عينات الشمرا الاخضر وزيت الريحان 175-177 ميكروجرام/100 جرام عينة لبنة على التوالى . كانت زادت نسبة الاحماض الدهنية الغير مشبعة فى عينات اللبنة المضاف اليها زيت الريحان و الشمرا البودر عن باقى العينات. اظهرت اضافة الاعشاب تأثير على اعداد بكتريا حامض اللاكتيك و البكتريا المحللة للدهن والبروتين والفطر والخميرة حيث ادت الى زيادة اعداد بكتريا حامض اللاكتيك خلال فترات التخزين فى كل المعاملات . كما ادت الى طول فترة حفظ اللبنة حيث لم تظهر البكتريا المحللة للدهن وبكتريا القولون طوال فترات التخزين و لم تظهر الفطريات والخمائر الا بعد 4 اسابيع فى كل المعاملات . فى حين ظهورهما فى عينة الكنترول فى الاسبوع الثالث وتلوثت تماما فى الاسبوع الرابع مما يثبت دور هذه الاعشاب فى اطالة مدة حفظ اللبنة المدعمة بها. حصلت عينات الشمرا الاخضر والبودر لللبنة على اعلى درجات . واطهرت النتائج امكانية استخدام الاعشاب كمواد حافظة حيوية . حيث امكن بنجاح زيادة مدة حفظ اللبنة المخزنة على 7 لمدة 4 اسابيع دون تلف مع احتفاظهما بطعم جيد ومقبول.

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