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COMPOSITION AND MICROSTRUCTURE OF CONCENTRATED YOGHURT (LABNEH) MANUFACTURED FROM BUFFALOE'S MILK FORTIFIED BY SERIGEL LP POWDER

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ABSTRACT: *The use of a commercial whey protein concentrate (Serigel LP powder) in the manufacture of labneh was investigated. Labneh was manufactured from buffalo's milk supplemented with 1, 2, 3 and 4 % of Serigel LP.*

The changes in the composition and organoleptic properties of labneh were determined after 7 and 14 days storage in refrigerator. The microstructure of labneh was examined when fresh and at end of storage using scanning electron microscopy.

The yield of labneh has increased as the level of Serigel LP powder added to milk increased. The acidity gradually increased during storage, while pH value showed an opposite trend. The total solids, fat, total protein, soluble nitrogen and ash contents of labneh gradually increased with storage to a maximum at the end of storage, while lactose content showed an opposite trend. Acetaldehyde and diacetyl in the fresh labneh samples were higher than in the stored samples.

Scanning electron microscopy showed that the high protein content labneh samples had more compact structure and smaller voids than that with low protein content.

Sensory evaluation indicated that the addition of Serigel LP powder at the rate of 3 % got the highest score.

Key words: *Buffalo milk, Concentrated yoghurt, Labneh, Serigel LP, Chemical composition, Scanning electron microscopy.*

INTRODUCTION

The consumption of fermented dairy products has increased considerable in Egypt during the last 10 years. Product quality and consumer satisfactions are fundamental elements for successful and continuous sale. The increasing demand for additional sources of food protein has intensified research in dairy product rich in proteins.

Concentrated yoghurt is known as 'labneh' in Middle East, as 'strained yoghurt' in Greece and in rest of Europe, or as 'Greek Yoghurt' in UK. A similar, plain or fruit-flavoured product is consumed as a main dish at breakfast in many Middle Eastern countries, such as Iraq and Lebanon. In

Arab countries, labneh is garnished with dried herbs and olive oil and is served with bread (Tamime and Robinson, 1978).

Traditionally, labneh is made by straining normal yoghurt in cloth bags placed in refrigerator and allowing for some whey to drain off.

The popularity of labneh has increased during recent years. Its increasing economic importance has been achieved as a result of its perceived nutritional benefits and storage characteristics (Benezech and Maingonnat 1994).

Large variation in labneh composition has been reported in Egypt (Abd El-Salam and El-Alamy, 1982; El-Samragy, *et al.* 1988; Hofi, 1988 and Hamad and Al-Sheikh, 1989), Saudia Arabia (Salji, *et al.* 1987) and Lebanon (Tamime and Robinson, 1978). This variation can be attributed to the manufacturing methods and conditions used, also, type of milk and nature of fermenting organisms.

Several trials were carried out to improve the quality of labneh and its consistency, such as increasing the solids content of the initial milk by evaporation, or by ultrafiltration. Abd El-Salam and El-Alamy, (1982) used ultrafiltriered recombined milk in the manufacture of labneh. Alternatively, labneh has been produced successfully by mechanized processes such as ultrafiltralon and reverse osmosis (Tamime, *et al.* 1989 [a, b] ; Dagher and Ghariebeh, 1985 as well as Ozer, *et al.* 1999); by concentrating warm skim milk yoghurt to the desired level of solids then cream is blended with product (Salji, *et al.* 1983; Robinson & Tamime, 1986 and Rasic, 1987); addition of whey protein concentrate (Mahfouz, *et al.*1992); using partial or full substitution by vegetable oils (El-Deeb, *et al.*,1987 ; Hefnawy, *et al.*, 1992 and Soad, *et al.*,1997).

Recently a new whey protein concentrate powder called "Serigel LP" has been manufactured especially for yoghurt making. This product is prepared from acid whey from casein manufacture, UF concentrated and specially treated.

The objective of this study was to investigate the possibility of manufacturing labneh by enriching buffalo milk with "Serigel LP". The composition of labneh and its microstructure were followed in fresh and during cooled storage.

MATERIALS AND METHODS

Fresh buffalo's milk was obtained from the herd of Faculty of Agriculture, Cairo University. Serigel LP powder was obtained from EURIAL (Nantes-France) with the following composition, moisture 4%; proteins 35%; lactose 50% and lipids <5%.

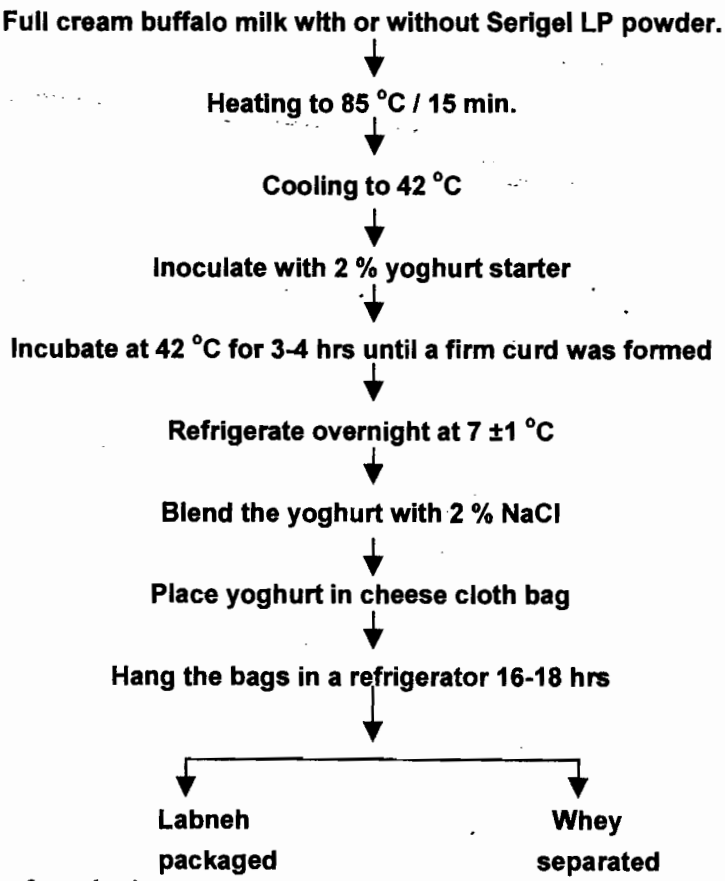
Yoghurt mixed starter culture (1:1) of *Streptococcus salivarius* subsp. *Theromphilus,* and *Lactobacillus delbrueckii* subsp. *Bulgaricus,* MY 87 (Texel-France).

Labneh manufacture:

Buffalo's milk was supplemented with Serigel powder according to following sequence:

C : Whole buffalo's milk as control.
I : Whole buffalo's milk with 1 % Serigel LP powder.
II : Whole buffalo's milk with 2 % Serigel LP powder.
III: Whole buffalo's milk with 3 % Serigel LP powder.
IV: Whole buffalo's milk with 4 % Serigel LP powder.
Three replicates were made from each treatment.

The traditional method for making concentrated yoghurt (labneh) is summarized as in the following diagram:



Methods of analysis:

Labneh was analysed in duplicates for total solids by the drying oven method at 105°C for 3 hr., fat, titratable acidity and ash as described by

A.O.A.C. (1990). Total nitrogen and soluble nitrogen were determined by the Kejldahl method (Ling, 1963). Lactose content was colorimetrically determined as described by Barnett and Abd El-Tawab (1957). Acetaldehyde and diacetyl were determined according to Lees and Jago (1970). The pH values were measured using laboratory pH meter with a glass electrode.

The actual yield of labneh was expressed w/w as percentage of labneh / milk, salt and starter culture. Weight of labneh was taken at the end of draining (18 hrs).

Microstructure:

Labneh samples were prepared for scanning electron microscopy (SEM) according to Brooker & Wells (1984) and Kalab, (1979) as follows: portions of the labneh (5 mm) were fixed by immersion in 4% glutaraldehyde in 0.1 M sodium cacodylate buffer (pH 4.4) for 4-6 hr. at 4°C. The samples were post fixed in 1% osmium tetroxide for 1 hr., and then was followed by washing in three changes of the same buffer over a period of 0.5 hr. After post fixation dehydration of the specimens was carried out through a graded series of ethanol (50% to 100% ethanol in increments of 10%, 10 min. at each increment except the absolute 3 x 10 min.). The samples were further dried using liquid Co_2 in (Balzers Union Critical Point Dryer). All dehydrated samples were mounted on aluminum stubs, and then, sputter-coated with gold in the S 150A Sputter Coater (Edwards, UK) apparatus for 2 min. The samples were examined with JEOL Scanning Microscope T20.

Sensory evaluation:

Labneh samples were organolepticaly scored by a regular score panel of 11 assessors from the staff members of Dairy Dept., National Research Centre allowing 10 points for appearance, 30 points for body and texture as well as 60 points for flavour.

RESULTS AND DISCUSSION

The average gross composition of buffalo's milk supplemented with Serigel LP is given in Table (1). It is clear that the total solids, protein, fat, lactose and ash contents increased with increasing Serigel LP addition.

Yield:

As shown in Table (2), it is clear that the yield increased with increasing the level of Serigel LP powder added to milk compared with control.

Gross chemical composition of labneh:

Table (2) shows the changes in pH and acidity of labneh with different ratios of Serigel LP during storage period. It is evident that acidity gradually increased during storage for control and all treatments. These changes were expected for culture activity and lactose reduction. Also, it is clear that the changes in acidity had an opposite trend of the changes in pH values and lactose content. These results are in agreement with those reported by El-Sayed, *et al.*, (1993); Abbas, *et al.*, (1999) and Hassan, *et al.*, (2001).

In addition, the obtained data in the same table indicated that the acetaldehyde and diacetyl in the fresh labneh samples were higher than in the stored samples, then were decreased to record their lowest values at the end of storage, probably due to its degradation and conversion into another organic compounds, and also as a metabolic product of the *Streptococcus and Lactobacillus* (Lees, and Tago, 1978).

These data are in agreement with those of Salama, (1993) who reported that the decrease in acetaldehyde content of yoghurt during storage may be due to the ability of numerous lactic organisms to reduce acetaldehyde to ethanol or oxidize to acetic acid. Also, Abbas, *et al.*, (1999) reported that the acetaldehyde and diacetyl values progressively decreased throughout the storage to record their lowest value at the end of storage. In contrary with those reported by Amer, *et al.*, (1997), whom mentioned that as storage progressed their values increased to reach maximum values after 14 days followed by a decrease up to the end of storage.

Table (1): Gross composition (%) of buffalo's milk supplemented with different percentages of Serigel LP. *

Treatment	Total solids	Protein	Fat	Lactose	Ash
C	15.20	4.04	6.00	4.40	0.85
I	16.17	4.38	5.95	4.95	0.90
II	17.13	4.78	5.80	5.50	0.97
III	18.15	5.14	5.70	6.12	1.04
IV	19.00	5.41	5.65	6.65	1.15

C : Whole buffalo's milk as control.
I : Whole buffalo's milk with 1 % Serigel LP powder.
II : Whole buffalo's milk with 2 % Serigel LP powder.
III: Whole buffalo's milk with 3 % Serigel LP powder.
IV: Whole buffalo's milk with 4 % Serigel LP powder.
* : Average of 3 replicates.

Table (2): Yield, pH, titratable acidity, acetaldehyde and diacetyl of labneh made from different treatments during storage. [1**]

Storage period (days)	Treatment	Test				
		Yield %	pH	Acidity %	Acetaldehyde *	Diacetyl *
(0) Fresh	C	40.32	4.48	1.23	423	262
	I	43.60	4.52	1.22	390	260
	II	49.21	4.53	1.28	405	243
	III	51.29	4.53	1.25	400	240
	IV	53.40	4.56	1.27	440	255
7	C	-	4.38	1.29	384	210
	I	-	4.40	1.28	320	217
	II	-	4.40	1.35	361	191
	III	-	4.43	1.33	367	180
	IV	-	4.44	1.35	380	170
14	C	-	4.22	1.34	315	144
	I	-	4.25	1.38	290	140
	II	-	4.28	1.40	305	135
	III	-	4.30	1.39	295	130
	IV	-	4.35	1.43	300	139

1 : Average of three replicates.
* : μ mol / 100 g sample.
**: See legand table 1.

As shown in Table (3) the total solids content of labneh from all treatments increased throughout storage period. These results are in agreement with that reported by Mahdi, *et al.*, (1990) and El-Sayed, *et al.*, (1993). Also, the fat, total protein, soluble nitrogen and ash contents of labneh increased throughout storage to record a maximum at the end of cold storage. These increases could be due to decrease in moisture content of labneh during storage. Also, the increase in soluble nitrogen content with advanced storage may be due to the protein degradation. Similar data was reported by El-Sayed, *et al.*, (1993); Abbas, *et al.*, (1999) and Hassan, *et al.*, (2001).

However, changes in the lactose content followed an opposite trend, it decreased to record their lowest values at the end of storage.

Ozer, *et al.*, (1998) and Tamime, *et al.*, (1989 [b]) reported similar results.

Table (3): Chemical composition of labneh manufactured from different treatments during storage. [1*]

Storage period (days) / Treatment		Test %					
		T.S.	Fat	T.P.	Soluble Nitrogen	Lactose	Ash
(0) Fresh	C	28.74	13.10	8.99	0.54	4.20	1.73
	I	28.91	12.75	9.02	0.59	4.50	1.81
	II	29.34	12.50	9.15	0.61	4.88	2.09
	III	29.81	12.15	9.45	0.63	5.62	2.26
	IV	30.15	11.90	9.61	0.63	6.17	2.15
7	C	29.66	14.40	9.30	0.63	3.34	2.01
	I	30.16	13.90	9.61	0.63	3.97	2.28
	II	30.72	13.60	9.99	0.70	4.32	2.50
	III	31.34	13.55	10.40	0.69	4.56	2.26
	IV	31.91	13.00	10.70	0.70	5.37	2.78
14	C	31.33	15.80	9.68	0.72	2.78	2.75
	I	31.90	15.20	10.40	0.70	3.11	2.99
	II	31.99	14.70	10.91	0.76	3.59	3.13
	III	32.98	14.55	11.02	0.76	4.06	3.33
	IV	33.51	14.40	11.31	0.81	4.77	3.33

1 : Average of three replicates.

* : See legand table 1.

Scanning electron microscopy (SEM):

The microstructure of fresh labneh from control and containing 1 or 2 % Serigel powder treatments as examined by SEM are shown in Fig.1 $_{(a, b \text{ and } c)}$. It could be seen that they have similar structure with relatively uniform matrix in which occasionally, small lumps of fluffy or spongy protein aggregates. Also, open structure was found as hollow (void spaces) in control Labneh.

The protein matrix appeared to be influenced by adding high ratios (3 and 4 % Serigel powder), being slightly compacted with fat particles embedded in protein in fresh (Fig. 1$_{d \text{ and } e}$) than after two weeks stored labneh, which were

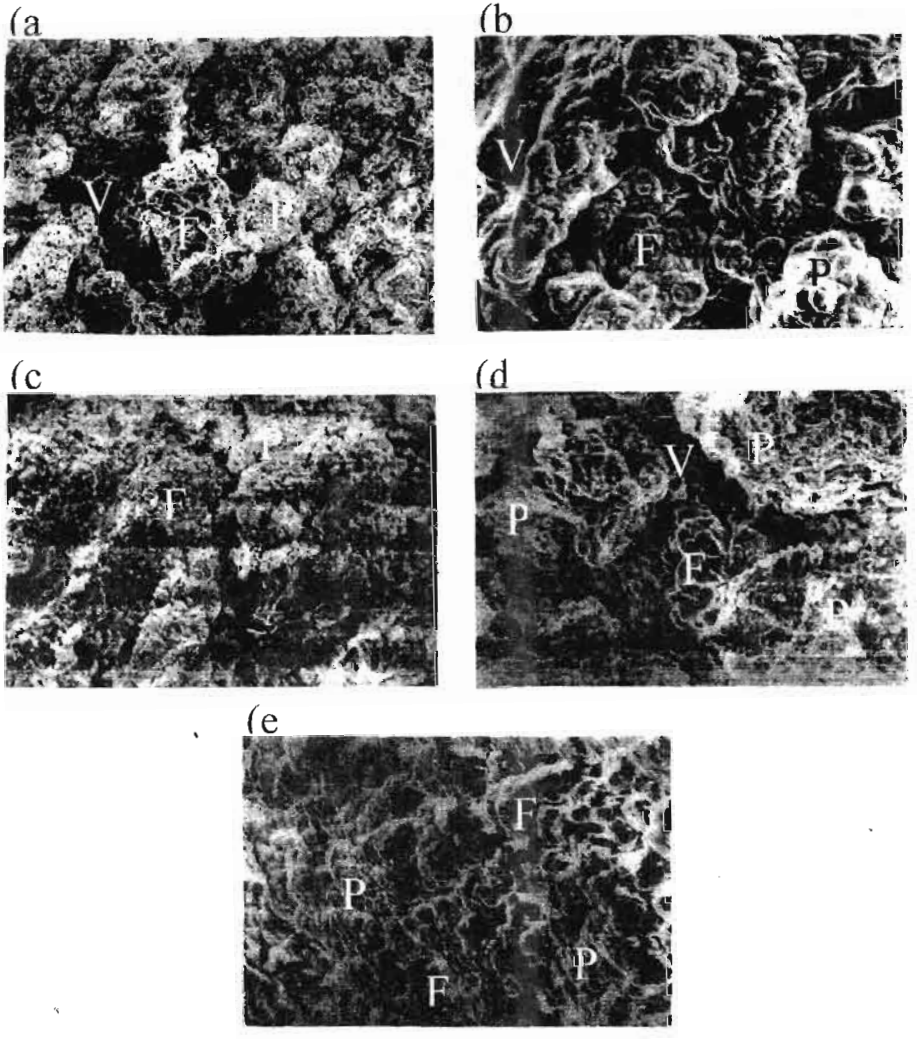


Fig. (1): Scanning electron microscopy (x 1000) of fresh labnehs:
a) Whole buffalo milk (control). b) Supplemented milk with 1% serigel powder. c) 2% serigel powder.
d) 3% serigel powder. e) 4% serigel powder.
Fat globules = F ; Protein matrix = P ; Void spaces = V

more compact with agglomeration of fat particles as nodes forming bridges between two protein aggregates (Fig. 2 c and d). The open matrix was due to the formation of larger void spaces, while compact matrix appeared in labneh with high levels of Serigel powder. These results are in agreement with those reported by Tamime, *et al.* (1989[b]) and Ozer, *et al.* (1999[a, b]).

In general, differences in the microstructure of labnehs were apparent with different Serigel powder levels, which may be attributed to increase in the total solids, increasing the density of the gel matrix. This was in accordance with those reported by Kalab, *et al.* (1983).

The microstructure of labneh was markedly different from the microstructure of non fat yoghurt due to the presence of fat labneh and the distribution of fat particles incorporated in the protein matrices (Harwalkar and Kalab, 1983 as well as Kalab, *et al.*1983). Another difference was the density of the protein matrix, which reflected the high protein content in labneh.

Organoleptic properties:

Table (4) gives the average scores for organoleptic properties of labneh as affected by the level of Serigel LP powder added. The results suggest that the addition of Serigel LP powder improved the organoleptic quality of labneh. The quality of labneh slightly decreased during storage, but retained acceptable properties. These results are in accordance with those reported by Mahdi, *et al.*, (1990); El-Sayed, *et al.*, (1993) and El-Sheikh, (2001).

No foreign or undesirable flavour was detected in all treatments. However, the highest total score, was given to labneh manufactured with addition of Serigel LP powder at the rate of 3%. This result was in line with the finding of El-Sheikh, (2001).

After 14 days the samples deteriorated during storage. This result was in line with the finding of El-Khadragy, (1988) who found that fresh labneh made from buffalo's milk gained more score points than 10 days old labneh. Moreover, Tamime and Robinson (1978) reported that the traditionally made labneh usually has short shelf life even it stored under refrigeration, which may be due to the poor sanitary conditions usually associated with the cloth bags used.

Furthermore, (Salji, 1986) reported that the statutory standard of labneh in Saudi Arabia is 15 days.

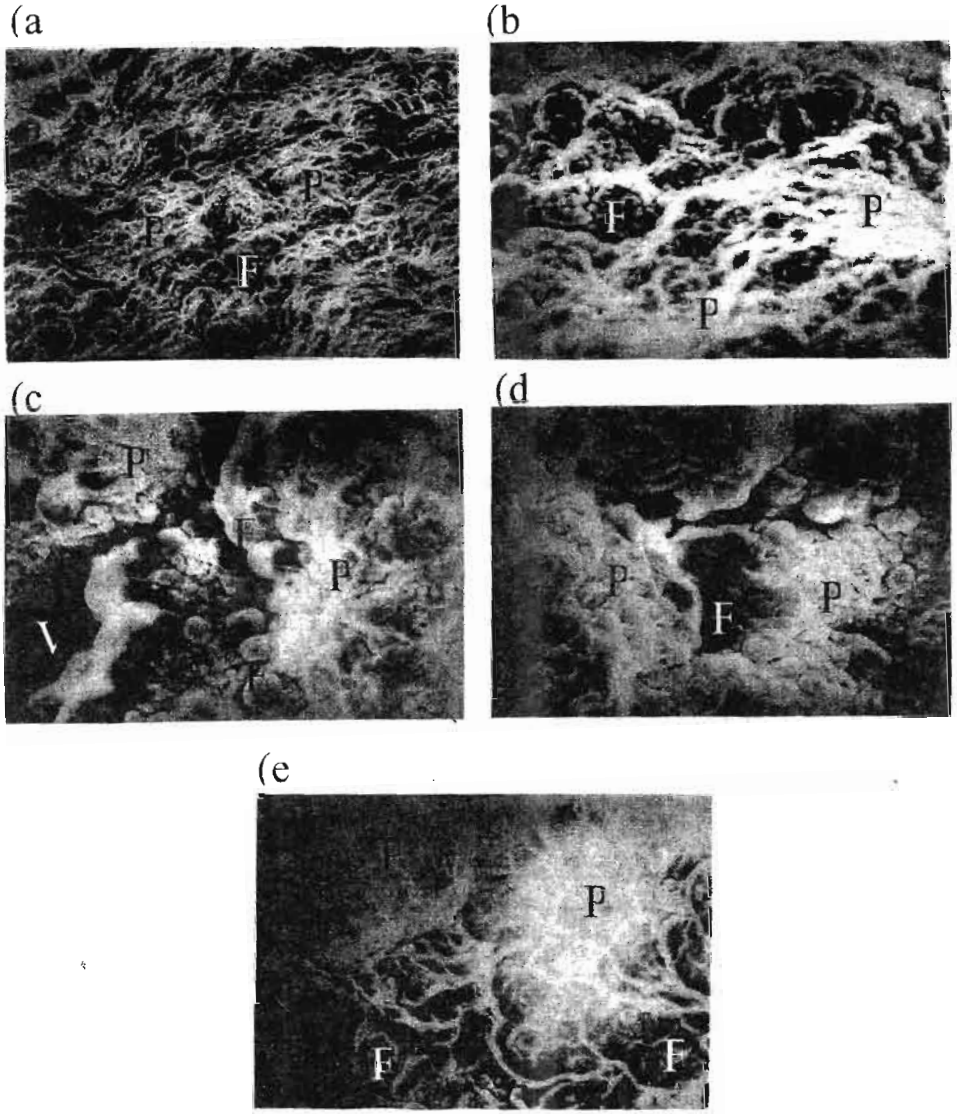


Fig. (2): Scanning electron microscopy (x 1000) of labnehs after two weeks:
a) Whole buffalo milk (control). b) Supplemented milk with 1% serigel powder. c) 2% serigel powder.
d) 3% serigel powder. e) 4% serigel powder.
Fat globules = F ; Protein matrix = P ; Void spaces = V

In conclusion, the addition of Serigel LP powder to buffalo's milk at the rate of 3% for labneh manufacture improved the sensory properties of labneh without any undesirable effect on the quality and composition.

Table (4): Organoleptic evaluation of labneh manufactured from different treatments during storage period. [1*]

Storage period (days)	Treatment	Flavour 60 points	Body &Texture 30 points	Appearance 10 points	Total 100 points
(0) Fresh	C	49.73	26.44	8.96	85.13
	I	52.86	26.74	8.96	88.56
	II	53.36	27.28	8.98	89.62
	III	54.83	27.53	8.90	91.26
	IV	52.64	26.89	8.76	88.29
7	C	51.65	25.57	8.23	85.45
	I	53.43	25.86	8.46	87.75
	II	53.28	25.65	8.51	87.44
	III	54.88	25.50	8.23	88.61
	IV	52.76	23.87	8.07	84.70
14	C	51.06	25.60	8.66	85.32
	I	52.50	25.33	8.50	86.33
	II	52.83	25.83	8.50	87.16
	III	53.20	26.50	8.50	88.20
	IV	52.90	20.66	8.40	82.16

1 : Average of three replicates and of 11 panelists
* : See legand table 1.

REFERENCES

Abbas H. M., F.A.M. Hassan and A.K. Enab (1999). Nutritional and flavour properties of labneh produced from Egyptian goat milk. Arab Univ. J. Agric. Sci. Ain Shams Univ., Cairo, 7 (1) : 71-78.

Abd El-Salam, M. H. and H.A. El-Alamy (1982). Production and properties of yoghurt and concentrated yoghurt (labneh) from ultrafiltered recombined milk. Res. Bull. Fac. Agric. Ain Shams Univ., No.1803: 1-11.

Amer, S.N., E.S. Girgis, S.H. Taha and S.H. Abd El-Moeety (1997). Effect of milk total solids and type of starter on the quality of labneh. Egyptian J. Dairy Sci., 25:179-192.

A.O.A.C. (1990). Association of Official Analytical Chemists. Official Method of Analysis 15th ed. AOAC, Benjamin Franklin Station, Washington DC, USA.

Barnett, A.J. and G. Abd El-Tawab (1957). Rapid method for determination of lactose in milk and cheese. J. Sci. Food Agric. , 7: 437.

Benezech, T. and J.F. Maingonnat (1994). Characterization of the rheological properties of yoghurt. A review. J. Food Engineering, 21: 447-472.

Brooker, B.E. and K. Wells (1984). Preparation of dairy products for scanning electron microscopy etching of epoxy resin embedded material. J. Dairy Res., 51: 605.

Dagher, S. and A. Ali-Ghariebeh (1985). Effect of pasteurization, centrifugation and additives on quality of concentrated yoghurt (labneh). J. Food Prot., 48:300-302.

El-Deeb, S.A., H,N, Hassan and Y.R. Shokry (1987). Characteristics of labneh as affected by partial substitution of milk fat with cotton seed oil. Alex. Sci. Exch., 8:151.

El-Khadragy, M.M.S. (1988). Microbiological and technological studies on milk. Microbiological and biochemical studies on labneh. M.Sc. Thesis, Fac. of Agric., Alex. Univ., Egypt.

El-Sayed, N. H., F.A.M. Hassan and M.H. El-Senaity (1993). Manufacture of labneh from goat's milk. J. Agric. Sci. Mansoura Univ., 18 (11): 3310-3316.

El-Sheikh, M.M. (2001). Manufacture of yoghurt with added Serigel LP powder. J. Agric. Sci. Mansoura Univ., 26 (10): 6279-6291.

Hamad, A. M. and S.S. Al-Sheikh (1989). Effect of milk solids concentration and draining temperature on the yield and quality of labneh (concentrated yoghurt). Cultured Dairy Products J., 20: 25.

Harwalkar, V.R. and M. Kalab (1983). Relationship between microstructure and susceptibility to syneresis in yoghurt made from reconstituted nonfat dry milk. Food Microstructure, 5 (2): 287-294.

Hassan, F. A. M. ; Baker, S. A. and Abd El-Gawad, M. A. M. (2001). Effect of the type of starter and processing method on quality of labneh. J. Agric. Sci. Mansoura Univ., 26 (1) : 319-331.

Hefnawy, S., S.A. Ibrahim and S. Abd El-Kader (1992). A study on composition and properties of concentrated yoghurt (labneh) manufactured from recombined milk with different vegetable oils. Egyptian J. Dairy Sci., 20: 351-358.

Hofi, M.A. (1988). Labneh (concentrated yoghurt) from ultrafiltrated milk. Scandinavian Dairy Industry, 2 (1): 50-52.

Kalab, M. (1979). Microstructure of dairy foods. 1. Milk products based on protein. J. Dairy Sci., 62:1352.

Kalab, M., P. Allan-Wojtas and D.E. Phipps-Todd (1983). Development of microstructure in set-style nonfat yoghurt- A review. Food Microstructure, 2 (1): 51-66.

Lees, G.J. and G.R. Jago (1970). The estimation of diacetyl in the presence of other carbonyl compounds. J. Dairy Res., 37:129-132.

Lees, G.J. and G.R. Jago (1978). Role of acetaldehyde in metabolism: A review. 2. The metabolism of acetaldehyde in cultured dairy products. J. Dairy Sci., 61:1216.

Ling. E.R. (1963). A Text Book of Dairy Chemistry vol. II, 3rd ed., Chapman and Hall, Ltd., London.

Mahdi, H.A., A.Y. Tamime and G. Davies (1990). Some aspects of the production of "labneh" by ultrafiltration using cow's, sheep's and goat's milk. Egyptian J. Dairy Sci., 18: 345-367.

Mahfouz, M.B., H.F. El-Dein, H.M. El-Etriby and A.F. Al-Khamy (1992). The uses of whey protein concentrate in manufacture of concentrated yoghurt (labneh). Egyptian J. Dairy Sci., 20: 9-20.

Ozer, B.H., A.E. Bell and R.K. Robinson (1998). Rheological properties of concentrated yoghurt (labneh). J. of Texture Studies, 29:67-79.

Ozer, H.P., R.A. Stenning, A.S. Grandison and R.K. Robinson (1999[a]). Effect of protein concentration on the properties and structure of concentrated yogurts. International J. Dairy Tech., 52, 4 (11): 135-138.

Ozer, H.P., R.A. Stenning, A.S. Grandison and R.K. Robinson (1999[b]). Rheology and microstructure of labneh (concentrated yogurt). J. Dairy Sci., 82:682-689.

Rasic, J.L. (1987). Yogurt and yogurt cheese manufacture. Cultured Dairy Products J., 22 (4): 6-8.

Robinson, R.K. and A.Y. Tamime (1986). Modern Dairy Technology, Vol.2 Advances in Milk Products, (ED) Robinson, R.K. Elsevier Applied Science Publishers Ltd., London, UK, 1-34.

Salama, F. M. M. (1993). Chemical and organoleptical properties of biograde-like product made from lactose hydrolysed milk. Egyptian J. Dairy Sci., 21: 273-282.

Salji, J.P., W.N. Sawaya and M. Ayaz (1983). The yoghurt industry in the Central Province of Saudi Arabia. Cult. Dairy Prod., 18 (4): 14-18, 37.

Salji, J. P. (1986). Fermented dairy products of Saudi Arabia. Cult. Dairy Prod. J., 21 (3): 6.

Salji, J. P., W.N. Sawaya and M. Ayaz (1987). The dairy processing industry in the Central Province of Saudi Arabia. Dairy and Food Sanitation, 7: 6013.

Taha, S.H., E.S. Girgis, S.N. Amer and S.H. Abd El-Moeety (1997). Effect of milk fat substitution with vegetable oils on the quality attributes of labneh. Egyptian J. Dairy Sci., 25: 193-203.

Tamime, A.Y. and R.K. Robinson (1978). Some aspects of the production of a concentrated yoghurt (labneh) popular in the Middle East. Milchwissenschaft, 33: 209-212.

Tamime. A.Y., G. Davies, A.S. Chehade and H.A. Mahdi (1989 [a]). The production of labneh by ultrafiltration - a new technology. J. Soc. Dairy Tech. 42:35-39.

Tamime. A.Y., M. Kalab and G. Davies (1989[b]). Rheology and microstructure of strained yoghurt (labneh) made from cow's milk by three different methods. Food Microstructure, 8: 125-135.

التركيب الكيماوى والبنائى للزبادى المركز (اللبنة) المصنعة من اللبن الجاموسى المدعم بمسحوق الـ Serigel LP

محمـــد منصـــور اللولـــى
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الملخص العربى

يهـدف هـذا البحـث إلى إستخدام مسحوق الـSerigel LP التجارى المحضر من الشـرش الحامضـى "الـناتج مـن صناعة الكازين" بالترشيح الفائق والمعد خصيصا لصناعة الـزبادى فى تدعيم اللبن الجاموسى بنسب ١، ٢، ٣ ، ٤ % لصناعة الزبادى المركز (اللبنة) بالإضافة إلى الكنترول ، ودراسة بعض خواصها الطبيعيه والكيماويه والبنائية.

تـم تخزيـن العينات لمدة أسبوعين على درجة حرارة الثلاجة ، وتم تتبع التغيرات فى التركيب الكيماوى ، وقياس محتوى كلا من الأسيتالدهيد والداى أسيتيل ، وكذلك معرفة التركيب البـنائى بواسطة الميكروسكوب الإلكترونى ، كما تم التحكيم على الخواص الحسية للبنة خلال فترة التخزين لمدة ١٤ يوم على درجة حرارة الثلاجة.

وأظهـرت النـتائج أن إستخدام مسحوق الـ Serigel LP أدى إلى زيادة تصافى اللبـنة بـزيادة نسبة المسحوق ، كما أدى إلى زيادة كلا من محتوى الجوامد الكلية والبروتين الكلى والبروتين الذائب والدهن والرماد فى كل المعاملات ، وكذلك زادت الحموضة بزيادة فترة التخزين. بينما على العكس من ذلك فإن محتوى اللاكتوز قد قل بزيادة فترة التخزين.

ولقد أوضح الميكروسكوب الإلكترونى أن التركيب البنائى للعينات المحتوية على النسب العاليه من مسحوق الـ Serigel LP (٣ ، ٤%) كانت أكثر إندماجا مع وجود فراغات قليلة من الشرش عنة فى النسب الأقل.

كما أوضحت نتائج التحكيم الحسي أن إضافة ٣ % من مسحوق الـ Serigel LP قد أعطى أفضل النتائج للبنة المصنعة.