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CHEMICAL, TECHNOLOGICAL, RHEOLOGICAL AND ORGANOLEPTIC PROPERTIES Of SPREAD PROCESSED CHEESE.

Seliman, Nahed E.; Eman A. El-Dakhakhny; S. A. Salem and Hayam H. Ahmad

Department of Dairy Science and Technology, Faculty of Agriculture, University of Alexandria

ABSTRACT

This study was carried out to study the possibility of using some dairy products such as (Labenah, Feta cheese made by U.F. and Ricotta cheese made from Mozzarella cheese whey, which are available in many dairy factories as substitute for Ras cheese (ripened or semi-ripened) at ratio 50% or 100% in the manufacture of spread processed cheese . The effect of substituting these products on physico-chemical, rheological and organoleptic properties of spread processed cheese was also studed during storage period up to 3 months at 5°c. The obtained results could be summarized as follows:

Spreads processed cheese (PCSs) made by substituting semi-ripened or ripened Ras cheese for all treatments were significantly lower in dry matter (DM) values, Total protein/ dry matter(TP/DM), and higher significantly in fat/dry matter (F/DM) as compared with control. This was more pronounced when substituting semi-ripened Ras cheese more than the ripened cheese.

In all treatments, significantly lower pH values ,soluble nitrogen (SN) and total protein (TP) were observed , and significantly higher in titratable acidity % ,fat/ total nitrogen (F/ TN) and also higher significant in casein / total N nitrogen than the control.

Substituting of Ras cheese in all treatments led to highly significant in meltability values in ripened Ras cheese more than semi-ripened as compared with control at ratio 50%.

Substituting of semi-ripened Ras cheese by 50% from Labenah or Ricotta cheese resulted in an increase in the oil separation , while using Feta cheese at the same ratio resulted in lower oil separation. No oil separation occurred when substituting 100% semi-ripened Ras cheese with any substitutes.In all treatments, the hardness of cheeses was highly significant, while it was lower during the storage period than control, and it was less in semi-ripened case than the ripened Ras cheese. Significantly higher values of chewiness, adhesiveness and gumminess than the control, and lower in cohesiveness values. PCSs made by replacing Ras cheese for all treatments were highly significant in elasticity values as compared with control. On the other hand, when substituting 50% semi ripened Ras cheese with Labenah resulted in similar elasticity in case of replacing ripened Ras cheese by Feta cheese or Ricotta cheese at ratio 50% and 50%, 100% respectively. They were significantly different in organoleptic properties of PCSs for all treatments . Substituting of Ras cheese resulted hn significant decrease in flavour values, but it was the best when using semi-ripened, while the texture was similar or better than the control, when substituting the semi-ripened Ras cheese at ratio 50%. Substituting ripened Ras cheese with Feta cheese or Ricotta cheese at ratio 50% resulted to the best texture than control.

INTRODUCTION

Processed cheese is a generic term used to describe three separate categories of cheese. These categories are pasteurized processed cheese (PC), Pasteurized cheese food (PCF) and pasteurized cheese spread (PCS). (Code of Federal Regulation, 2003). These categories differ on basis of the requirements for minimum fat content, dry matter basis and the maximum moisture content as well allowed as the quality and the number of optional ingredients that can be used. The moisture content of pasteurized cheese food is not more than 44% and the fat content is not less than 23%. The moisture content of pasteurized cheese spreads between 50-55%and the fat content is between 20-22%.

Egyptian consumers prefer the processed cheese because of its taste, spreadability and its low price as well as the high keeping quality even if it is stored out of the refrigerator.Cheese ripening requires great facilities and long period since most hard cheese demands large storage room equipped with a refrigeration system and humidity controller which is commercially expensive. On the other hand, the experiments which have been done through the last 25 years concerning acceleration of cheese ripening didn't give the aimed results. At mean time the continuous increase of ripening price (3-8months) results in increasing the cheese cost.

Recently, in the USA and Europe, imitations cheese had been marketly appeared with reasonable prices are highly appreciated by the consumers; it is widely exploited to different variety of cheese, e.g. Cheddar, Chishire and Edam cheese.

The use of whey protein concentrates (WPC) in processed cheese spread had several technological, nutritional and economic advantages. The use of the cheap (WPC) to replace the expensive cheese would reduce the cost of this product and offer feasible way for utilization of (WPC) the high biological value of whey proteins would improve the nutritional value of processed cheese spreads containing (WPC). Also, the addition of (WPC) in processed cheese spread can modify the functional properties of the product for different usages.

The Aim of study: Utilize some cheap dairy products such as (Labenah, Feta cheese made by ultra- filtration, Ricotta cheese made from Mozzarella's cheese whey) which are available in many factories. Also study, the effect of their substituting with semi ripened or ripened Ras cheese on physico- chemical, organoleptic and rheological properties of spread processed cheese, and to investigate the effect of storage period up to 3 months on spread processed cheese properties.

MATERIALS AND METHODS

- Semi ripened Ras cheese (three month) and ripened Ras cheese (six month).
- Milk: Fresh raw cow's milk
- Cream
- Fresh Ricotta cheese from Mozzarella whey was obtained from the Dairy pilot plant at the Department of Dairy Science and Technology, Faculty of Agriculture, Alexandria University.
- Feta cheese was obtained from Green land Group food products.
- The emulsifying salts used were a mixture of Egy FOS S20and Egy FOS B4with ratio (1:1)
- Stabilizer: The stabilizer used was Dairy Gel 162.

Emulsifying salts and stabilizers were obtained from Egy Dairy Egyptian co.

- Dried whey: (11% protein) was obtained from Gars. Food composition Alex.
- Preservatives: Nissin, potassium sorbate: Were obtained from EL-Gomhouria co. Alexandria

Table (1): composition of Ingredients:

Ingredient	Moisture (%)	Dry matter (%)	Fat (%)	Protein (%)	pH
Ripened Ras cheese	29.31	70.68	30.00	29.00	5.50
Semi ripened Ras cheese	32.42	67.58	33.00	30.00	5.97
Feta cheese	63.38	36.62	14.50	14.00	4.68
Ricotta cheese	77.86	22.14	9.50	12.00	4.05
Labenah	69.98	30.02	13.00	10.00	4.00
Cream	54.90	45.10	40.00	3.60	ND

Whey of Mozzarella cheese was heated in water bath at 90°Cfor 30 min, acidified with lactic acid. The denatured whey protein was recovered by filtration through fine cheese cloth for 6h (Morr, 1985 and Metwally, 1992).

Cow's milk was heated at 90°Cfor 15 min, then cooled to 45°C, and inoculated with 2% (V/V) yoghurt starter *(S. thermophilus + L. bulgaricus)* and incubated at 42°C for about four hours then, 5% (V/V) of salt was added then recovered by filtration through fine cheese cloth for 24h according to (Tamime and Crawford 1984)

Control processed cheese was prepared (5kg) from 20% semi ripened Ras cheese and 30% ripened Ras cheese as a base blend by cooking at 95°Cfor 8 min to obtain the control processed cheese spread. According to (Meyer 1973).

Twelve treatments of processed cheese spread were prepared by replacing the hard cheese in the base blend at ratios of 50 and 100% by Labenah, Feta cheese and Ricotta cheese (Table 2). The composition of each batch of processed cheese treatments were adjusted to contain in a final product, 56% ± 1% moisture and 50% ± 1% fat /dry matter according to the Egyptian standards (2001).The hot product of processed cheese spreads was packaged into 250g glass Jars. Then cooled and stored at 5°C ± 1.The resultant processed cheese spreads were analyzed for chemical, physical,

rheological and organoleptic properties. when fresh and after storage for 1, 2 and 3 months, at 5°C.

Titratable acidity in milk and cheese was determined as a lactic acid % according to A.O.A.C (2000).

The pH values in milk and cheese were estimated using a glass electrode pH meter type. Digital. (Hanna instruments pH meter Hi8014 Italy). According to A.O.A.C (2000).

The moisture content in milk and cheese was determined according to A.O.A.C (2000).

Fat content was determined by conventional Gerber's method was described by Ling (1963).

The Total Nitrogen content in the cheese and raw materials was estimated as described by Kosikowsky (1978).

The Soluble Nitrogen in cheese was estimated according to EL-Erian (1969) and as modified by Attia (1970).

Meltability of processed cheese spread was measured in duplicate using the meltability test as described by Olson and Price (1958) and modified by Rayan (1980).

The fat lackage methods described by Nilson and Lacshair (1976).

The cheese samples were calculated for textural properties according to Chen *et al.* (1979):

Processed cheese samples were organoleptically evaluated according to Ayad *et al.*_(2004) as follows: 10 point for colour, 40 point for Body and Texture and 50 point for flavour.

Data reported are the average of 3 measurements per replicate. The GLM procedure using SAS statistical analysis software package (SAS Institute, 1999) was used for ANOVA. Means of separation was conducted using Duncan's multiple range tests. Differences were considered significant at $P \leq 0.05$.

RESULTS AND DISCUSSION

Physico-chemical properties of processed cheese spreads (PCSs) made by substituting semi ripened and semi ripened Ras cheese with Labenah (A1a, A1b), (A2a, A2b Feta cheese (B1a, B1b), (B2a , B2b) and Ricotta cheese (C1a, C1b), (C2a, C2b) respectively are shown in Tables (3, 4)

Results revealed that PCSs made by replacing semi ripened and ripened Ras cheese for all treatments were significantly lower in DM than the control (L.S.D 0.066) as illustrated in Tables(3a and 3b). PCSs made by replacing semi ripened Ras cheese with A1a, B1a and C1a were significantly higher in DM than those made by replacing ripened Ras cheese with A2a, B2a and C2a, while DM of PCSs made by replacing semi ripened Ras cheese with A1b and B1b were lower than those made by replacing ripened Ras cheese with A2a, B2b. Moreover, DM of PCSs made by replacing semi ripened Ras cheese with C1b was similar with that made by replacing ripened Ras cheese with C2a and C2b.

Table (2): Composition of different mixtures of processed cheese spread treatments:

Igredients	Control	1						2					
		A1		B1		C1		A2		B2		C2	
		A1a	A1b	B1a	B1b	C1a	C1b	A2a	A2b	B2a	B2b	C2a	C2b
Ripened Ras cheese	30.00	30.00	30.00	30.00	30.00	30.00	30.00	15.00	00.00	15.00	00.00	15.00	00.00
Semi ripened Ras cheese	20.00	10.00	00.00	10.00	00.00	10.00	00.00	20.00	20.00	20.00	20.00	20.00	20.00
Feta cheese				10.00	20.00					15.00	30.00		
Ricotta cheese						10.00	20.00					15.00	30.00
Labenah		10.00	20.00					15.00	30.00				
Cream	10.02	15.40	20.00	15.00	20.60	17.90	20.00	12.85	15.20	12.71	15.29	13.57	17.00
Added water	30.68	25.30	21.44	25.70	21.00	22.80	23.39	27.85	25.50	27.99	25.41	27.13	23.70

1 ,2 : Replace semi ripened and ripened Ras cheese.
A1 ,A2 : Replace semi ripened and ripened Ras cheese with labenah; A1a A2a: ratio 50%; A1b,A2b : ratio 100%.
B1,B2 : Replace semi ripened and ripened Ras cheese with Feta Cheese; B1a.,B2a: ratio 50%; B1b , B2b: ratio 100%.
C1 ,C2 : Replace semi ripened and ripened Ras cheese with Ricotta cheese. C1a : ,C2a ratio 50% & C1b ,C2b: ratio 100%.

Table (3): Effect of substituting semi ripened and ripened Ras cheese with Labenah, Feta cheese and Ricotta cheese at ratios of 50 and 100% respectively on some physico-chemical on processed cheese spreads during storage period up to 3 months at 5°C.

Composition	Storage Period (Month)	control	1						2					
			A1		B1		C1		A2		B2		C 2	
			A1a	A1b	B1a	B1b	C1a	C1b	A2a	A2b	B2a	B2b	C2a	C2b
DM	0	44.40	44.05	44.02	44.26	44.26	44.15	44.00	44.01	44.12	44.02	44.30	44.00	44.00
	1	44.60	44.19	44.18	44.37	44.37	44.22	44.10	44.16	44.27	44.17	44.51	44.20	44.10
	2	44.80	44.27	44.26	44.49	44.49	44.35	44.35	44.18	44.72	44.29	44.42	44.36	44.25
	3	44.93	44.35	44.34	44.53	44.53	44.57	44.41	44.26	44.57	44.41	45.17	44.52	44.40
F/DM	0	49.10	49.49	49.30	49.03	49.03	49.38	49.55	49.53	49.18	49.07	48.98	49.55	49.55
	1	48.88	49.33	49.12	48.91	48.91	49.30	49.43	49.59	49.42	49.13	49.98	49.55	49.66
	2	48.88	49.47	49.25	49.00	49.00	49.38	49.61	49.80	49.30	49.22	48.62	49.59	49.72
	3	48.97	49.38	49.39	48.96	48.96	49.36	49.76	49.93	49.36	49.31	49.70	49.64	50.00
TP/DM	0	31.04	29.10	28.99	29.12	29.12	29.63	29.43	29.43	29.06	29.58	29.10	30.02	29.73
	1	31.61	29.74	29.31	29.34	29.34	30.01	29.80	29.62	29.41	29.75	29.52	30.16	30.09
	2	31.76	30.11	29.55	29.69	29.69	30.21	30.06	30.04	29.74	29.96	29.46	30.34	30.28
	3	32.80	30.51	29.93	30.38	30.38	30.36	30.17	30.12	29.77	30.17	29.51	30.53	30.52

These results depend on the percentage of moisture of substituted materials, consequently they affect on t he content from DM. There were significant difference ($P \leq 0.0001$) in the DM content among treatments. DM of all cheese treatment increased significantly (L.S.D 0.036) as storage period progressed [Table (3c)] .

Table (3a): Mean square and significant different on physico-chemical properties of substituting semi ripened Ras cheese with Labenah, Feta cheese and Ricotta cheese at ratios50 and 100%, respectively

Composition	Control	Treatments						L.S.D
		A2		B2		C2		
		A2a	A2b	B2a	B2b	C2a	C2b	
DM	44.70^{A}	44.15^{F}	44.31^{C}	44.22^{DE}	44.71^{A}	44.31^{C}	44.23^{DE}	0.066
F/DM	49.08^{CD}	49.66^{A}	49.24^{BC}	49.09^{CD}	49.10^{CD}	49.61^{A}	49.62^{A}	0.178
TP/DM	30.94^{A}	29.36^{E}	28.98^{FGH}	29.51^{C}	28.95^{HG}	29.78^{B}	29.72^{B}	0.097

Table (3b): Mean square and significant different on physico-chemical Properties of substituting ripened Ras cheese with Labenah, Feta cheese and Ricotta cheese at ratios 50 and 100%, respectively.

Composition	Effect		Mean square by storage period				L.S.D
	Storage period DF=3	Treatments DF=12	T0	T1	T2	T3	
DM	1.23***	0.37***	44.12^{D}	44.27^{C}	44.40^{B}	44.53^{A}	0.036
F/DM	0.25**	0.65***	49.31^{B}	49.27^{B}	49.35^{B}	49.46^{A}	0.098
TP/DM	0.18***	3.71***	29.48^{A}	29.39^{B}	29.37^{BC}	29.32^{C}	0.054

Tables (3c): Mean square and significant different between cheese treatments and storage period on physico-chemical properties of PCSs stored at 5°C.

Composition	Control	Treatments						LSD
		A1		B1		C1		
		A1a	A1b	B1a	B1b	C1a	C1b	
DM	44.70^{A}	44.22^{EF}	44.22^{DEF}	44.41^{B}	44.22^{DE}	44.32^{C}	44.28^{CD}	0.066
F/DM	49.08^{CD}	49.33^{B}	49.36^{B}	49.02^{D}	49.41^{B}	49.37^{B}	49.61^{A}	0.178
TP/DM	30.94^{A}	29.05^{GF}	28.92^{H}	29.07^{F}	28.92^{H}	29.49^{CD}	29.40^{DE}	0.097

DM: Dry Matter TP/DM: Total protein / Dry Matter F/DM: Fat / Dry Matter

A,B,C,D,: means not followed by the same upper case letter in column are significantly different ($P<0.05$

(** Significant at $P<0.001$) (*** Significant at $P<0.0001$) DF: degree of freedom

The results revealed that PCSs made by replacing semi ripened Ras cheese for all treatments were significantly higher in F/DM than the control, while PCSs made by B1a were significantly lower than the control(L.S.D 0.178) [Table (3a)]. PCSs made by replacing ripened Ras cheese with A2a, A2b, C2a and C2b were significantly higher in F/DM than the control, while with B2a and B2b were non- significant in F\DM than the control(L.S.D 0.178) [Table (3b)]. PCSs made by replacing semi ripened Ras cheese with A1b and B1b were higher in F\DM than those made by replacing ripened Ras cheese

with A2b and B2b,but PCSs made by replacing semi ripened Ras cheese with C1b was similar in F\DM which made by replacing ripened Ras cheese with C2a and C2b. While PCSs made by replacing ripened Ras cheese with A2a and B2b were higher in F/DM than made by replacing ripened Ras cheese with A1a and B1a. There were significant differences ($P \leq 0.0001$) in F/DM content among treatments. The storage period at 5°C for T0,T1 and T2 were non significant while T3 was significantly higher in F\DM (L.S.D 0.098). while interaction between time of storage for all treatment were significant in F/DM ($P \leq 0.001$) [Tables (3c)]. The results revealed that the PCSs made by replacing semi ripened Ras cheese for all treatments were significantly lower in TP/DM than the control (L.S.D 0.097) [Table (3a)]. Also PCSs made by replacing ripened Ras cheese for all treatments were significantly lower in TP/DM than the control (L.S.D 0.097) [Table (3b)]. While PCSs made by replacing ripened Ras cheese for all treatments were higher in TP/DM than those made by replacing semi ripened Ras cheese. There were significant differences ($P \leq 0.0001$) in TP/DM among treatments. The TP/DM content of all cheese treatments decreased significantly (L.S.D 0.054) as during storage period progressed [Table (3c)].

Results also revealed that PCSs made by replacing semi ripened and ripened Ras cheese in all treatments were significantly lower in pH than control cheese (L.S.D 0.093) [Tables(4a) ,(4b)]. This could be due to the low pH value of Labenah, Feta cheese and Ricotta cheese as compared with that of semi ripened and ripened Ras cheese. PCSs made by replacing ripened Ras cheese with were higher in pH values than PCSs made by replacing semi ripened Ras cheese with Salem *et al.* (1987) found that using denatured whey protein (DWP) or co-precipitates (CP) decreased the pH values with increasing content of (DWP) and (CP). EL-Saadany (1997) found that the partial substitution of Ras cheese with ultrafiltred retentate caused a significant increase in pH value.

Our results agree with those of Hanna and Nader (1998), who found that making processed cheese from Iraqi white soft cheese in place of cheddar cheese had lower pH value. Also,. pH values of all cheese treatment decreased significantly (L.S.D 0.05) as storage period progressed at 5°C for 3 months. There were significant differences ($P \leq 0.0001$) in pH values among cheese treatments as shown in Table (2c).This reduction could be attributed to the limited growth and the activity of resistant microflora and enzymes in the products. It could also be due to the hydrolysis of polymerized phosphate present in the emulsifying salts and interaction with protein (Tamime *et al.*, 1990, Younis *et al.*, 1991a, Aly *et al.*, 1995 and Chambre &Daurelles, 2000).

Therefore,these result revealed that PCSs made by replacing semi ripened and ripened Ras cheese in all treatments in this study were significantly higher in T. acidity than PCSs control cheese (L.S.D 0.048) [Tables (4a) , (4b)]. On the other hand, PCSs made by replacing semi ripened Ras cheese with A1b, B1b and C1b were higher in T. acidity than PCSs made by replacing ripened Ras cheese with A2b, B2b and C2b,. However the PCSs made by replacing semi ripened Ras cheese with C1a was similar with that of ripened Ras cheese with (B2a and C2a). This could

be due to the increase in T. acidity of Labenah, Feta cheese and Ricotta cheese as compared with acidity content of semi ripened and ripened Ras cheese. Our results agree with those of Salem *et al.* (1987), who found that the using denatured whey protein (DWP) and co-precipitates (CP) in making low fat processed cheese spread caused an increase in the titratable acidity with increasing content of (DWP) and (CP) values. Omer (2003) found that using cow's, buffaloes' and mixture of buffaloes' and cow's milk (1:1) fresh soft white cheese and flavored pastes in making processed cheese spread increased acidity. There were significant differences ($P \leq 0.0001$)) in titratable acidity (T.A) among treatments. Trititable acidity of all cheese treatments increased signlficantly(L.S.D 0.026) as storage period progressed [Table (4c)] .

Results revealed that substituting of semi ripened Ras cheese for all treatments in base blend resulted in significantly lower TP content in PCSs than the control. Substituting ripened Ras cheese for all treatments in base blend resulted in significantly lower TP content than control cheeses. while the PCSs made by substituting ripened Ras cheese were higher in TP content than those made by substituting semi ripened Ras cheese for all treatments (L.S.D 0.041) [Table (4a) ,(4b)]. These changes occurred in TP of PCSs may be due to the differences in TP contents of the components and semi ripened and ripened Ras cheese as shown in (Table I).. This result agreed with EL Neshawy *et al.* (1988) who reported that the addition of WPC to blends resulted in products of fine consistency and high in protein content. EL-Saadany (1997) found that the increased in total protein content of (PC), when making by partial substitution of Ras cheese by ultrafiltration retentate with ratios of 50 and 100 % respectively. Kebary *et al.* (2001) found that total nitrogen increased by substitution of kariesh cheese with denatured whey protein. There were significant differences ($P \leq 0.0001$) in Total Protein (TP) content among cheese treatments. TP content of all cheese treatments increased significantly (L.S.D 0.01) as storage period progressed[Table (4c)] .

Results also revealed, that PCSs made with substituting semi ripened Ras cheese for all treatments were significantly lower in SN content than the control PCSs. Also the PCSs made with substituting ripened Ras cheese for all treatments were significantly lower in SN content than the control PCSs (L.S.D 0.055) [Tables (4a), (4b)], While PCSs made by A2a similar in SN with control. Which could be due to the low SN content in Labenah, Feta cheese and Ricotta cheese being added in the formula. The SN contents decreased by increasing the replacement ratios of semi ripened and ripened Ras cheese with Labenah, Feta cheese and Ricotta cheese in the base blend. PCSs made by substituting ripened Ras cheese with (A2a, A2b) and (B2a, B2b) were higher than PCSs those made by substituting semi ripened Ras cheese with (A1a, A1b) and (B1a, B1b). While PCSs made by substituting semi ripened Ras cheese with (C1a, C1b) were higher than the PCSs made by substituting ripened Ras cheese with (C2a, C2b). [Tables (4a) , (4b)]. Our results are in agreement with those reported by (Abd EL- Baky 1987 and Salem *et al.*, 1987). El-saadany (1997) found that the using of ultrafiltration retentate in making processed cheese had a significant decrease in soluble nitrogen content.

Table (4): Effect of substituting semi ripened and ripened Ras cheese with Labenah, Feta cheese and Ricotta cheese at ratios of 50 and 100% respectively on some physico-chemical properties of processed cheese spreads during storage period up to 3 months at 5°C.

composition	Storage Period (Month)	control	1						2					
			A1		B1		C1		A2		B2		C2	
			A1a	A1b	B1a	B1b	C1a	C1b	A2a	A2b	B2a	B2b	C2a	C2b
pH	0	5.90	5.67	5.67	5.72	5.69	5.76	5.69	5.67	5.77	5.80	5.75	5.79	5.89
	1	5.88	5.65	5.64	5.70	5.67	5.75	5.67	5.64	5.73	5.77	5.72	5.77	5.85
	2	5.86	5.63	5.62	5.67	5.64	5.73	5.63	5.63	5.71	5.73	5.70	5.73	5.80
	3	5.85	5.63	5.60	5.65	5.63	5.71	5.61	5.61	5.69	5.70	5.68	5.71	5.78
%Acidity	0	0.98	1.20	1.25	1.10	1.20	1.07	1.21	1.25	1.09	1.07	1.08	1.07	1.01
	1	1.02	1.40	1.40	1.19	1.28	1.09	1.29	1.29	1.10	1.09	1.10	1.09	1.04
	2	1.03	1.47	1.48	1.25	1.38	1.10	1.47	1.47	1.16	1.10	1.13	1.11	1.07
	3	1.04	1.47	1.49	1.35	1.48	1.16	1.48	1.48	1.20	1.17	1.18	1.16	1.09
%TP	0	13.78	12.82	12.76	12.89	12.76	13.08	12.95	12.95	12.82	13.02	12.89	13.21	13.08
	1	13.81	12.84	12.78	12.90	12.77	13.09	12.96	12.96	12.84	13.04	12.92	13.24	13.09
	2	13.84	12.85	12.79	12.92	12.79	13.11	12.99	12.96	12.86	13.06	12.96	13.26	13.11
	3	13.86	12.86	12.80	12.93	12.80	13.14	13.00	12.97	12.88	13.08	13.00	13.28	13.19
%SN	0	0.95	0.91	0.88	0.76	0.75	0.75	0.77	0.95	0.91	0.78	0.76	0.67	0.65
	1	0.98	0.93	0.90	0.78	0.78	0.79	0.79	0.95	0.94	0.80	0.79	0.68	0.68
	2	1.10	0.96	0.92	0.80	0.80	0.80	0.80	0.98	0.97	0.82	0.81	0.72	0.72
	3	1.40	0.99	0.95	0.84	0.84	0.83	0.82	1.10	1.00	0.85	0.84	0.76	0.75
%Casein /Total Nitrogen	0	93.12	92.90	93.10	94.10	94.12	94.27	94.05	92.88	92.90	94.01	94.10	94.93	95.03
	1	92.90	92.76	92.96	93.85	93.89	93.96	93.90	92.67	92.68	93.87	93.89	94.79	94.81
	2	92.05	92.53	92.81	93.81	93.75	93.90	93.84	92.44	92.46	93.72	93.75	94.57	94.51
	3	91.90	92.30	92.58	93.50	93.45	93.68	93.69	91.52	92.24	93.50	93.54	94.28	94.21
%F/TN	0	10.09	10.85	10.85	10.74	10.90	10.63	10.74	10.74	10.80	10.59	10.74	10.53	10.63
	1	10.09	10.85	10.85	10.74	10.90	10.63	10.74	10.79	10.85	10.64	10.74	10.53	10.66
	2	10.09	10.90	10.90	10.74	10.95	10.68	10.74	10.84	10.90	10.63	10.79	10.58	10.73
	3	10.14	10.84	10.90	10.74	10.90	10.68	10.78	10.89	10.94	10.68	10.78	10.63	10.78

There were significant differences ($P \leq 0.0001$) in Soluble Nitrogen (SN) content among treatments. The SN content of all cheese treatment increased significantly (L.S.D 0.03) as storage period progressed [Table (4c)]. The change occurred in SN contents during storage might be due to the enzymatic activity of heat resistant proteinases or psychotropic spore forming bacteria present in the product Tamime *et al.* (1990), Younis *et al.* (1991a) and Aly *et al.* (1995).

Therefore, these results revealed that PCSs made by substituting semi ripened for all treatments and ripened Ras cheese for all treatments were significantly higher in casein/ Total Nitrogen than the control (L.S.D 0.324) [Tables (4a) , (4b)]. While PCSs made from the substituting of semi ripened Ras cheese with (A1a, A1b, B1a and B1b) were higher than PCSs made by substituting ripened Ras cheese with (A2a, A2b, B2a and B2b), while PCSs made by C1a and C1b were lower than those made by C2a and C2b. These changes occurred in casein/Total Nitrogen of PCSs which made by partial substituting of semi ripened and ripened Ras cheese. It may be attributed to the differences in soluble nitrogen and total nitrogen contents in the semi ripened and ripened Ras cheese. There were significant differences ($P \leq 0.0001$) in Casein/ Total Nitrogen content among treatments. Casein /Total Nitrogen of all cheese treatment decreased significantly (L.S.D 0.18) as storage period progressed [Table (4c)].The results revealed that PCSs made by substituting semi ripened and ripened Ras cheese for all treatments were significantly higher (L.S.D 0.035) in F/TN than the control [Table (4a) ,(4b)]. PCSs made by substituting semi ripened Ras cheese were higher in F/TN than PCSs made by substituting ripened Ras cheese. It could be attributed to the differences in total nitrogen contents for the components or the semi ripened and ripened Ras cheese. There were significant differences ($P \leq 0.0001$) in the F/TN content among treatments. F/TN did not significantly change at T0, T1 but change significantly at T2 (L.S.D 0.019) [table (4c)].The chemical compositions of PCSs were reported to be changed very slightly during storage at the refrigerator temperature (Abd EL- Salam *et al.*, 1996; Hamed *et al.*, 1997; El Sorbaty *et al.*, 1998 and Mohamed, 2004).

Table (4a): Mean square and significant different on physico-chemical properties of substituting semi ripened Ras cheese with Labenah, Feta cheese and Ricotta cheese at ratios50 and 100%, respectively.

Composition	Control	Treatments						L.S.D
		A1		B1		C1		
		A1a	A1b	B1a	B1b	C1a	C1b	
pH	5.87^{A}	5.65^{DE}	5.63^{E}	5.69^{CDE}	5.74^{BC}	5.73^{CD}	5.67^{CDE}	0.093
Acidity	1.02^{E}	1.39^{A}	1.37^{A}	1.20^{C}	1.32^{B}	1.12^{D}	1.35^{AB}	0.048
Casein/TN	91.99^{E}	92.62^{CD}	92.86^{C}	94.09^{B}	93.80^{B}	93.95^{B}	93.87^{B}	0.324
TP	13.82^{A}	12.85^{F}	12.79^{EF}	12.91^{C}	12.78^{EF}	13.06^{B}	13.01^{BC}	0.041
SN	1.11^{A}	0.95^{BC}	0.91^{CD}	0.79^{E}	0.79^{E}	0.79^{E}	0.87^{D}	0.055
F/TN	10.10^{H}	10.85^{B}	10.88^{B}	10.74^{D}	10.91^{A}	10.66^{F}	10.75^{D}	0.035

Table (4b): Mean square and significant different on physico-chemical properties of substituting ripened Ras cheese with Labenah, Feta cheese and Ricotta cheese at ratios50 and 100%, respectively.

Composition	Control	Treatments						L.S.D
		A2		B2		C2		
		A2a	A2b	B2a	B2b	C2a	C2b	
pH	5.87^{A}	5.75^{Bc}	5.71^{CDE}	5.75^{BC}	5.71^{CDE}	5.75^{BC}	5.83^{AB}	0.093
Acidity	1.02^{E}	1.36^{AB}	1.14^{D}	1.10^{D}	1.12^{D}	1.10^{D}	1.05^{E}	0.048
Casein/TN	91.99^{E}	92.38^{D}	92.57^{CD}	93.78^{B}	93.82^{B}	94.64^{A}	94.64^{A}	0.324
TP	13.82^{A}	12.95^{BC}	12.83^{EF}	13.04^{BC}	12.94^{C}	13.19^{AB}	13.13^{B}	0.041
SN	1.11^{A}	0.99^{B}	0.96^{BC}	0.81^{E}	0.80^{E}	0.71^{F}	0.70^{F}	0.055
F/TN	10.10^{H}	10.82^{C}	10.87^{B}	10.64^{F}	10.76^{D}	10.57^{G}	10.70^{E}	0.035

SN: Soluble Nitrogen; TP: Total Protein; F/TN: Fat/Total Nitrogen

A,B,C,D,E,F,H,G: means not followed by the same upper case letter in column are significantly different ($P<0.05$)

Table (4c): Mean square and significant different of cheese treatments and storage period on physico-chemical properties of PCSs stored at 5°C.

Composition	Effect		Mean square by storage period				L.S.D
	Storage period DF=3	Treatments DF=12	T0	T1	T2	T3	
pH	0.09***	0.06***	5.75^{A}	5.77^{A}	5.69^{B}	5.68^{B}	0.051
Acidity	0.26***	0.22***	1.12^{C}	1.14^{C}	1.25^{B}	1.29^{A}	0.026
Casein/TN	4.36***	9.12***	93.81^{A}	93.62^{B}	93.40^{C}	93.03^{D}	0.180
TP	0.22***	0.14***	12.98^{D}	13.00^{C}	13.03^{B}	13.05^{A}	0.010
SN	0.13***	0.17***	0.81^{C}	0.83^{BC}	0.86^{B}	0.94^{A}	0.031
F/TN	0.037***	0.53***	10.68^{B}	10.69^{B}	10.73^{A}	10.74^{A}	0.019

SN: Soluble Nitrogen; TP: Total Protein; F/ TN: Fat/Total Nitrogen.

A,B,C,D: Means not followed by the same upper case letter in column are significantly different ($P<0.05$). (*Significant at $P<0.05$) (Significant at $P<0.001$) (*** Significant at $P<0.0001$)**

DF: degree of freedom

The meltability of PCSs made by replacing semi ripened and ripened Ras cheese in the base blend with Labenah, Feta cheese and Ricotta cheese is presented in Table (5) .The PCSs made by replacing semi ripened and ripened Ras cheese in all treatment were significantly higher in meltability than control cheese (L.S.D 1.57). Meltability of cheese PCSs made by replacing ripened Ras cheese were higher than those made by replacing semi ripened Ras cheese [Tables (5a) , (5b)]. On the other hand PCSs made by replacing semi ripened Ras cheese with (A1b, B1b and C1b) were higher melting quality than control cheese. However, the meltability values of all cheese treatments decreased significantly (L.S.D 0.757) as storage period progressed [Table (5c)]. Sood & Kosikowski (1979) reported that the melting index of processed cheese is controlled largely by the ratio of insoluble to total casein nitrogen in ingredient. Kebary *et al* (2001) found that PCSs made by replacing kariesh cheese by denatured whey protein caused a significant increase in meltability.

Table (5): Effect of substituting semi ripenedand ripened Ras cheese with Labenah, Feta cheese and Ricotta cheese at ratios of 50 and 100% respectively on rheological properties of spread processed cheese during storage period up to 3 months at 5°C.

Composition	Storage Period (Month)	control	1						2					
			A1		B1		C1		A2		B2		C2	
			A1a	A1b	B1a	B1b	C1a	C1b	A2a	A2b	B2a	B2b	C2a	C2b
Melting Index	1	20.33	24.67	0.00	23.76	0.00	21.33	0.00	27.33	27.00	29.00	37.67	28.67	27.00
	2	20.33	22.33	0.00	21.32	0.00	18.33	0.00	27.33	26.33	27.67	36.00	27.33	26.33
	3	18.33	20.66	0.00	20.76	0.00	18.33	0.00	26.67	25.33	26.00	34.00	27.33	25.33
Oil separation	1	21.68	25.67	0.00	20.00	0.00	25.00	0.00	15.00	15.00	15.00	3.33	15.00	25.00
	2	26.67	28.33	0.00	21.33	0.00	26.67	0.00	15.00	20.00	18.33	5.00	21.67	30.00
	3	30.00	28.33	0.00	20.00	0.00	30.00	0.00	20.00	21.67	20.00	5.33	21.67	31.67

Table (5a): Mean square and significant different on rhelogical properties of substituting semi ripened Ras cheese with Labenah, Feta cheese and Ricotta cheese at ratios50 and 100%, respectively.

Composition	Control	Treatments						L.S.D
		A1		B1		C1		
		A1a	A1b	B1a	B1b	C1a	C1b	
Melt Index	19.66^{D}	22.55^{C}	0.00^{E}	21.95^{C}	0.00^{E}	19.33^{D}	0.00^{E}	1.57
Oil Separation	26.67^{B}	27.44^{B}	0.00^{H}	20.44^{C}	0.00^{H}	27.22^{B}	0.00^{H}	1.35

Table (5b): Mean square and significant different on rhelogical properties of substituting ripened Ras cheese with Labenah, Feta cheese and Ricotta cheese at ratios50 and 100%, respectively.

Composition	Control	Treatments						L.S.D
		A2		B2		C2		
		A2a	A2b	B2a	B2b	C2a	C2b	
Melt Index	19.66^{D}	27.11^{B}	26.22^{B}	27.56^{B}	32.56^{A}	27.78^{B}	26.22^{B}	1.57
Oil Separation	26.67^{B}	16.67^{F}	18.89^{DE}	17.78^{EF}	4.55^{G}	19.45^{CD}	28.87^{A}	1.35

Tables (5c): Mean square and significant different of cheese treatments and storage period on rhelogical properties of of PCSs stored at 5°C.

Composition	Effect		Mean square by storage period			L.S.D
	Storage period DF=2	Treatments DF=12	T1	T2	T3	
Meltability	67.75***	12.51***	20.52^{A}	19.49^{B}	17.90^{C}	0.75
Oil Separation	128.53***	11.92***	14.02^{C}	16.38^{B}	17.09^{A}	0.65

A, B, C, D,E,F,H,G: means not followed by the same upper case letter in column are significantly different ($P<0.05$).: means not followed by the same upper case letter in column are significantly different ($P<0.05$). (*** Significant at $P<0.0001$) DF= degree of freedom

Generally, Guinee (2003) mentioned that the effect of added whey protein on the flowability of PCSs might be due to differences in pretreatment of the whey protein and its levels of denaturation, methods of whey protein inclusion, the overall product formulation and processing conditions. Our results were agreed with those of Mohammed (2004) and Abd EL-Salam *et al* (1996) they reported that the meltability of PCSs increased with the increasing in the percentage of added WPC while its decreased with advanced storage.

Oil separation values of PCSs made by replacing semi ripened and ripened Ras cheese in the base blend with Labenah, Feta cheese and Ricotta cheese during storage for 3 months at 5 °C were presented in Table (5). It can be noticed that, PCSs made by replacing semi ripened Ras cheese with (A1a and C1a) were significantly higher in oil separation values while B1a was significantly lower than control cheese. (L.S.D 1.353). [Table (5a]. While PCSs made by replacing ripened Ras cheese with (A2a, A2b), (B2a, B2b) and C2a, C2b) were significantly lower in oil separation values than the control (L.S.D 1.353) [Table (5b)]. There were no oil separation in cheese

made by substituting semi ripened Ras cheese with (A1b, B1b and C1b). The absence of oil separation may be due to the emulsifying salts were suitable for maintaining a uniform structure and distribution of protein and fat contents after the melting stage, also to adjust the pH to the desired levels to avoid any oil separation from the products (Younis *et al.,* 1991b). PCSs made by replacing semi ripened Ras cheese with A1a, B1a and C1a were significantly higher in oil separation than those made by replacing ripened Ras cheese with A2a, B2a and C2a.

While PCSs made by replacing ripened Ras cheese with A2b, B2b and C2b were higher than those made by replacing semi ripened Ras cheese with A1b, B1b and C1b [Table (5a) ,(5b)].This could be attributed to ripening. (Abd EL- Salam *et al.*, (1996); Hamed *et al.*, (1997) and Mohamed (2004) found that presumable, unfolding of the whey protein molecule during heat processing exposes hydrophobic groups that could orient at the oil and water interface and improve emulsion stability. Kebary *et al.*,(2001) found that the PCSs made from substitution kariesh cheese with denatured whey protein causes a significant decrease in oiling off. There were a significant different in oil separation among all treatments($P \leq 0.0001$). The oil separation values increased significantly (L.S.D 0.650) in all cheese treatments as storage period advanced [Table (5c)]. The increase in the free oil with storage has been reported in several studies (Parmer and Sly 1943, Thomas 1973).

Hardness is a parameter for cheese quality (soft, firm and hard). Hardness values for all treatments of the PCSs made by replacing semi ripened and ripened Ras cheese is shown in Tables (6). PCSs made by replacing semi ripened Ras cheese for all treatments except C1a were significantly higher , also, in the PCSs made by replacing ripened Ras cheese for all treatments were significantly higher except B2b (LSD 0.083) than the control , but all treatments of PCSs made replacing semi ripened Ras cheese was significantly lower than that PCSs made by replacing ripened Ras cheese expected when substituting A2a [Tables (6a) , (6b)]. The differences in hardness of these treatments are related to protein structure and network. The structural matrix of cheese is a cross linked casein- calcium phosphate network in which fat globules are physically entrapped (Prentice *et al.*, 1993). Our results agree with those of awad *et al.* (2006) who found that the high proteolysis in aged cheeses decreases the hardness of processed cheese control as compared to that made from blending of young and slurry Ras cheese. There were significant differences ($P \leq 0.0001$) in hardness values among treatments. Hardness values of all cheese treatments increased significantly (L.S.D 0.046) as storage period progressed [Table (6c)].

The differences in cohesiveness values among treatments is shown in Table (6). However, these values in the PCSs made by replacing semi ripened and ripened Ras cheese in all treatments in this study were significantly lower (L.S.D 0.03) than control cheese. [Tables (6a) , (6b)]. On the other hand, PCSs made by replacing semi ripened Ras cheese with A1a, A1b, B1a, B1b and C1b were lower than those made by replacing ripened Ras cheese with A2a, A2b, B2a, B2b and C2b, while PCSs made by C1a similar in cohesiveness with C2a. Irudayaraj *et al.* (1999) reported that the nature and the content of the protein matrix and extent of fat dispersion

contribute to cohesiveness or the tendency of cheese to adhere to itself. Proteolysis disrupts the structural integrity of the protein matrix, leading to reduced cohesiveness. The results revealed that there were significant differences in cohesiveness values among treatments ($P \leq 0.0001$). Cohesiveness of all cheese treatments decreased significantly (L.S.D 0.016) as storage period progressed. [Table (6c)].

PCSs made by replacing semi ripened and ripened Ras cheese with for all treatments were significantly lower (L.S.D 0.03) in Gumminess values than control cheese [Tables (6a), (6b)]. While PCSs made by replacing semi ripened Ras cheese with A1b, B1a, B1b, C1a and C1b were lower than those made that by replacing ripened Ras cheese with A2b, B2a, B2b, C2a and C2b, but PCSs made by replacing semi ripened Ras cheese with A1a was higher than that made by replacing ripened Ras cheese with A2a. The results revealed that there were significant differences in Gumminess values among treatments ($P \leq 0.0001$). Gumminess values of all cheese treatments was not significant (LSD 0.017) as e storage period increased.[Table (6c)].

The differences in chewiness values among treatments are shown in Table (6). However, the PCSs made by replacing semi ripened and ripened Ras cheese in all treatment expect B2a, B2b, C2a and C2b in this study were significantly lower (L.S.D 0.02) in chewiness than PCSs control [Tables (6a), (6c)]. On the other hand, PCSs made by replacing semi ripened Ras cheese with A1b, B1a, B1b, C1a and C1b were lower than those made by replacing ripened Ras cheese with A2b, B2a, B2b, C2a and C2b. but PCSs made by replacing semi ripened Ras cheese with A1a was higher than made by replacing ripened Ras cheese with A2a. The results revealed that there were significant differences ($P \leq 0.0001$) in chewiness values. Chewiness of all cheese treatments increased significantly (LSD 0.011) as storage period progressed Table(6c).

PCSs made by replacing semi ripened and ripened Ras cheese in all treatments expect C2b were significantly lower (L.S.D 0.20) in adhesiveness values than control cheese (Tables (6a) , (6c)]. On the other hand, the PCSs made by replacing semi ripened Ras cheese with A1b, B1a, B1b, C1a and C1b were lower than that made by replacing ripened Ras cheese with A2b, B2a, B2b, C2a and C2b, but PCSs made by replacing semi ripened Ras cheese with A1a was higher than made by the PCSs made by replacing ripened Ras cheese with A2a. The results revealed also that, there were significant differences ($P \leq 0.0001$) in adhesiveness values among treatments. Adhesiveness of all cheese treatments increased significantly (L.S.D 0.115) as storage period progressed. (Table (6c)].

The PCSs made by replacing semi ripened and ripened Ras cheese in all treatments in this study were significantly higher (L.S.D 0.009) in elasticity values than PCSs control [Tables (6a) and (6b)]. On the other hand PCSs made by replacing semi ripened Ras cheese with A1a was similar to made by replacing ripened Ras cheese with B2b, C2a and C2b. While PCSs made by replacing semi ripened Ras cheese with A1b, B1a, B1b, C1a and C1b were similar to made by replacing ripened Ras cheese with A2a, A2b and B2a. Salem *et al.* (1987) reported that PCSs made with co-precipitates (CP) has elasticity value greater denatured whey protein than control.

Table (6): Effect of substituting semi ripened and ripened Ras cheese with Labenah, Feta cheese and Ricotta cheese at ratios of 50 and 100% respectively on rheological properties of spread processed cheese during storage period up to 3 months at 5°C.

Composition	Storage Period (Month)	Control	1						2					
			A1		B1		C1		A2		B2		C2	
			A1a	A1b	B1a	B1b	C1a	C1b	A2a	A2b	B2a	B2b	C2a	C2b
Hardness	0	-1.86	-1.34	-1.55	-1.39	-1.59	-1.44	-1.57	-1.50	-1.48	-1.30	-1.45	-1.39	-1.38
	1	-1.51	-1.31	-1.54	-1.36	-1.54	-1.42	-1.54	-1.49	-1.46	-1.28	-1.42	-1.37	-1.37
	2	-1.20	-1.29	-1.53	-1.33	-1.45	-1.40	-1.51	-1.44	-1.45	-1.25	-1.35	-1.35	-1.37
	3	-0.98	-1.25	-1.51	-1.31	-1.43	-1.37	-1.51	-1.43	-1.32	-1.24	-1.31	-1.32	-1.33
Cohesiveness	0	0.78	0.61	0.62	0.63	0.63	0.67	0.64	0.63	0.65	0.66	0.64	0.67	0.70
	1	0.74	0.59	0.61	0.62	0.62	0.66	0.63	0.61	0.64	0.64	0.63	0.66	0.69
	2	0.69	0.58	0.60	0.60	0.61	0.65	0.60	0.60	0.62	0.62	0.61	0.64	0.67
	3	0.66	0.58	0.58	0.59	0.59	0.63	0.60	0.59	0.61	0.60	0.59	0.62	0.65
Gumminess	0	-0.27	-0.24	-0.25	-0.25	-0.23	-0.22	-0.26	-0.25	-0.26	-0.19	-0.26	-0.20	-0.18
	1	-0.18	-0.24	-0.25	-0.24	-0.23	-0.23	-0.26	-0.25	-0.26	-0.19	-0.26	-0.20	-0.19
	2	-0.13	-0.25	-0.26	-0.25	-0.23	-0.23	-0.25	-0.25	-0.27	-0.19	-0.26	-0.21	-0.20
	3	-0.13	-0.24	-0.26	-0.25	-0.22	-0.25	-0.25	-0.25	-0.28	-0.21	-0.27	-0.22	-0.21
Chewiness	0	-0.07	0.03	-0.02	0.02	-0.03	0.02	-0.01	-0.01	0.004	0.05	0.005	0.04	0.05
	1	0.01	0.03	-0.03	0.02	-0.02	0.02	-0.02	-0.01	0.01	0.06	0.004	0.03	0.05
	2	0.07	0.03	-0.03	0.02	-0.01	0.02	-0.02	-0.0001	0.002	0.06	0.004	0.04	0.03
	3	0.12	0.04	-0.03	0.02	-0.01	0.01	-0.02	0.001	-0.01	0.05	0.004	0.03	0.04
Adhesiveness	0	0.71	1.53	0.90	1.37	0.85	1.50	0.98	1.12	1.25	1.89	1.25	1.73	1.88
	1	1.61	1.48	0.93	1.38	0.91	1.80	1.00	1.07	1.23	1.87	1.20	1.70	1.81
	2	2.27	1.46	0.80	1.36	1.03	1.42	0.91	1.18	1.12	1.84	1.23	1.63	1.68
	3	2.80	1.55	0.79	1.37	1.08	1.38	0.89	1.15	1.09	1.95	1.25	1.62	1.70
Elasticity	0	0.77	0.81	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.81	0.81	0.81
	1	0.79	0.81	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.81	0.80	0.81
	2	0.80	0.81	0.80	0.80	0.80	0.80	0.80	0.81	0.80	0.81	0.80	0.80	0.80
	3	0.81	0.81	0.80	0.80	0.80	0.80	0.80	0.81	0.80	0.81	0.80	0.80	0.80

Table (6a): Mean square and significant different on rhelogical properties of substituting semi ripened Ras cheese with Labenah, Feta cheese and Ricotta cheese at ratios50 and 100%, respectively

Composition	Control	Treatments						L.S.D
		A1		B1		C1		
		A1a	A1b	B1a	B1b	C1a	C1b	
Hardness	-1.39^{BC}	-1.30^{DE}	-1.51^{A}	-1.37^{BCD}	-1.50^{A}	-1.41^{BC}	-1.50^{A}	0.083
Cohesiveness	0.72^{A}	0.59^{F}	0.61^{EF}	0.61^{EF}	0.61^{EF}	0.65^{BC}	0.62^{DEF}	0.030
Gumminess	-0.16^{H}	-0.24^{DE}	-0.31^{A}	-0.25^{DE}	-0.30^{A}	-0.23^{EF}	-0.30^{A}	0.03
Chewiness	0.03^{BC}	0.02^{BC}	-0.02^{G}	0.02^{BC}	-0.01^{GEF}	0.02^{BC}	-0.02^{G}	0.020
Adhesiveness	1.79^{AB}	1.51^{CD}	0.89^{J}	1.37^{DEF}	0.97^{JHI}	1.43^{DE}	0.92^{JI}	0.208
Elasticity	0.79^{C}	0.81^{A}	0.80^{BC}	0.80^{BC}	0.80^{BC}	0.80^{BC}	0.80^{BC}	0.009

Table (6b): Mean square and significant different on rhelogical properties of substituting ripened Ras cheese with Labenah, Feta cheese and Ricotta cheese at ratios50 and 100%, respectively

Composition	Control	Treatments						L.S.D
		A2		B2		C2		
		A2a	A2b	B2a	B2b	C2a	C2b	
Hardness	-1.39^{BC}	-1.45^{AB}	-1.43^{ABC}	-1.26^{E}	-1.38^{BC}	-1.36^{CD}	-1.36^{CD}	0.083
Cohesiveness	0.72^{A}	0.61^{EF}	0.63^{CDE}	0.63^{CDE}	0.62^{CDE}	0.65^{BCD}	0.68^{B}	0.030
Gumminess	-0.16^{H}	-0.26^{ABC}	-0.27^{BCD}	-0.20^{G}	-0.26^{CDE}	-0.21^{FG}	-0.20^{G}	0.03
Chewiness	0.03^{BC}	0.0003^{DEF}	0.002^{DEF}	0.05^{A}	0.01^{CDE}	0.03^{AB}	0.05^{A}	0.020
Adhesiveness	1.79^{AB}	1.13^{GH}	1.17^{FGH}	1.89^{A}	1.23^{EFG}	1.65^{BC}	1.74^{AB}	0.208
Elasticity	0.790^{C}	0.80^{BC}	0.80^{BC}	0.80^{BC}	0.81^{A}	0.80^{BC}	0.81^{AB}	0.009

A,B,C,D,E,F,G,H,I: Means not followed by the same upper case letter in column are significantly different (P<0.05)

Table (6c): Mean square and significant different of cheese treatments and storage period on rhelogical properties of PCSs stored at 5°C.

Composition	Effect		Mean square by storage period				L.S.D
	Storage period DF=3	Treatments DF=12	T0	T1	T2	T3	
Hardness	-0.22***	-0.07***	-1.496^{A}	-1.427^{B}	-1.371^{B}	-1.319^{C}	0.046
Cohesiveness	0.02***	0.01***	0.656^{A}	0.641^{A}	0.622^{B}	0.607^{B}	0.016
Gumminess	-0.0004	-0.03***	-0.24^{A}	-0.24^{A}	-0.24^{A}	-0.25^{A}	0.017
Chewiness	0.001	0.0007***	0.019^{B}	0.015^{AB}	0.013^{AB}	0.006^{A}	0.011
Adhesiveness	0.1488*	1.4210***	1.287^{B}	1.332^{AB}	1.379^{AB}	1.431^{A}	0.115
Elasticity	0.0001	0.0002	0.800^{A}	0.801^{A}	0.801^{A}	0.804^{A}	0.005

AB,C: Means not followed by the same upper case letter in column are significantly different (P<0.05) (* Significant at P<0. 05); (* Significant at P<0.0001)**

DF: Degree of freedom

Our results agree with Kabary *et al.* (2001) were reported that the addition of denatured whey protein in manufacture processed cheese caused a significant increase in elasticity. The results revealed that there were not significant differences ($P \leq 0.0002$) in elasticity values among treatments. Elasticity of all cheese treatments caused not significant different (LSD 0.005) as storage period progressed .[Table (6c)].

These indicated that the texture properties of processed cheese are related to many factors (i.e. moisture, pH, protein structure, fat content, salt content and protein content).

Sensory evaluation of PCSs manufactured by substituting semi ripened and ripened Ras cheese with Labenah, Feta cheese and Ricotta cheese during storage period, is illustrated in Table (7).The results revealed that flavour scores of PCSs which made by substituting semi ripened and ripened Ras cheese were significantly lower (L.S.D 0.156) than the control cheese [Tables (7a) , (7b)]. PCSs made by replacing semi ripened Ras cheese for all treatments were better in flavour than those made by replacing ripened Ras cheese for all treatments. Dhoul *et al.* (1994) found that the PCSs made from replacing Ras cheese with 40 % cheddar cheese with chakka did not significant affected in organoleptic quality of the cheese spread. Aly *et al.* (1995) found that replacing matured Ras cheese with lipase treated retentates gave product with flavour, consistency and colour superior to the control when fresh or after storage. Tukan *et al.* (1998) found that the best sensory evaluation in PCSs showed that a combination of desalted white cheese to Labenah was 2.5: 1. There were significant differences ($P < 0.0001$) in flavour scores among all treatments. Flavour of all treatments cheese improved significantly (L.S.D 0.087) as storage period progressed. [Table (7c)].

The results revealed also that the PCSs made by replacing semi ripened Ras cheese with B1b and C1b was of better texture than the control and other treatments. While PCSs made by replacing semi ripened Ras cheese with A1b was significantly lower in texture scores than control. However, the PCSs made by replacing semi ripened Ras cheese with A1a, B1a and C1a were similar in texture to control [Table (7a)].On other hand, the PCSs made by replacing ripened Ras cheese with B2a and C2a were significantly higher in texture scores than the control. While PCSs made by replacing ripened Ras cheese with A2a, A2b, B2b and C2b were significantly lower in texture scores than the control [Table (7b)]. Hamed *et al.* (1997) found that the addition of whey protein concentrate in processed cheese spread improved their body and texture. The type, characteristic, age of natural cheese and moisture content play a major role in controlling the texture, viscoelastic, functional, microstructure and sensorial properties of processed cheese (Bowland and Foegeding, 2001; French *et al*_., 2002; Glenn *et al.*, 2003; Acharya and Mistry, 2005; higherover Awad *et al.*, 2006). There were significant differences ($P \leq 0.0001$) in texture among treatments). Texture values of all cheese treatments significant different (L.S.D 0.2113) as the storage period progressed.[Table (7c)].

The results revealed also that The PCSs made by replacing semi ripened Ras cheese for all treatments were as darker colour than control cheese. On the other hand the PCSs made by replacing ripened Ras cheese with, B2b and C2b were light in colour than control cheese. The colour scores of PCSs made by replacing ripened Ras cheese with (A2a andA2b) were similar to control, while PCSs made by replacing ripened Ras cheese with B2a and C2a were darker than the control.

Table (7): Effect of substituting semi ripened and ripened Ras cheese with Labenah, Feta cheese and Ricotta cheese at ratios of 50 and 100% respectively on organoleptic properties during storage period up to 3 months at 5°C.

Organoleptic properties	Storage Period (Month)	control	1						2					
			A1		B1		C1		A2		B2		C2	
			A1a	A1b	B1a	B1b	C1a	C1b	A2a	A2b	B2a	B2b	C2a	C2b
Flavour (50)	0	47.00	45.00	41.00	45.00	40.00	44.00	40.00	41.00	40.50	45.20	38.60	43.60	41.00
	1	47.40	45.50	41.40	45.50	40.40	44.50	40.40	41.50	41.00	45.60	39.00	44.10	41.50
	2	47.80	45.90	41.90	45.90	40.90	45.00	40.90	41.90	41.40	46.00	39.40	44.60	41.90
	3	48.20	46.30	42.30	46.30	41.20	45.50	41.20	42.20	41.90	46.30	39.90	45.20	42.20
Texture (40)	0	37.00	37.00	34.00	37.00	40.00	37.00	40.00	36.10	35.30	38.60	35.20	37.80	34.50
	1	37.30	37.40	34.40	37.50	40.00	37.30	40.00	36.50	35.70	38.90	35.60	38.20	35.00
	2	37.7	37.80	34.80	38.00	40.00	37.70	40.00	36.90	36.00	39.10	36.00	38.60	35.40
	3	38.00	38.20	35.20	38.40	40.00	38.20	40.00	37.20	36.50	39.50	36.00	38.90	35.90
Colour (10)	0	9.00	8.00	8.00	8.00	8.00	8.00	8.00	9.00	9.00	9.20	8.50	9.10	8.50
	1	9.00	8.00	8.00	8.00	8.00	8.00	8.00	9.00	9.00	9.20	8.50	9.10	8.50
	2	9.00	8.00	8.00	8.00	8.00	8.00	8.00	9.00	9.00	9.20	8.50	9.10	8.50
	3	9.00	8.00	8.00	8.00	8.00	8.00	8.00	9.00	9.00	9.20	8.50	9.10	8.50
Total Score (100)	0	93.00	90.00	83.00	90.00	88.00	89.00	88.00	86.10	84.80	93.00	82.30	90.50	84.00
	1	93.70	90.90	83.80	91.00	88.40	89.80	88.40	87.00	85.70	93.70	83.10	91.40	85.00
	2	94.50	91.70	84.70	91.90	88.90	90.70	88.90	88.80	86.40	94.30	83.90	92.30	85.80
	3	95.20	92.50	85.50	92.70	89.20	91.70	89.20	88.40	87.40	95.00	84.40	93.20	86.60

Table (7a): Mean square and significant different on organoleptic properties of substituting semi ripened Ras cheese with Labenah, Feta cheese and Ricotta cheese at ratios 50 and 100%, respectively

Composition	Control	Treatments						L.S.D
		A2		B2		C2		
		A2a	A2b	B2a	B2b	C2a	C2b	
Flavour	47.60^{A}	41.65^{E}	41.20^{F}	45.77^{B}	39.22^{H}	44.37^{D}	41.65^{E}	0.156
Texture	37.50^{D}	36.67^{E}	35.90^{F}	39.02^{B}	36.02^{F}	38.29^{C}	35.20^{G}	0.380
Colour	9.00^{C}	9.00^{C}	9.00^{C}	9.20^{A}	8.50^{D}	9.10^{B}	8.58^{D}	0.097
Total Score	90.26^{BC}	87.58^{CDE}	86.08^{DEF}	94.00^{A}	83.43^{F}	91.85^{AB}	85.35^{DEF}	3.516

Table (7b): Mean square and significant different on organoleptic properties of substituting ripened Ras cheese with Labenah, Feta cheese and Ricotta cheese at ratios 50 and 100%, respectively.

Composition	Control	Treatments						LSD
		A1		B1		C1		
		A1a	A1b	B1a	B1b	C1a	C1b	
Flavour	47.60^{A}	45.67^{B}	41.65^{E}	45.67^{B}	40.62^{G}	44.75^{C}	40.62^{G}	0.156
Texture	37.50^{C}	37.60^{D}	34.84^{G}	37.72^{D}	40.00^{A}	37.55^{D}	40.00^{A}	0.380
Colour	9.00^{C}	8.00^{E}	8.00^{E}	8.00^{E}	8.00^{E}	8.00^{E}	8.00^{E}	0.097
Total Score	90.26^{BC}	91.35^{AB}	84.25^{EF}	91.39^{AB}	88.62^{BCD}	90.55^{ABC}	88.62^{BCD}	3.516

Table (7c): Mean square and significant different of cheese treatments and storage period on organoleptic properties of PCSs stored at 5°C.

Composition	Effect		Mean square by storage period				L.S.D
	Storage period DF=3	Treatments DF=12	T0	T1	T2	T3	
Flavour	12.11***	82.20***	42.46^{D}	42.91^{C}	43.35^{B}	43.75^{A}	0.087
Texture	4.41***	33.18***	37.06^{C}	37.22^{C}	37.54^{B}	37.82^{A}	0.2113
Colour	0.006	3.12***	8.48^{A}	8.48^{A}	8.48^{A}	8.51^{A}	0.054
Total Score	70.41*	125.21***	87.82^{BC}	87.35^{C}	89.55^{AB}	90.15^{A}	1.951

A, B, C, D,E,F,G: means not followed by the same upper case letter in column are significantly different.). (*Significant at $P<0.05$); (*** Significant at $P<0.0001$)

Moreover PCSs made by replacing ripened Ras cheese was dark in colour scores than made by replacing semi ripened Ras cheese [Tables (7a) and (7b)].

Bley *et al.*, 1985; Singh and Kanawjia 1989 and Hamed *et al.*, 1997 showed that the colour of processed cheese changed markedly during storage, and these appeared to be due to progressive browning and mallard's reaction. Mashaly (1987) reported that the storage of the produced processed cheese up to 30 days at 5 *C* didn't affect the organoleptic quality. There were significant differences ($P \leq 0.0001$) in colour among treatments. Colour of all cheese treatments was not significant (L.S.D 0.054) as storage period progressed [Table (7c)].

Table (8): Effect of replacing semi ripened and ripened Ras cheese with Labenah, Feta cheese and Ricotta cheese at ratios of 50 and 100% respectively on total cost of ingredients (5Kg) used for manufacturing processed cheese spreads

Ingredients	Price L.E/Kg	Control	1						2					
			A1		B1		C1		A2		B2		C2	
			A1a	A1b	B1a	B1b	C1a	C1b	A2a	A2b	B2a	B2b	C2a	C2b
Ripened Ras cheese	29.00	43.50	43.50	43.50	43.50	43.50	43.50	43.50	21.75	0.00	21.75	0.00	21.75	0.00
Semi ripened Ras cheese	29.00	29.00	14.50	0.00	14.50	0.00	14.50	0.00	29.00	29.00	29.00	29.00	29.00	29.00
Labenah	21.50		10.75	21.50					6.13	32.25				
Feta cheese	12.00				6.00	12.00					9.00	18.00		
Ricotta cheese	5.00						2.50	5.00					3.75	7.50
Cream	14.00	7.112	10.6	14.00	10.36	12.70	11.30	14.00	9.00	11.00	8.90	10.70	9.50	11.90
Total cost		86.87	86.60	87.25	82.61	76.45	77.55	65.75	84.13	80.5	76.90	65.95	68.5	49.15
Cost Reduction		00.00	0.33	0.77	6.59	14.33	9.81	21.49	4.69	9.25	13.77	27.52	19.60	18.01

The results revealed that replacing semi ripened and ripened Ras cheese with A1a, A1b, A2a and A2b were lower in total cost by (0.33, 0.77%) and (4.69, 9.25%), respectively than the control cheese. Also, the costs were lower by replacing semi ripened and ripened Ras cheese with B1a, B1b, B2a and B2b were lower in total cost by (6.59, 14.33%) and (13.77, 27.52%) respectively than the control cheese. However, the replacing semi ripened and ripened Ras cheese with Ricotta cheese were lower in total cost by (9.81, 21.49%) and (19.60, 18.02%) respectively than the control cheese. Generally, it can be manufacturing PCSs by replacing semi ripened and ripened Ras cheese with Labenah, Feta cheese and Ricotta cheese with ratios 50 and 100% respectively with reduction of cost and keeps the good quality.

Conclusion:

Processed cheese spreads made with substituting semi ripened and ripened Ras cheese at ratio 50%could be made by Labenah, Feta cheese and Ricotta cheese in the base blend, which gave the best organoleptic, chemical, physical and rheological properties in most treatments during storage at 5°c for 3 months; as well as reduced the total costs for manufacturing by (0.33, 4.69%) for Labenah & (6.59, 13.77%) for Feta cheese and (9.81, 19.60%) for Ricotta cheese at ratio of 50% respectively than the control spread.

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بعض الدراسات الكيماوية و التكنولوجيـــة و الريولوجيـــة و الخـــواص الحـــسية العضوية فى الجبن القابل للفرد

ناهد السيد سليمان، إيمان عبد الحميد الدخاخنى، سمير أحمد سالم و هيام حمدى أحمد
قسم الألبان – كلية الزراعة – جامعة الأسكندرية

أجريت هذه الدراسه بغرض:دراسة أمكانية إستخدام بعض منتجات الألبان مثل (اللبنـــة و جبن الفيتا المنتجه بالترشيح الفوقى و جبن الريكوتا المنتجة من شرش جبن الموزاريلا) المتـــوفرة لدى مصانع الألبان كبديل للجبن الرأس المسوى أو النصف مسوى بنسبة ٥٠-١٠٠% في صناعة الجبن المطبوخ القابل للفردة ودراسة تأثير أستبدال تلك المنتجات على الخواص الفيزوكيماويـــة و التكنولوجية و الريولوجية والحسية العضوية للجبن موضوع الدراسة خلال فترة التخزين لمدة ثلاثة أشهر على5 °C .و يمكن تلخيص النتائج المتحصل عليها كما يلى:

أدى أستبدال الجبن الرأس (النصف مسوى(لمدة ٣ شهور) ، مسوى(لمدة ٦ شهور) فـــي جميع المعاملات إلى حدوث أنخفاضاً معنوياً في قيم المادة الجافة والبروتين/ للمادة الجافة و زيادة معنوية في قيم الدهن/ للمادة الجافة بالنسبة للجبن المقارن و كانت القـــيم أكثـــر أنخفاضـــاً عنـــد الاستبدال للجبن النصف مسوى عن الجبن المسوى.

أدى أستبدال الجبن الرأس أيضاً في جميع المعاملات إلى أنخفاض معنوى فـــي قـــيم ال pH و نسبة النتروجين الذائب و البروتين الكلى و بصورة أكثر وضوحاً مع الجبن النصف مسوى و زيادة معنوية في محتواها من الحموضه الظاهرية و قيم الدهن/ للنتروجين الكلى و فـــي نـــسبة الكازين/ النتروجين الكلى بالنسبة للجبن المقارن.

كما أدى الأستبدال للجبن الرأس في جميع المعاملات إلى حدوث زيادة معنوية في القابلية للأنصهار فى الجبن المسوى أكثر من النصف مسوى بالنسبة للجبن المقارن و كانت عند الأستبدال بنسبة ٥٠% أفضل من الأستبدال بنسبة ١٠٠%. أدى الأستبدال باللبنة أو الجبن الريكوتا بنـــسبة ٥٠% للجبن الرأس النصف مسوى إلى حدوث زيادة في القابلية لإنفصال الزيت بعكس الأســـتبدال بالجبن الفيتا ، ولم يحدث إنفصال للزيت في مفرودات الجبن المطبوخ النـــاتج مـــن الأســـتبدالات بنسبة١٠٠% للجبن الرأس النصف مسوى سواء باللبنة أو الجبن الفيتا و جبن الريكوتا.

أدى الأستبدال للجبن الرأس في جميع المعاملات إلى حدوث زيادة معنوية في قيمة الصلابة hardness بينما أنخفضت خلال فترة التخزين عن الجبن المقارن و كانت في الجبن النصف المسوى أقل عن قيمتها عند الأستبدال للجبن الرأس المسوى و زيادة معنوية في قوة الألتصاق adhesiveness و في القيمة الصمغية Gumminess و في قيم المضغ chewiness وفي قابليتها للمطاطية elasticity بالنسبة للجبن المقارن و إلى حدوث أنخفاض في قيمة قوة التماسك cohesiveness . مفرودات الجبن المطبوخ المصنعة بإستبدال الجبن الرأس في جميع المعاملات أعطت زيادة معنوية من حيث القابلية للمطاطية بالنسبة للجبن المقارن ، و كانت عند الأستبدال للجبن النصف المسوى باللبنة بنسبة ٥٠% متشابهه في خاصية القابلية للمطاطية مع الجبن المصنعه بإستبدال الجبن الرأس المسوى بنسبة ٥٠% للجبن الفيتا و بنسبة (٥٠- ١٠٠%) للجبن الريكوتا. توجد أختلافات معنوية في الخواص الحسية العضوية بين مفرودات الجبن المتحصل عليها ، فلقد أدى الأستبدال في جميع المعاملات إلى حدوث أنخفاضاً معنوياً في النكهه و كانت أفضهم عند الأستبدال بالجبن النصف مسوى عن المسوى ، بينما كان القوام متشابه مع الجبن المقارن عند أستبدال الجبن الرأس النصف مسوى بنسبة ٥٠% و أعطت قواماً أقوى عند أستبدال الجبن الرأس المسوى بالجبن الفيتا أو الريكوتا بنسبة ٥٠% عن الجبن المقارن.

قام بتحكيم البحث

أ.د / طه عبد الحليم نصيب — كلية الزراعة – جامعة المنصورة

أ.د / منير محمود العبد — كلية الزراعة – جامعة القاهرة