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EFFECT OF PARTIALLY REPLACEMENT OF KAREISH CHEESE WITH UF-RETENTATE CURD ON THE QUALITY OF PROCESSED CHEESE SPREAD

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ABSTRACT: *Four blends of processed cheese spread were made to study the effect of storage temperature, partially replacement of Kareish cheese with UF-retentate curd and storage period on cheese quality. Kareish cheese was replaced by UF-retentate at rates of zero (control), 25, 50 and 75%. Cheese spreads were stored at refrigerator (5 ± 1°C) and room temperatures (22-25°C) for three months. Samples from all cheeses were analysed when fresh and after 1, 2 and 3 months during storage period for chemical composition (moisture, fat, total nitrogen (TN), soluble nitrogen (SN), SN/ TN %, salt (NaCl) contents, total volatile fatty acids (T.V.F.A) content and pH value), physical properties (firmness, meltability) and for sensory evaluation. Statistical analysis showed that no significant differences (P > 0.05) between storage temperatures on moisture, fat, TN, SN, SN/TN contents and also, pH value. But, salt & TVFA contents as well as, firmness, meltability values were increased (P ≤ 0.05) significantly, being higher at room than refrigerator temperature. Total scores were higher at refrigerator than the other one. On the other hand, there were slight significant (P ≤ 0.05) decrease for moisture content, pH, firmness, meltability values as well as total scores as storage period progressed. Fat, T.N, S.N, S.N/T.N, salt and TVFA contents were increased as storage period advanced. The partially replacement of Kareish cheese with UF-retentate curd not affected on SN, salt contents and pH value, but moisture content and SN/TN ratio were significantly (p ≤ 0.05) decreased. On the other hand, fat, TN and TVFA contents as well as firmness and meltability values were increased significantly. Also, total scores were increased up to 50% replacement, then decreased.*

Key words: Kkareish cheese, UF-retentate, processed cheese spread.

INTRODUCTION

Processed cheese is highly suitable as a diet food because of the particularly good digestibility and beneficial properties. It is also important food for children and adults due to its high nutritional value and relatively good keeping quality. Consumption of processed cheese has been increased markedly in Egypt during the last two decades. Processed cheese is desirable by consumers and producers because it can be produced in greater diversity of type and intensity of flavour and texture to over wide

range of choices, it is packaged for easy handling, it has better keeping quality than those of natural cheese during prolonged storage, it reduces refrigeration costs during storage and transport. It is suitable for home use as well as for snack restaurants and it can be formulated from several ingredients some of which are by-products in Dairy Factories (Caric and Kalab, 1987). The assortment of processed cheese was greatly expanded due to numerous possible combinations of various types of cheese and the inclusion of other dairy and non-dairy components which might affects processed cheese composition. The production and consumption of processed cheese showed a constant increase all over the country. Its production has reached about 10 thousand tons in governmental and private sectors (Awad *et al.*, 2002). Processed cheese is one of the most important source of calcium in dairy products in a balanced diet and a significant source of protein as well as other nutritents (Awad *et al.*, 2003). Many researches have been done to develop the properties and the nutritive value of this sort of cheese using different types, ages of natural cheeses. Ultrafiltration (UF) is one of the most fascinating technologies which has recently been introduced for application in the dairy industry. The application of UF for making processed cheese is based on the manufacture of cheese base. This is an entirely new product, and it is developed with the pourpose of replacing partly or fully Cheddar or other cheeses in the production of processed cheese or cheese spreads (Renner and Abd El-Salam (1991).

The objectives of this study were to investigate the possibility of partially replacement of Kareish cheese with UF-retentate curd in the manufacture of processed cheese spreads and evaluating the chemical, physical and sensory properties of cheese during storage under refrigeration or room temperature for three months.

MATERIALS AND METHODS

Ingredients:

Mature Ras cheese (3 months old), butter and gelatin were obtained from the local market. Kareish cheese was made from buffaloe's skim milk. UF-retentate was purcashed. Fresh skim buffaloe's milk was pasteurized at 75°C for 15 seconds, cooled to 50°C at which the UF process was run at a private dairy factory namely Menodairy at Meet-Ghamr City, Dakahlia Governorate, using an APV unit at a pressure of 2 Mpa to about 30% total solids. The resultant retentate was standardized to ~ 6% fat using fresh cream. Calf rennet powder was added to coagulate the retentate within about 30 min. to prepare fresh curd. The emulsifying salts used were a mixture of (Joha NO) and (Joha S9S) (Hansen Lab., Denmark) in ratio of 1:2.

Cheese making:

Four blends of processed cheese spread were prepared as mentioned in Table (1) and chemical composition of ingredients used in processed cheese making (Table 2). The first blend as a control (C) was prepared without adding fresh UF-retentate curd, and the other 3 blends (T1, T2 & T3) were by adding fresh UF-retentate curd to replace partially the Kareish cheese at levels of 25, 50 and 75%, respectively. The ingredients of each blend were mixed and heat processed to 85-90°C with holding time of 3 min. in a 3 kg pilot processing kettle (Kustner Co., England). Two minutes before the end of processing, 0.1% sodium bisulphite was added. The hot processed cheese spread was poured into cardboard boxes (200 gm) lined with aluminum foil and stored at refrigerator (5°C ± 1°C) or room (22-25°C) temperatures for three months. Three replicates were made from each treatment and cheese was analysed after manufacture (fresh) and after 1, 2 and 3 months of storage for chemical composition, physical and organoleptic properties.

Table (1): Formulation of ingredients used in processed cheese spread manufacture.

Ingredients (%)	Cheese blend quantities (kg)			
	C	T1	T2	T3
Matured Ras cheese	46.00	46.00	46.00	46.00
Fresh Kareish cheese	17.00	12.75	8.50	4.25
Fresh UF-Retentate curd	0.00	4.25	8.50	12.75
Butter	7.00	7.00	7.00	7.00
Emulsifying salts	2.80	2.80	2.80	2.80
Gelatin	0.50	0.50	0.50	0.50
Water	26.70	26.70	26.70	26.70
Total	100.00	100.00	100.00	100.00

C= Control. T1, T2 and T3 = Substitution cheese treatments.

Table (2): Chemical composition of ingredients used in processed cheese spread manufacture.

Component	Ras cheese	Kareish cheese	FUFRC*
Total solids (TS)(%)	41.0	27.0	28.0
Fat (%)	28.0	6.0	6.5
Fat/DM** (%)	47.5	22.2	23.2
Solids-not-fat (SNF) %	31.0	21.0	21.5
pH value	5.6	5.0	6.1

* FUFRC: Fresh UF-retentate curd. D.M = Dry matter.

Chemical of analysis:

Moisture, titratable acidity, fat contents of cheese were determined according to A.O.A.C. (1990). Total nitrogen (TN) and soluble nitrogen content (SN) were determined as described by Ling (1963). The pH value was measured by using a pH meter (Orion Research Cambridge, M.A, U.S.A). Salt (NaCl) and total volatile fatty acids (TVFA) contents were determined as mentioned by Kosikowaski (1978).

Meltability of cheese was measured according to Olson and Price (1958) and slightly modified by Savello *et al.* (1989). Cheese columns, 25 mm in diameter and 25 mm hight, weighting 15 ± 0.1 gm were placed at the end of 300 mm long Pyrex glass tube (30 mm inner diameter) and the opposite ends were closed with rubber stoppers. The melting tubes were placed in horizontal position in an oven at 110°C for 50 min. The flow of melted cheese within the tubes was stopped upon removal from the oven. The distance of cheese flow was measured in millimeters and recorded as cheese flow. Firmness of cheese was measured at 15°C using a penetrometer (Koehler Instrument Co. Inc. U.S.A). The penetrometer needle was adjusted to touch the surface of the processed cheese sample in the glass dish. The needle was then released to sink into the sample for 5 Sec., at this instant it was stopped. The penetration depth was recorded in units of 0.1 mm. The measurement was repeated five times using five different positions in the same dish and the average was recorded. Penetrometer values are related inversely to the firmness of processed cheese.

Sensory evaluation:

All samples of processed cheese were sensory evaluated by 10 panelists as follows: Outer appearance (20 points), inner appearance (40 points) and flavour (40 points) according to Meyer (1973).

Statistical analysis:

Factorial design was used to analyze the data and Duncan's test was followed to make the multiple comparisons (Steel and Torrie, 1980). Significant differences were determined at $P \leq 0.05$ level.

RESULTS AND DISCUSSION

Moisture content of all processed cheese spread as affected by storage temperature, storage period and partially replacement of Kareish cheese with UF-retentate curd are presented in Tables (3 and 7). Storage temperature at refrigerator and room were not significantly affected ($P > 0.05$) on moisture content of all processed cheeese treatments. On the other hand, moisture content was increased gradually ($P \leq 0.05$) as the storage period advanced (Tables 3 & 7), which might be due to the evaporation of cheese moisture. These results are in agreement with those reported by Al-Khamy *et al.* (1997), Hamed *et al.* (1997), Khader *et al.* (1997), Kebary *et al.* (1998), Hussein *et al.*

(1999), Abeid *et al.* (2001), Badawi *et al.* (2001) and Kebary *et al.* (2001). While, replacement of Kareish cheese with UF-retentate curd caused a decrease ($P \leq 0.05$) in moisture content and this decrease was proportional to the rate of replacement (Tables 3 & 7). These results may be attributed to the higher moisture content of UF-retentate curd than in Kareish cheese (Table 2).

Table (3): Changes in moisture, fat and total nitrogen (T.N) contents of processed cheese spread treatments during storage period for 3 months stored at refrigeration and room temperatures.

Storage temperature	Storage period (months)	Treatments*			
		C	T1	T2	T3
		Moisture %			
Refrigerator (5 ± 1°C)	Fresh	56.10	55.24	55.01	54.55
	1	55.98	55.01	54.80	54.37
	2	55.82	54.86	54.65	54.12
	3	55.64	54.69	54.46	53.98
Room (22-25°C)	Fresh	56.10	55.54	55.01	54.55
	1	55.91	54.79	54.54	54.10
	2	55.78	54.67	54.41	53.09
	3	55.52	54.58	54.30	53.90
		Fat %			
Refrigerator (5 ± 1°C)	Fresh	22.0	22.2	22.3	22.3
	1	22.2	22.3	22.5	22.6
	2	22.3	22.5	22.6	22.7
	3	22.5	22.6	22.7	22.6
Room (22-25°C)	Fresh	22.0	22.2	22.3	22.3
	1	22.5	22.6	22.8	22.6
	2	22.7	23.0	22.9	22.8
	3	23.0	23.2	23.1	23.0
		T.N%			
Refrigerator (5 ± 1°C)	Fresh	2.62	2.70	2.71	2.79
	1	2.64	2.72	2.74	2.81
	2	2.66	2.75	2.77	2.84
	3	2.69	2.77	2.80	2.88
Room (22 -25°C)	Fresh	2.62	2.70	2.71	2.79
	1	2.69	2.73	2.76	2.85
	2	2.71	2.76	2.80	2.88
	3	2.74	2.80	2.83	2.91

* See Table (1).
Each value in the Table is the mean of three replicates.

Fat content of all processed cheese spread as affected by storage temperature, storage period and partially replacement of Kareish cheese with UF-retentate curd are presented in Tables (3 & 7). Storage temperatures at refrigerator or room were not significantly affected ($P > 0.05$) on fat content of all processed cheese treatments. Fat content increased during storage period (Tables 3 & 7). These results are in agreement with those observed by Magdoub *et al.* (1984) and Abdel-Hamid *et al.* (2002). Replacement of Kareish cheese with UF-retentate caused a significant increase ($P \leq 0.05$) in fat content (Tables 3 & 7), being in the order of T3> T2, T1> C, this increase was proportional to the rate of replacement.

Substitution of Kareish cheese with UF-retentate curd caused slight increase ($P \leq 0.05$) in total nitrogen (T.N) content of processed cheese spread treatments by replacing Kareish cheese with UF-retentate curd (Tables 3 & 7). On the other hand, T.N content of all treatments increased ($P \leq 0.05$) significantly during storage period (Tables 3 & 7). These results are in accordance with those reported by Kebary *et al.* (1998), Abeid *et al.* (2001), Kebary *et al.* (2001) and Abdel-Hamid *et al.* (2002). This increasing may be owing to the evaporation of water from the cheese. Storage temperature at refrigerator or room were not significantly affected ($P > 0.05$) on T.N content of all processed cheese treatments (Tables 3 & 7).

Replacement of Kareish cheese by UF-retentate curd and storage temperatures did not affect significantly ($P > 0.05$) soluble nitrogen (S.N) content of all processed cheese spread treatments (Tables 4 and 7). On the other hand, SN content of all processed cheese spread treatments increased slightly ($P \leq 0.05$) as storage period increased. These results are in a consistency with those mentioned by El-Shibiny *et al.* (1996), Awad *et al.* (2003) and Hussein and Mohamed (2008). But, concerning the replacement of Kareish cheese by UF-retentate curd slightly ($P \leq 0.05$) decreased in S.N / T.N ratio, being in the order of C> T1, T2> T3 (Fig. 1 and Table 7), while slightly increase occurred as storage period proceeded. No significant differences ($P > 0.05$) between storage temperatures observed (Table 7). This increasing may be owing to the evaporation of water from the cheese, so that the solids will be increase respectively.

Salt (NaCl) contents of all processed cheese spreads increased significantly ($P \leq 0.05$) throughout storage period (Tables 4 & 7). These results are in accordance with the results of El-Sonbaty (1995). Storage temperatures affected significantly ($P \leq 0.05$), being room > refrigerator temperature (Tables 4 & 7). While, NaCl content did not affected ($P > 0.05$) by replacement Kareish cheese with UF-retentate curd, this increasing in NaCl content may be attributed to the corresponding decrease occurred in the moisture content of the cheese during the storage period.

Table (4): Changes in soluble nitrogen (S.N), salt (NaCl) and total volatile fatty acids (TVFA) contents of processed cheese spread treatments during storage period for 3 months stored at refrigeration and room temperatures.

Storage temperature	Storage period (months)	Treatments*			
		C	T1	T2	T3
		S.N%			
Refrigerator (5 ± 1°C)	Fresh	1.34	1.36	1.36	1.37
	1	1.35	1.37	1.38	1.39
	2	1.37	1.40	1.40	1.42
	3	1.39	1.42	1.43	1.45
Room (22-25°C)	Fresh	1.34	1.36	1.36	1.37
	1	1.37	1.38	1.39	1.42
	2	1.40	1.41	1.41	1.45
	3	1.42	1.44	1.43	1.47
		Salt (NaCl) %			
Refrigerator (5 ± 1°C)	Fresh	1.88	1.86	1.88	1.90
	1	1.94	1.90	1.92	1.90
	2	1.96	1.94	1.94	1.95
	3	2.00	1.98	1.97	1.99
Room (22-25°C)	Fresh	1.88	1.86	1.88	1.90
	1	1.96	1.95	1.99	1.94
	2	1.99	2.01	2.03	1.98
	3	2.02	2.06	2.07	2.03
		TVFA (ml 0.1N NaOH /100 gm cheese)			
Refrigerator (5 ± 1°C)	Fresh	31.3	29.7	30.4	33.3
	1	33.5	30.8	32.3	34.1
	2	34.7	31.7	33.8	35.6
	3	36.2	32.6	34.9	37.8
Room (22 -25°C)	Fresh	31.3	29.7	30.4	33.3
	1	34.0	31.3	33.6	35.0
	2	35.2	32.9	35.5	36.1
	3	37.3	34.8	36.3	36.9

* See Table (1). - Each value in the Table is the mean of three replicates.

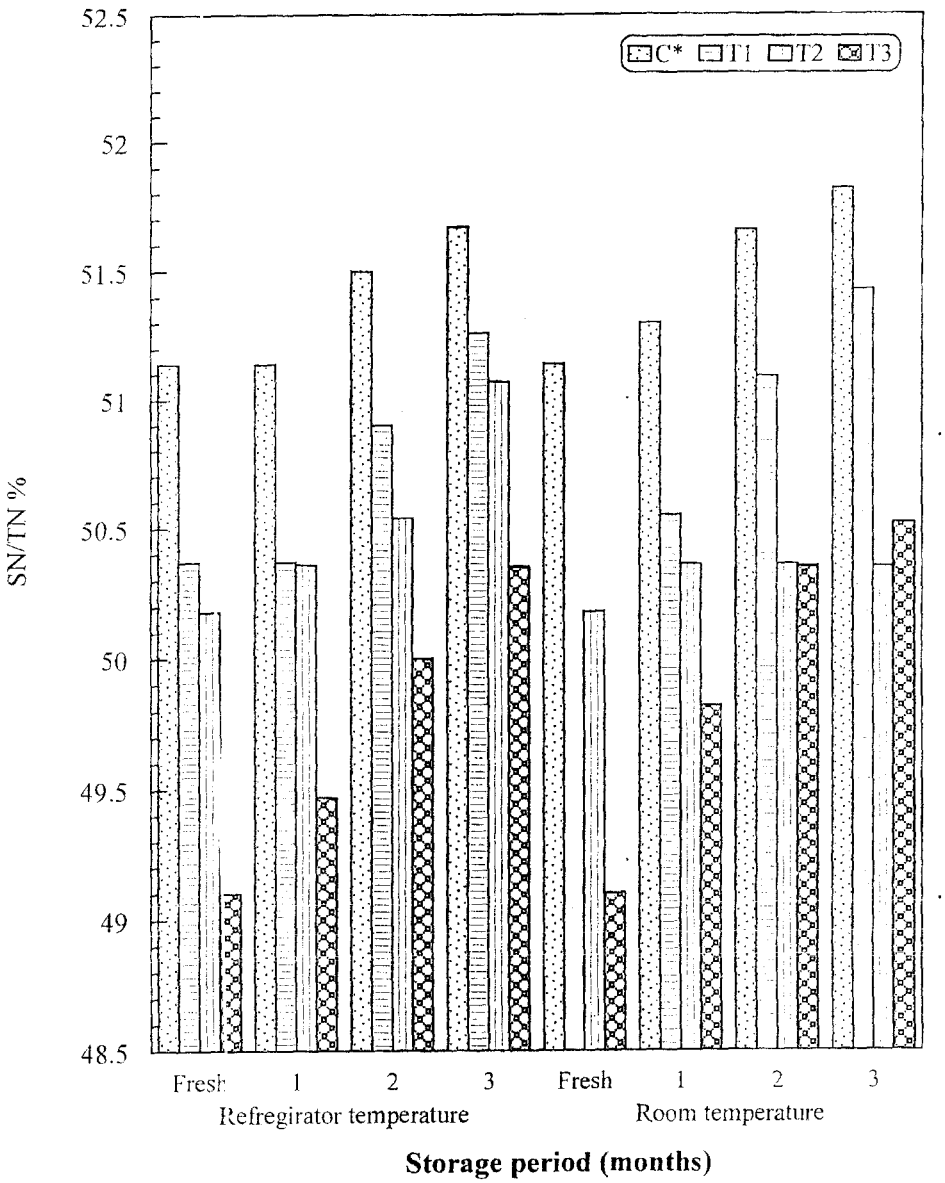

Fig. (1). Changes in soluble nitrogen per total nitrogen (SN/TN) content of processed cheese spread stored at refregirator (5 ± 1°C) and room temperature (22 - 25°C) durnig storage period.

Total volatile fatty acids (TVFA) of all processed cheese spreads increased significantly ($P \leq 0.05$) between storage temperatures, also throughout storage period (Tables 4 & 7). These results are in accordance with the results of El-Sonbaty (1995), Abeid *et al.* (2001), Abdel-Hamid *et al.* (2002) and Hussein and Mohamed (2008). While, TVFA contents increased ($P \leq 0.05$) significantly, being in the order of T3> C, T2> T1 when Kareish cheese was partially replaced with UF-retentate and this increase was proportional to the rate of replacement and also, due to the hydrolysis of fat by bacterial lipases during pickling.

The pH values of processed cheese spreads decreased ($P \leq 0.05$) during storage period (Fig. 2 and Table 7), which might be due to the limited growth and activity of cheese microflora. These results are in accordance with those obtained by Abeid *et al.* (2001), Kebary *et al.* (2001), Abdel-Hamid *et al.* (2002), Awad *et al.* (2003), Abd Rabou *et al.* (2004) and Hussein and Mohamed (2008). No significant differences occured concerning the replacement of Kareish cheese by UF-retentate or due to storage temperature (Fig. 2 and Table 7).

As shown in Fig. 3 and Table 7 there are significant differences in firmness values of all cheese spreads between storage temperatures, also during storage period ($P \leq 0.05$). These results are in agreement with those reported by Aly *et al.* (1995), Abdel-Hamid *et al.* (2002) and Awad *et al.* (2003). Firmness values of all processed cheese treatments were increased slightly by replacing Kareish cheese with UF-retentate curd. Generally, this increase in the firmness of processed cheese spread may be partially attributed to the evaporation of water from the cheese, also could be due to the fact that some hydrolysis of the emulsifying salts take place during the melting stage and the remainder during the early stages of storage and enhanced hydrolysis has occurred at higher storage temperature than the lower one. As a result greater interaction between the phosphates and protein has taken place (Tamime *et al.*, 1990).

Meltability values of all cheese spreads decreased significantly ($P \leq 0.05$) as storage period advanced (Fig. 4 and Tables 7). These results are in agreement with those reported by El-Shibiny *et al.* (1996), Al-Khamy *et al.* (1997), Hamed *et al.* (1997), Abeid *et al.* (1998), Kebary *et al.* (1998), Abeid *et al.* (2001) and Kebary *et al.* (2001). Meltability values were increased significantly at room temperature. Also, the same thing concerning the treatments, being in the order of T2, T3 > T1 > C (Fig. 4 and Table 7).

Changes in the scores of sensory evaluation of processed cheese spreads are shown in Tables (5, 6 and 7). Scores of flavour, outer and inner appearance exhibited almost similar trends. Replacement of Kareish cheese by UF-retentate curd up to the level of 50% increased the scores of sensory evaluation, which means that increasing the acceptability of cheese made with UF-retentate. On the other hand, storage temperature at refrigeration was better than room temperature. Replacement of Kareish cheese with

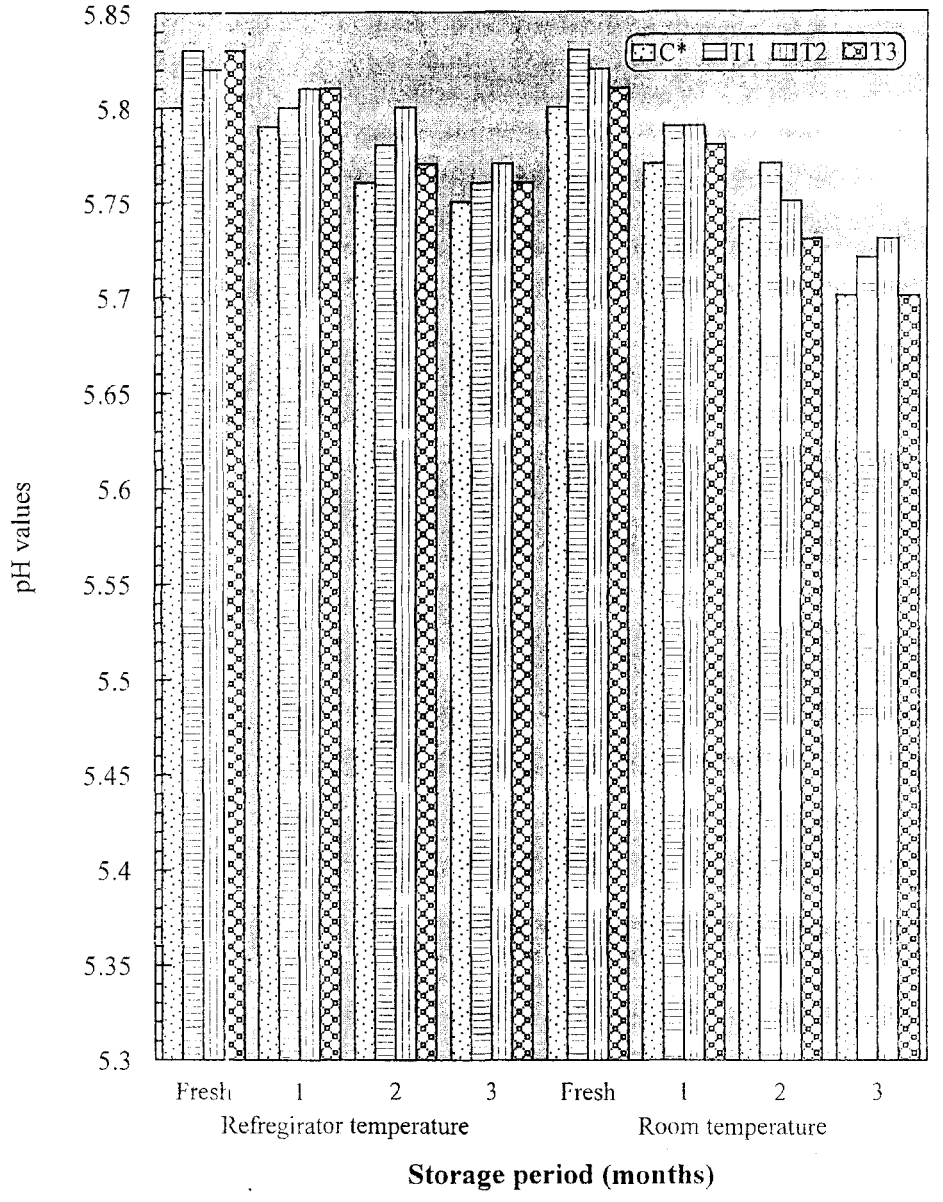

Fig. (2). Changes in pH value of processed cheese spread stored at refregirator (5 ± 1°C) and room temperature (22 - 25°C) durnig storage period.

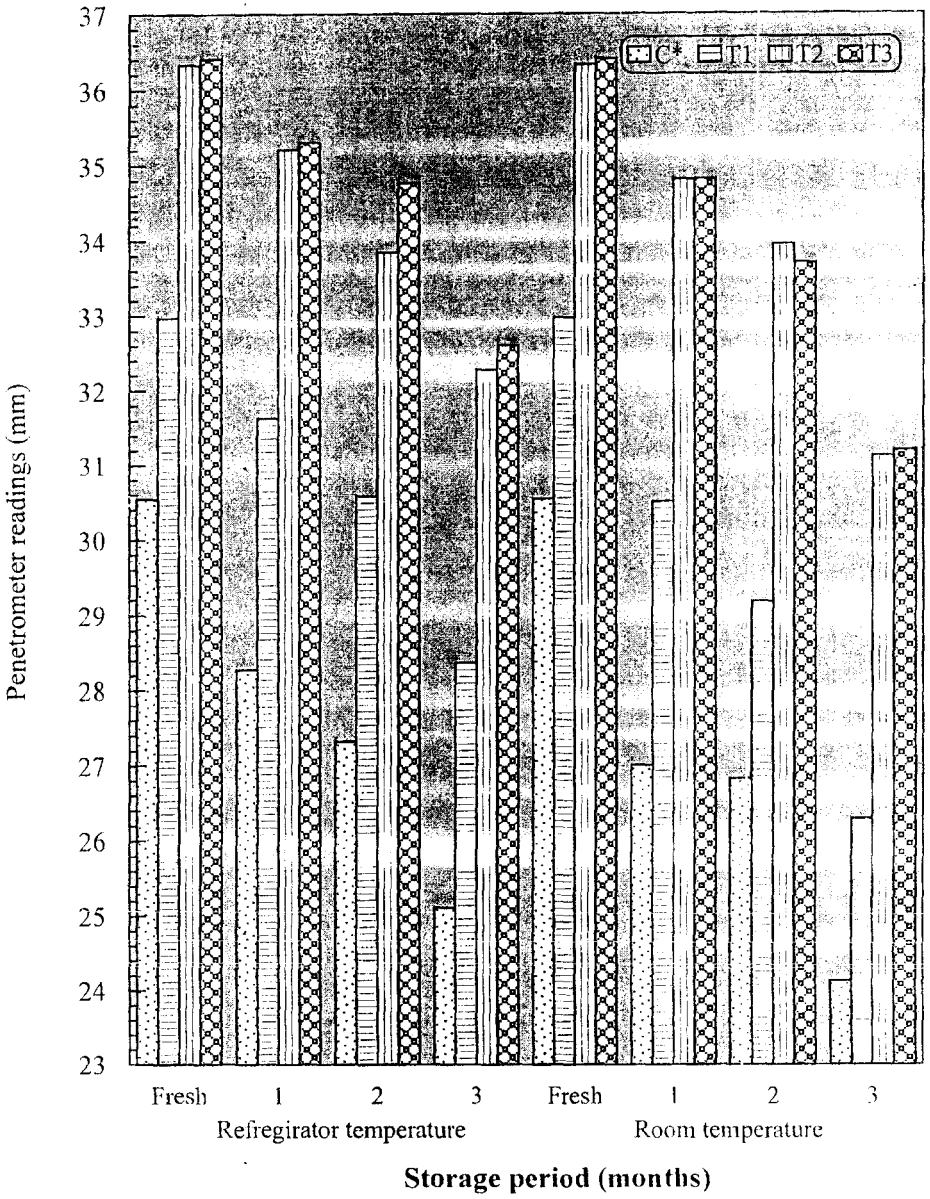

Fig. (3). Changes in firmness values of processed cheese spread stored at refregirator (5 ± 1°C) and room temperature (22 - 25°C) durnig storage period.

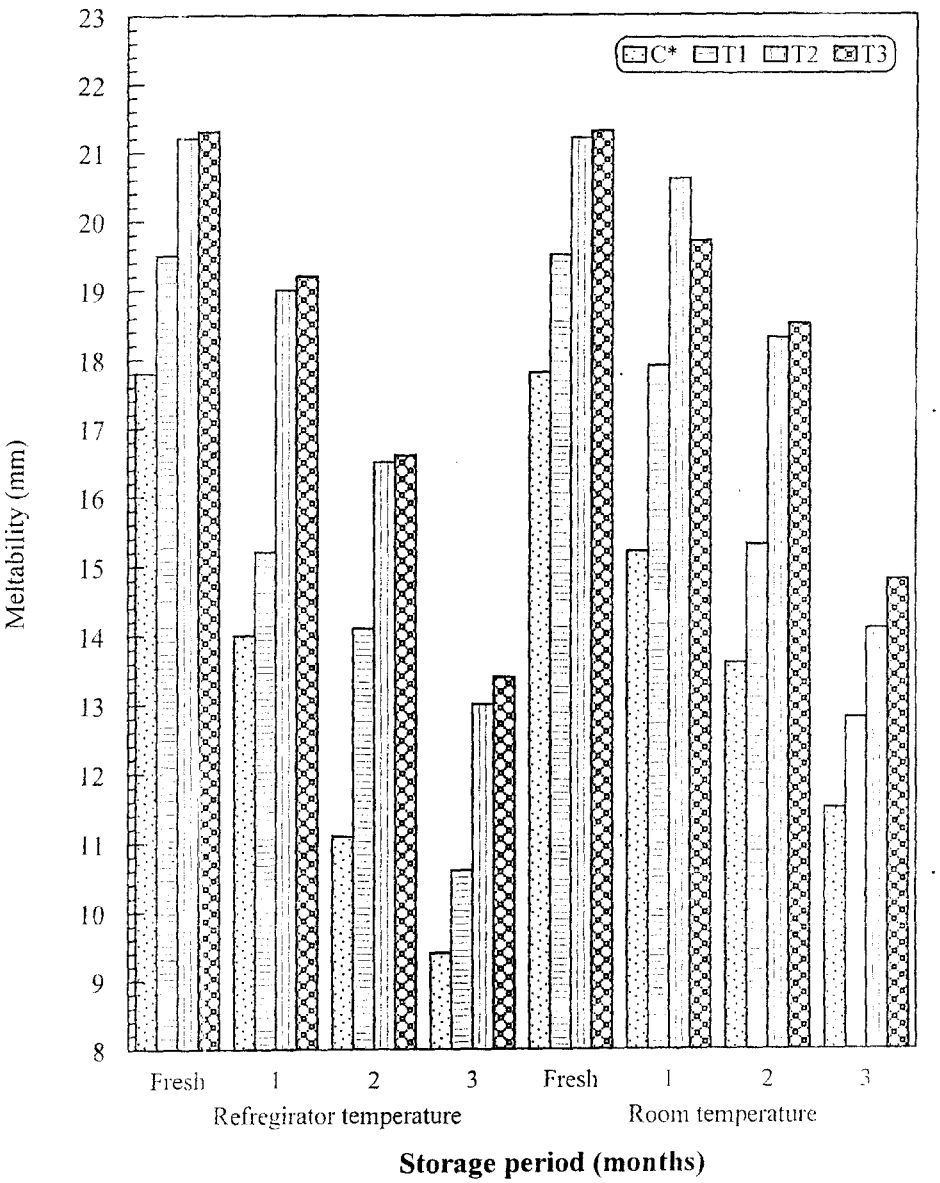

Fig. (4). Changes in meltability (mm) of processed cheese spread stored at refregirator (5 ± 1°C) and room temperature (22 - 25°C) durnig storage period.

Table (5): Sensory evaluation of processed cheese spread during storage period at refrigerator temperature (5 ± 1°C).

Storage period (months)	Properties	Treatments*			
		C	T1	T2	T3
Fresh	O.A. (20 points)	18	18	18	17
	I.A.(40 points)	36	36	37	35
	Flavour (40 points)	36	36	38	36
	Total (100 points)	90	90	93	88
1	O.A. (20 points)	17	18	18	17
	I.A.(40 points)	35	35	36	34
	Flavour (40 points)	36	34	36	34
	Total (100 points)	88	87	90	85
2	O.A. (20 points)	17	17	17	16
	I.A.(40 points)	34	33	34	33
	Flavour (40 points)	34	33	34	33
	Total (100 points)	85	83	86	82
3	O.A. (20 points)	16	16	16	16
	I.A.(40 points)	33	33	34	31
	Flavour (40 points)	32	32	33	32
	Total (100 points)	81	81	83	79

* See Table (1).
O.A. = Outer appearance.
I. A. = Inner appearance.
Each value in the Table is the means of three replicates.

Table (6): Sensory evaluation of processed cheese spread during storage period at room temperature (22-25°C).

Storage period (months)	Properties	Treatments*			
		C	T1	T2	T3
Fresh	O.A. (20 points)	18	18	18	17
	I.A.(40 points)	36	36	37	35
	Flavour (40 points)	36	36	38	36
	Total (100 points)	90	90	93	88
1	O.A. (20 points)	17	17	18	16
	I.A.(40 points)	35	34	35	34
	Flavour (40 points)	34	33	35	33
	Total (100 points)	86	84	88	83
2	O.A. (20 points)	16	16	17	16
	I.A.(40 points)	34	33	34	33
	Flavour (40 points)	32	31	33	30
	Total (100 points)	82	80	84	79
3	O.A. (20 points)	16	16	16	15
	I.A.(40 points)	32	33	33	30
	Flavour (40 points)	30	29	31	30
	Total (100 points)	78	78	80	75

* See Table (1).
O.A. = Outer appearance.
I. A. = Inner appearance.
Each value in the Table is the means of three replicates.

Table (7): Statistical analysis of processed cheese spread properties during storage periods.

Cheese properties	Effect of storage temperature◊			Effect of cheese treatments◊					Effect of storage period (months)◊				
	Mean squares	Multiple comparisons*		Mean squares	Multiple comparisons*				Mean squares	Multiple comparisons*			
		Ref.	Room		C•	T1	T2	T3		Fresh	1	2	3
Moisture (TS) %	0.0851	A	A	5.604*	A	AB	AB	B	1.054*	A	AB	BC	C
Fat content %	0.7476	A	A	8.152*	B	AB	AB	A	2.356*	D	C	B	A
Total nitrogen (TN)%	0.0162	A	A	0.061*	C	B	B	A	5.491*	D	C	B	A
Soluble nitrogen (SN) %	0.0451	A	A	0.273*	B	AB	AB	A	0.032*	C	B	A	A
SN/TN %	0.1261	A	A	5.338*	A	B	B	C	0.554*	B	AB	AB	A
Salt (NaCl) %	0.0408*	B	A	0.152	A	A	A	A	0.019*	D	C	B	A
TVFA▫ content	11.1384	A	A	27.803*	AB	B	AB	A	12.709*	D	C	B	A
PH value	0.0160	A	A	0.035*	A	A	A	A	4.112*	A	B	C	D
Firmness (mm)	12.943	A	A	67.445*	C	B	A	A	14.529*	A	B	C	D
Meltability(mm)	27.735	A	A	59.659*	B	AB	A	A	32.121*	A	B	C	D
Total scores	15.094*	A	B	46.969*	B	B	A	C	28.406*	A	B	C	D

• See Table 1. * Significant at 0.05 level. Ref.= Refrigerator temperature.

◊ For each effect the different letters in the same row means the multiple comparisons are different from each other. Letter A is the highest mean followed by B, C .....etc.

▫TVFA = Total volatile fatty acids (0.1N NaOH / 100 gm cheese).

UF-retentate up at level of 75% had the lowest score than control cheese as well as 25% replacement. Scores of organoleptic properties of all cheese spreads decreased significantly as storage period progressed. Similar results are reported by El-Shibiny *et al.* (1996), Al-Khamy *et al.* (1997), Kebary *et al.* (1998), Abeid *et al.* (2001) and Kebary *et al.* (2001).

It could be concluded that replacement of Kareish cheese by UF-retentate in processed cheese manufacture improved the acceptability of cheese. It is possible to replace Kareish cheese by UF-retentate curd at the rate up to 50% without detrimental effect on processed cheese quality.

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تأثير الإستبدال الجزئى للجبن القريش بخثرة اللبن المركز بالترشيح الفائق على جودة مفرود الجبن المطبوخ

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الملخص العربى:

يزداد حاليا فى مصر إستهلاك الجبن المطبوخ وذلك لظهور أنواع عديدة منه مصنعة من مواد ونكهات مختلفة ولقد اهتم البحث الحالى بتصنيع مفرود الجبن المطبوخ بإستبدال الجبن القريش بخثرة اللبن المركز بالترشيح الفائق وذلك بهدف تحسين جودة مفرود الجبن المطبوخ. ولقد أضيف خثرة اللبن المركز بالترشيح الفائق بدلا من الجبن القريش وذلك بنسبة صفر، ٢٥، ٥٠، ٧٥% لكل من الكنترول، المعاملة T1، المعاملة T2 والمعاملة T3 على التوالى. ولقد تم دراسة تأثير التخزين على حرارة الغرفة (٢٢-٢٥°م) والثلاجة (٥ ±١°م) ، وكذلك تم دراسة تأثير مدة التخزين حتى ثلاثة شهور ولقد أوضحت النتائج المتحصل عليها بعد تحليلها احصائيا مايلى:

١- أدى احلال خثرة اللبن المركز بالترشيح الفائق محل الجبن القريش الداخل فى صناعة الجبن المطبوخ الى حدوث نقص معنوى فى الرطوبة ونسبة النيتروجين الذائب إلى النيتروجين الكلى، وزيادة فى الدهن والنيتروجين الكلى والأحماض الدهنية الطيارة الكلية وقيم الصلابة والقابلية للإنصهار. أما درجات التحكيم الكلية فقد زادت حتى وصلت لأقصاها عند نسبة استبدال ٥٠ % ثم قلت بعد ذلك. بينما لم تتأثر نسب النيتروجين الذائب والملح وكذلك قيم الـ pH .

٢- لم تؤثر درجة حرارة التخزين معنويا على كل من الرطوبة، الدهن، النيتروجين الكلى والذائب وكذلك على نسبة النيتروجين الذائب الى الكلى والـ pH . على حين حدث زيادة معنوية عند التخزين على درجة حرارة الغرفة مقارنة بالتخزين فى الثلاجة فى كل من

الملح والأحماض الدهنية الكلية الطيارة ودرجة الصلابة والقابلية للإنصهار، أما عند تخزين الجبن فى الثلاجة فقد حصل على أعلى درجات فى التحكيم الحسى.

٣- حدث نقص تدريجى فى نسبة الرطوبة والـ pH ودرجتى الصلابة والقابلية للإنصهار وكذلك درجات التحكيم الكلية بتقدم فترة التخزين، فى حين حدثت زيادة فى نسب الدهن والنيتروجين الكلى والذائب وكذلك نسبة النيتروجين الذائب إلى الكلى والملح والأحماض الدهنية الطيارة.

مما سبق يتضح أنه لصناعة مفرود الجبن المطبوخ بخواص جودة محسنة فإن البحث الحالى يوصى بإمكانية استبدال الجبن القريش اللازم للصناعة بخثرة اللبن المركز بالترشيح الفائق (UF-retentate) حتى نسبة استبدال ٥٠% وأن تخزين الجبن فى الثلاجة أفضل من التخزين على حرارة الغرفة فى المحافظة على جودة الجبن.