

STUDIES ON THE USE OF VEGETABLE OILS AND STABILIZERS IN MAKING TALLAGA CHEESE - LIKE

Omar, M. A. M*; A. A. El - Hadidi* and A. I. A. Mansour**

* Dairy Department, Faculty of Agriculture, Al -Azhar University (Cairo)

** Dairy Department, Faculty of Agriculture, Al -Azhar University (Assiut)

ABSTRACT

Tallaga cheese – like was made from skim milk containing milk fat, coconut oil and palm oil. Milk fat was substituted with levels of Nil, 25, 50, 75 and 100 % of coconut or palm oil. Cheese was made by the traditional method. Chemical, microbiological and organoleptic properties were determined during storage period for 28 days at refrigerated temperature. Generally, replacement of milk fat with vegetable oils (coconut or palm oil) up to 100% had slight effect on the chemical composition during storage. A slight oily flavor was observed in fresh samples especially on the use of palm oil, that flavor was greatly reduced up on storage. The storage of cheese had considerable improved effect on the quality of cheese made using high level of coconut or palm oil. Also the use of stabilizer, especially Unicream improved the quality of cheese. The optimum ratio of 50:50 of coconut and 25:75 of palm oil to milk fat were recommended for production of Tallaga cheese – like. It was palatable obvious that addition of 75% coconut oil or 50% palm oil to replace milk fat in cheese making had no effect on cheese microflora. Total viable count increased up till the end of storage periods in control cheese and cheese with replacement of 75% coconut oil or 50% palm oil. Moulds and yeasts while, the coliform bacteria count were not detected in fresh cheese, but they were detected and gradually increased with the progress of storage up till 28 days. On the other hand, the control cheese had higher microbial counts than the experimental cheeses.

Keyword: Tallaga cheese, Coconut oil, Palm oil, Stabilizers, Chemical composition, Microbiological analysis, Organoleptic properties, Rheological properties.

INTRODUCTION

Cheese is an important nutritious food for human diet. However, due to rapid increasing costs of dairy products it is being gradually priced out of the reach of lower income groups. Cheese analogs are believed to be a possible solution to this economic problem by substitution the higher priced milk derived fat ingredient with lower priced vegetable oils. Besides, vegetable oils can also be stored for long periods of time without spoilage under normal warehousing conditions. Among various vegetable oils, palm and coconut oils show a promising potential as a substitute of milk fat. Replacement of milk fat with vegetable oils in making soft cheese had been studied by several investigators. The use of cotton seed oil (Hofi *et al.*, 1963); maize oil (El-Hefny, 1975) and palm oil (El-Shibiny *et al.*, 1983) in soft cheese making were reported to affect the coagulation and characteristics of the formed curd, to impart an oily flavor to fresh cheese along with the formation and ripening of cheese during pickling. While Aida & Abeid (1997) used sunflower oil to produce low sodium and cholesterol Domiati cheese. Nigm

(2000) studied the chemical and microbiological properties of locally manufactured cream cheese. Generally, saturated fatty acids of milk fat might causative agent of heart disease (blood vessel hardness) for the majority of humans (Grumdy & Denke, 1990). Tallaga cheese is a type of soft cheese that have a distinctive taste and rich flavor, where it contains low percentage of salt. El-Zayat & Osman, (2001) used probiotics in Tallaga cheese. In Egypt, this type of soft cheese gained a great popularity between children and those of low income. The consumption of Tallaga cheese has been markedly increased during the last decade (Badawi & Kebary, 1998) as a result of its low NaCl content.

The present work was carried out to study the effect of adding palm and coconut oils as milk fat substitute and using some stabilizers in Analogous Tallaga cheese making to study the effect of storage on the prepared cheese milk fat 100 % and to optimize replacement of oils.

MATERIALS AND METHODS

1. Materials :

Skim milk powder :

Natural non fat dry milk powder low heat Extra Grade made from pasteurized milk origin, India was used.

The following also was used

Milk fat : Manufactured and imported from Netherlands.

Coconut oil : Manufactured and imported from Singapore.

Palm oil : Hydrogenated palm kernel oil manufactured and imported from Malaysia.

Emulsifying salts: Unicream, was emulsifier – stabilizer of origin "Egy Dairy" Company, Egypt. Lacta (815), was stabilizer of origin "Mefad" company, Egypt.

Experimental procedure : Tallaga cheese – like treatments for this study were made by conventional method of making Domiati cheese (Fahmi and Sharara, 1950) with some modifications. Homogenized recombined milk in which milk fat(MF) substituted with levels of Nil, 25, 50, 75 and 100 % palm(PO) or coconut oil(CO) were used as described by Fayed et al.,(1988) with some modifications. The oils were mixed with milk by a blender at 63 o C for 30 min. Milk samples were heated to 70oC / 30 min and cooled to 37oC, then calcium chloride and sodium chloride were added at the ratios of 0.02 and 2.5 % (w/v), respectively. To improve the resultant cheese, some stabilizers(Unicream and Lacta, 815)were used. The resultant cheese was packed in plastic cups filled with previously boiled whey and stored at 5- 6oC for 28 days. The whole experiment was duplicated.

2. Methods of analyses : Cheese samples were analyzed chemically and microbiologically when fresh and after 7, 14, 21 and 28 days of storage.

Chemical analyses :Total solids (TS), fat content, titratable acidity, soluble nitrogen (SN)&total nitrogen (TN), were determined according to AOAC(1990). Also, pH value was measured by using pH meter (PTI-15,

Aqua Chemical Co., England). Total volatile fatty acids (TVFA) were determined as described by Kosikowski (1982).

Microbiological analyses : Total bacterial count, yeasts and moulds and coliform, of milk and cheese were determined according to American Public Health Association (1987).

Organoleptic properties: Organoleptic properties of cheese samples were evaluated according to the method of Pappas et al., (1996). Cheese was examined for flavor (50 points), body & texture (40 points), and appearance (10 points) by a panel test of twelve trained judges.

Rheological properties:

Consistency(Firmness): Curd firmness of cheese samples was measured at 15 °C using a penetrometer cone of 30 angle, and the speed of the cone was adjusted at 3 mm /sec to a depth of 20 mm penetration was recorded in triplicate at 3 different spots in each sample. The firmness was recorded in Newton (N) as described by Kammerlehner and Kessler (1980).

Synerises: 100 g curd was filtered through filter paper No.1. The released whey was collected and measured at 30 min intervals for 90 min as described by Hammad (1976).

RESULTS AND DISCUSSION

Chemical properties of Tallaga cheese – like:

Total solids content:

Data presented in table (1) illustrate the chemical properties of Analogous Tallaga cheese made with different substitution levels of coconut and palm oils with milk fat stored at refrigerated temperature for 28 days. The total solids content of all treatments slightly increased throughout the storage periods. This would possibly result from the loss of moisture during storage. Slight differences were observed in the total solids of cheese from different treatments suggesting that the replacement of milk fat with vegetable oils had no effect on the moisture content.

Cheeses contained vegetable oils had higher moisture than control cheese. This might be attributed to the effect of vegetable oils on curd tension. These findings are in agreement with Hefny, (1982) and Salem & Abeid, 1997; who reported that the use of vegetable oils in soft cheese weakened the resultant curd and cheese retained higher moisture content. As storage advanced, the moisture content of all treatments decreased. These results are in agreement with those reported by Hefny, (1982) and Fayed *et al.*, (1988).

Fat content:

The obtained results indicated that fat content of cheese was affected by milk fat substitution with coconut or palm oil. It could be noticed that cheese contained vegetable oils had lower fat content than control. This might be due to the characteristic of the vegetable oils (high unsaturated fatty acids content) and the high loss of fat in whey.

These results are in agreement with those reported by Aida and Abeid (1997). There was a gradual increase in fat content of cheese of all treatments during storage. This might be attributed to the decrease in the

moisture content and of non- fat solids content may be due to partial degradation of proteins and fermentation of lactose.

Fat / Dry Matter(F/DM):

The results showed that cheese contained vegetable oils had lower effect on F/DM than control (Table1).

Table (1): Chemical properties of Tallaga cheese – like during storage in refrigerator temperature (5-6 °C) .

Chemical properties	Storage days	Control (100% MF)	Percentage of substitution (%)							
			Coconut oil				Palm oil			
			25	50	75	100	25	50	75	100
TS %	F	37.6	37.5	37.5	37.1	37.0	37.6	37.3	37.0	36.8
	7	37.8	37.6	37.6	37.3	37.1	37.9	37.6	37.4	37.0
	14	38.1	38.0	37.8	37.6	37.5	38.0	37.9	37.9	37.2
	21	38.5	38.2	38.0	37.8	37.8	38.4	38.1	38.0	37.9
	28	39.4	38.9	38.6	37.9	37.8	38.7	38.6	38.3	38.2
Fat%	F	18.6	18.2	18.0	17.9	17.8	18.0	17.9	17.5	17.2
	7	18.9	18.5	18.2	18.0	17.9	18.2	18.1	17.8	17.3
	14	19.1	19.0	18.6	18.3	18.1	18.7	18.6	18.1	17.5
	21	19.4	19.1	18.8	18.5	18.3	19.1	18.8	18.6	18.3
	28	19.9	19.5	19.2	18.7	18.6	19.3	19.2	18.9	18.5
F/DM %	F	49.5	48.5	48.0	48.2	48.1	47.9	48.0	47.3	46.7
	7	50.0	49.2	48.4	48.3	48.2	48.0	48.1	47.6	46.8
	14	50.1	50.0	49.2	48.7	48.3	49.2	49.1	47.8	47.0
	21	50.4	50.0	49.5	48.9	48.4	49.7	49.3	48.9	48.3
	28	50.5	50.1	49.7	49.3	49.2	49.9	49.7	49.3	48.4
Acidity%	F	0.27	0.26	0.27	0.27	0.27	0.26	0.27	0.26	0.26
	7	0.27	0.26	0.27	0.27	0.27	0.27	0.27	0.26	0.27
	14	0.28	0.27	0.27	0.28	0.27	0.27	0.28	0.28	0.27
	21	0.29	0.28	0.28	0.28	0.28	0.28	0.29	0.29	0.28
	28	0.30	0.28	0.29	0.29	0.28	0.29	0.29	0.29	0.28
pH	F	6.80	6.76	6.78	6.75	6.77	6.75	6.76	6.74	6.75
	7	6.70	6.71	6.75	6.71	6.75	6.73	6.73	6.72	6.72
	14	6.64	6.68	6.69	6.68	6.70	6.69	6.70	6.69	6.67
	21	6.52	6.65	6.64	6.64	6.68	6.67	6.67	6.66	6.62
	28	6.51	6.61	6.60	6.62	6.63	6.64	6.64	6.62	6.61
TN%	F	2.30	2.29	2.24	2.23	2.20	2.21	2.21	2.20	2.19
	7	2.40	2.36	2.30	2.28	2.30	2.24	2.22	2.21	2.20
	14	2.40	2.37	2.33	2.30	2.30	2.26	2.24	2.23	2.22
	21	2.50	2.43	2.41	2.39	2.40	2.31	2.28	2.26	2.40
	28	2.60	2.53	2.49	2.45	2.50	2.40	2.35	2.31	2.50
SN%	F	0.39	0.37	0.35	0.32	0.31	0.34	0.33	0.32	0.31
	7	0.42	0.40	0.38	0.36	0.33	0.35	0.34	0.33	0.32
	14	0.43	0.42	0.40	0.39	0.36	0.36	0.35	0.34	0.33
	21	0.45	0.44	0.41	0.40	0.38	0.37	0.37	0.36	0.35
	28	0.47	0.46	0.44	0.43	0.42	0.40	0.39	0.38	0.42
(SN / TN) X 100	F	17.00	16.2	14.5	14.3	14.1	15.4	14.9	14.5	14.2
	7	17.50	16.9	16.5	15.8	14.3	15.6	15.3	14.9	14.5
	14	17.90	17.7	17.2	17.0	15.7	15.9	15.6	15.2	14.9
	21	18.00	18.1	17.0	16.7	15.8	16.0	16.2	15.9	14.9
	28	18.10	18.2	17.7	17.6	16.8	16.7	16.6	16.5	16.8
TVFA%*	F	13.5	12.0	11.6	11.9	11.9	12.0	12.1	11.8	11.9
	7	15.4	13.5	12.0	12.4	12.5	12.6	12.5	12.0	12.2
	14	17.2	15.8	13.9	13.5	13.6	13.2	13.1	13.2	13.3
	21	18.5	16.9	15.0	14.3	14.1	14.5	14.0	14.0	14.6
	28	19.7	18.0	15.8	15.9	15.6	15.3	15.2	14.9	15.9

F= fresh cheese, TVFA*: ml 0.1 N NaOH/100 g cheese.

This attributed to the content of fat and total solids. Also, the data demonstrated that F/DM increased during storage.

On the other hand, the cheeses made with coconut oil had higher F/DM than those values in cheese with palm oil, and cheeses that made with 100% milk fat. These results are in agreement with Nigm (2000).

Titrateable acidity and pH value:

The acidity of all treatments gradually increased with increasing storage period as a result of fermentation of residual lactose and degradation of protein and fat (Hofi *et al.*, 1991). On the other hand, the results indicated that cheeses made from substituted milk fat were characterized by slightly lower acidity and higher pH, compared with the control sample (Table 1). This might be attributed to the higher moisture content of vegetable oil- treated cheeses than control cheese.

Replacing milk fat with vegetable oil up to 100% did not affect the development of acidity and pH values in the cheese. Similar results were also reported by El-Shibiny *et al.*, (1983).

Total Nitrogen(TN) and Soluble Nitrogen(SN):

The TN and SN of in vegetable oil-treated cheeses were lower than of control cheeses (Table 1). This could be attributed to the lower fat of these experimented cheeses than the control cheese. On the other hand, it is clear from these data that as the storage period progressed, the SN/TN of all cheeses gradually increased. While, the cheeses made from substituted milk fat had lower SN/TN percent compared with the control sample. This decrease might be due to the effect of vegetable oils on the microorganisms responsible for protein breakdown. These results are in agreement with Hung *et al.*, (1990).

Total Volatile Fatty Acid(TVFA):

The results illustrated that TVFFA in the control cheese was higher than cheeses made using vegetable oils (coconut or palm oil) (Table 1). This could be due to the low short chain fatty acids content of vegetable oil. (Hung *et al.*, 1990). On the other hand, the TVFA levels increased gradually through the storage period.

Microbiological properties:

Table (2) shows the total viable, coliform, yeast and mould counts of control cheese and cheese with replacement with 75% coconut oil or 50% palm oil during storage period 28 days at refrigerated temperature. It is obvious that the addition of 75% coconut oil or 50% palm oil to replace milk fat in cheese milk had no effect on cheese microflora. This would explain the similar chemical changes in cheese with or without vegetable oil.

The total bacterial counts increased throughout the storage periods up till the end of storage periods in control cheese and cheese with replacement with 75% coconut oil or 50% palm oil.

Coliform bacteria and yeast and mould were not detected in fresh cheese with or without vegetable oil, but were detected and increased gradually with the progress of storage up to 28 days.

Yeasts and moulds counts were slightly low throughout the storage period. Control cheese had higher counts than made with vegetable oils.

Table (2): Some microbial group counts (C.F.U / g) in Tallaga cheese – like during storage at refrigerated temperature (5-6 °C).

Microbial group counts	Storage (days)	Control (100% MF)	CO:MF (75:25)	PO:MF (50:50)
Total viable count	Fresh	5.0×10^5	4.9×10^5	5.2×10^5
	7	6.2×10^6	6.0×10^6	6.3×10^6
	14	8.2×10^7	8.1×10^7	8.1×10^7
	21	5.3×10^8	5.1×10^8	5.2×10^8
	28	2.5×10^9	2.4×10^9	2.2×10^9
Coliform	Fresh	ND	ND	ND
	7	10	10	10
	14	5×10^1	4×10^1	3×10^1
	21	8×10^2	3×10^3	4×10^2
	28	7×10^3	6×10^3	9×10^2
Yeasts and Moulds	Fresh	ND	ND	ND
	7	ND	ND	ND
	14	30	15	10
	21	40	30	20
	28	60	40	35

MF= Milk Fat, CO:MF=Coconut: Milk Fat, PO:MF=Palm Oil: Milk Fat, ND = Not detected
C.F.U / g = Colony Forming unit

Organoleptic properties:

Data presented in table (3) show the mean score of organoleptic properties of all treatments. Replacing milk fat with coconut and palm oils imparted oily flavor in fresh cheese.

The oily flavor was more pronounced by increasing the percent of fat substitution, but the intensity of the oily flavor decreased with storage, possibly due to using stabilizers (Unicream or Lacta, 815). Cheese made with Unicream as stabilizer gave cheese without or with slight oily flavor. This could be attributed to the presence of emulsifiers in Unicream.

When milk fat was replaced with coconut oil at ratio 25,50 and 75% or palm oil at ratio 25 and 50%, the resultant cheeses showed quality attributes similar to that of control cheese, where no oily flavor was observed. Cheese made by substitution of milk fat with coconut or palm oil at ratio 100 and 75%, respectively, showed acceptable with slight oily flavor.

The oily flavor disappeared at the end of the storage. These results are in full agreement with those reported by Nigm, (2000); Fayed *et al.*, (1988) and El-Shibiny *et al.*, (1983); who mentioned that, the oily flavor of vegetable oils becomes progressively more masked as the cheese storage. While, cheese made with coconut or palm oil only characterized by clear oily flavor during storage periods.

With respect to body & texture, experimental and control cheeses had almost the same scores. Body and texture were improved with storage. That probably due to the progress of cheese ripening process (Abdel-Kader, 1971).

With respect to appearance, cheese made with 75 and 100 % coconut or palm oil showed high scoring points. Cheese was characterized with white color like that of buffaloes-milk cheese. This is due to the excellent bleaching characteristics of oil (Berger, 1986).

Table(3): Organoleptic scores of Tallaga cheese – like during storage at refrigerated temperature (5-6 °C).

Component (%)	Storage (days)	Control (100%MF)	Percentage of substitution (%)							
			Coconut oil				Palm oil			
			25	50	75	100	25	50	75	100
Flavor (50)	Fresh	45	45	44	42	36	44	42	38	35
	7	45	45	44	42	37	45	44	38	36
	14	46	46	45	44	37	45	44	39	36
	21	46	46	46	44	38	45	45	39	37
	28	46	46	46	44	39	45	45	39	38
Body & Texture (40)	Fresh	37	36	37	36	36	36	37	36	36
	7	37	37	37	37	36	36	37	37	37
	14	38	37	38	36	37	37	38	37	37
	21	38	38	38	38	37	37	38	37	37
	28	38	38	38	38	37	38	38	37	38
Appearance (10)	Fresh	8	7	7	8	8	7	7	8	8
	7	8	7	8	8	8	7	7	8	8
	14	8	8	8	8	8	8	8	9	9
	21	9	8	8	8	9	8	7	9	9
	28	9	8	8	9	9	8	8	9	9
Total (100)	Fresh	90	88	88	86	80	87	86	82	79
	7	90	89	90	87	81	88	88	83	81
	14	92	91	91	88	82	90	90	85	82
	21	93	92	92	90	83	90	90	85	83
	28	93	92	92	91	84	91	91	85	85

From the forgoing results, it could be concluded that Tallaga cheese – like can be made by substitution of milk fat with coconut oil up to 75% or palm oil up to 50% with added Unicream as stabilizer without development of oily flavor. Furthermore, cheese can be mad with 100% vegetable oils if subjected to refrigerated storage prior to consumption.

Rheological properties:

Data presented in table (4) show the mean value of some rheological properties of Tallaga cheese – like (consistency and syneresis) of control (100% MF) and cheese with replacement of 75% coconut oil and cheese with replacement of 50% palm oil. Replacing milk fat with coconut and palm oils imparted cheese low consistency than the control cheese. While the cheese made with vegetable oil resulted in samples with higher syneresis than the control cheese.

Generally, the results of cheese with using vegetable oils were slightly less than control for consistency and higher for syneresis. On the other hand, both consistency and syneresis of all treatments decreased throughout the storage periods till 28 days. So, when vegetable oils level decreased as substitution of milk fat, best results of rheological properties were recoded.

Table (4): Rheological properties of Tallaga cheese – like during storage at refrigerated temperature (5-6 °C).

Treatments	Storage (days)	Consistency (PE)	Syneresis (ml)
Control (100% MF)	Fresh	175	13
	7	175	13
	14	174	12
	21	173	11
	28	171	10
CO: MF (75:25)	Fresh	169	16
	7	168	16
	14	167	15
	21	166	14
	28	164	12
PO: MF (50:50)	Fresh	167	14
	7	167	13
	14	165	12
	21	164	11
	28	162	11

CO : Coconut oil. PO : Palm oil. PE : Penetration unit.

The higher of syneresis might be due to acid development and increased shrinkage in cheese throughout the storage. This results were agreement with those reported by (El-Shibiny *et al.*, 1983).

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دراسات على استخدام الزيوت النباتية والمثبتات في صناعة مشابه لجبن الثلجة (بحث مرجعي)

ممدوح أحمد محمد عمر* ، علاء الدين أحمد الحديدي* و على منصور**

* كلية الزراعة - جامعة الأزهر - (القاهرة)

** كلية الزراعة - جامعة الأزهر - (فرع أسيوط)

في هذا البحث تم تصنيع جبن مشابه لجبن الثلجة من لبن فرز مسترجع يحتوى على دهن اللبن مع الاستبدال الجزئى لدهن اللبن بكل من زيت جوز الهند وزيت النخيل على النحو التالى:

- (١) عينة مقارنة ، نسبة دهن اللبن ١٠٠ %.
- (٢) استبدال دهن اللبن بزيت جوز الهند بنسبة ٧٥ - ٢٥ %.
- (٣) استبدال دهن اللبن بزيت جوز الهند بنسبة ٥٠ - ٥٠ %.
- (٤) استبدال دهن اللبن بزيت جوز الهند بنسبة ٢٥ - ٧٥ %.
- (٥) استبدال دهن اللبن بزيت جوز الهند بنسبة ١٠٠ - ٠ %.
- (٦) استبدال دهن اللبن بزيت النخيل بنسبة ٧٥ - ٢٥ %.
- (٧) استبدال دهن اللبن بزيت النخيل بنسبة ٥٠ - ٥٠ %.
- (٨) استبدال دهن اللبن بزيت النخيل بنسبة ٢٥ - ٧٥ %.
- (٩) استبدال دهن اللبن بزيت النخيل بنسبة ١٠٠ - ٠ %.

وقد تم تخزين الجبن الناتج حتى ٢٨ يوم على درجة حرارة الثلجة. وتشير النتائج إلى أن استبدال دهن اللبن بالزيوت النباتية حتى ١٠٠% فى صناعة الجبن الثلجة تأثيره محدود على التركيب الكيماوى و المحتوى البكتيرى أثناء التخزين.

ومن النتائج المتحصل عليها لوحظ طعم زيتى فى العينات الطازجة المحتوية على زيوت نباتية، وخاصة عند زيادة نسبتها وهى أكثر وضوحا عند استخدام زيت النخيل، وقد تناقص هذا الطعم تدريجيا أثناء التخزين. كما وجد أن أفضل نسبة استبدال بزيت جوز الهند كانت حتى نسبة استبدال ٧٥% أما بالنسبة لزيت النخيل فكانت حتى ٥٠%.

وقد تم استخدام بعض المثبتات لتحسين صفات الجبن الناتج وذلك للمعاملات الآتية :-

- (١) عينة مقارنة ، نسبة دهن اللبن ١٠٠ %.
- (٢) عينة استبدال دهن اللبن بزيت جوز الهند بنسبة ٧٥ - ٢٥ %.
- (٣) عينة استبدال دهن اللبن بزيت النخيل بنسبة ٥٠ - ٥٠ %.

وذلك للتغلب على بعض التأثيرات الغير مرغوبة نتيجة هذه الاستبدالات والتي تتمثل فى تحسين القوام والطعم ، وقد وجد أن إضافة اليونيكريم قد أدى إلى تحسين صفات الجبن الناتج أفضل من اللاكتا ، ٨١٥ وذلك لاحتوائه على أملاح استحلاب ضمن تركيبه. وعموما فإن إضافة هذه المثبتات ضرورى لتحسين جودة الجبن الناتج والتغلب على فقد الدهن أثناء عملية التصنيع . وعموما ينصح باستخدام الزيوت النباتية فى صناعة جبن مماثل لجبن الثلجة حتى ٧٥% زيت جوز هند، أو ٥٠% زيت النخيل ويمكن أن تزداد هذه النسبة إلى ١٠٠% عند تخزين الجبن حتى ٢٨ يوم.