

RESEARCH ARTICLE

Comparative study between traditional Domiati cheese and recombined Feta cheese

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Abstract Domiati cheese is the most important white pickled cheese made from fresh cow and buffalos milk. The unique step in its manufacturing is the addition of (10 -14%) salt directly to cheese milk before renneting. The yield is highly depending on the quality and season of milk production. The cheese is consumed after three months (semi ripened) or after 6 months (well ripened). Its production needs big capital. Because of the high prices of milks and cost of ripening. New cast cheeses introduced to the local Egyptian markets, are namely Feta-like and Tallaga like cheese. These recombined cheeses, "designer cheeses" have found acceptability from producers and consumer. The three type of cheeses were experimentally processed under similar conditions, the resultant cheeses were, chemically, organoleptically and economically evaluated. Results showed lower protein and salt contents for cast cheeses as compared with traditional Domiati cheese. Fat content of Feta cheese was the highest as compared with other cheeses, even for 6 months old cheese. Feta-like cheese characterized with lower pH as a result of GDL and citric acid addition. Age of ripening had a highly significant effect ($p < 0.001$) on all Chemical composition (Moisture, pH value, Protein%, SN%, Fat%, TVFA, Ash % and Salt %) of Domiati cheese. Furthermore, a highly significant differences ($p < 0.001$) were showed between three fresh cheeses at zero time for previous chemical composition, except non significant differences ($p = 0.061$) were showed on the percentage of soluble nitrogen. The lower yield of Domiati cheese and the equal mathematical yield with practical yield of recombined cheese encouraged

processor to go on cast cheese production. Cast cheese gained higher organoleptic scoring points, especially Feta-like cheese because of the higher fat content and the clean acid flavour: The low salt content attracted the consumers to change their opinion from the salty flavour Domiati cheese. Economic study showed the higher profit from cast cheese because of the fully obtained yield, the marketing directly after processing, the running capital in shorter time while, running cost of Damiaty cheese takes longer time otherwise processors are obliged to sell their fresh cheese cheaper to get their running capital early. Results showed very promise future for recombined Feta-like cheese.

Keywords : Domiati cheese, economic study, recombined like Feta cheese, chemical composition

Introduction

Domiati cheese is the most popular soft white pickled cheese variety. It is made and consumed not only in Egypt but also in the Arab world and other European countries. It closely resembles Greece Feta cheese, and it is believed that Domiati cheese originated in Egypt since 332 BC (Abou-Donia, 1986).

Domiati cheese has unique step of processing that it is salted at the very first step in its manufacture; the salt is added directly to the raw milk, after salting and filtration the liquid animal rennet is added to have the coagulum in 2.5 - 3 hours, the curd was hooped into wooden moulds coated with the mouslin; the filtrated salty whey is collected for pickling the Domiati cheese. To have well ripened Domiati cheese, tins were left at room temperature for six months, the resultant cheese had sharp distinct aroma and acid flavour. The cheese had to some extent hard texture, the cheese gained the nomination "Estambulli cheese". The second soft white unpickled cheese known as Tallaga cheese which had higher moisture content and soft creamy texture as well less salty flavour. Tallage means in Arabic refrigerator, so this cheese should be ripened in low temperature storage rooms. Only 6%

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salt was added to the cheese milk. Nowadays, because of the increasing of prices of raw cow and buffalo milk with the big demand on white soft cheese. Processors of white cheese started to separate whole milk to sell the milk cream with high prices and used milk fat replacers mainly palm oil to produce designed soft cast cheese with low prices and marketing the cheese fresh after processing. Processors trained themselves to produce cast soft "designer cheeses" from skim milk powder with another ingredients, although traditional feta cheese is a soft white cheese, ripened and kept in brine, originally processed in Greece from sheep and goats milk, Egyptian processors took the name of their new designer cheese as Feta cheese, which is not similar to Greece Feta cheese.

Recombined Feta cheese was recommended by (IDF, 1979) to be manufactured from certified powder milk, whey protein concentrate and other healthy ingredients to overcome the problem of lack in milk production in developing countries. Two main designer varieties of while cheese now in Egypt are Feta-like and Tallaga-like cheese. Tallaga cheese is originally made from buffalo milk, because of its smoothly texture, the second recombined white cheese gained the same name Tallaga cheese or Tallaga-like cheese.

The first designer cheese, firstly made using a baby washer to warm and mix well the ingredients of the Feta-like cheese, so the cheese gained the name "Ghasala" cheese, in which "Ghasala" means in Arabic cloth washer. Hamad, (2002) collected 6 samples of Feta-like cheese "Ghasala cheese" from six separate local cheese factories located in Damietta, El-Dakahlia and El-Sharkia Governorates. The cheeses were divided into two parts, first kept at room temperature (25-30°C), while the second was kept at refrigerator (5-10°C), samples were analysed for chemical composition, microbiological analysis and samples were organoleptically evaluated. Results showed decrease of TS, pH values for all cheeses as the storage period advanced. Big variation in fat F%, F/DM%, protein contents were found between the six samples. Scoring points for fresh cheese ranged between 73 and 81 out of 100 points, the total scoring points increased for cheese kept at refrigerator, while decreased for those kept at room temperature. The coliform bacteria were not found in all samples. The same author (Hamad, 2002) run a lot of experiments to improve the processing procedure of Feta-like cheese. He recommended, using homogenization (150 bar) for this type of cheese, as well using heat treatment (85°C/18sec. - 45°C). The addition of stabilizer had the commercial name "Moon Song 2111". To have the best quality cheese, replacing 20% of vegetable oil by natural pure buffalo butter oil (Samneh).

Since no available comparative study between Domiati cheese and the designer cast cheeses. So, the aim of this investigation is to compare between the old traditional Domiati cheese and

the two new designer cast cheeses namely Feta-like and Tallaga-like cheese from chemical, organoleptic and economic points of view.

Materials and Methods

Fresh buffalo and cow milks were obtained from the herd of faculty of Agriculture Damietta university. Spray non-fat dry milk powder, low heat, of USA and Poland origin. Sodium caseinate, Emulac Na was obtained from Maggle GMBH, Germany which imported by MisrMilk and Food Company "Cairo". Glucono Delta lactone (GDL) was obtained from Jungbunzlauer S.A. France, F67390 Marckolsheim France. Palm oil "Shortening": palm oil produced by premium from vegetable oils B-H-D-S-L-O 66M, Galatetaimahdeoa-baser 81707 Malaysia. Calcium Chloride "flakes 77%" made in Sweden was imported by Kemira Kemi AB, Helsingborg. Citric acid and potassium sorbate Imported by Gersy Commercial Co. "Alex.", production by Z.K.W. China. Salt "Iodized salt", produced by EL-Nasr Saline's Co., Alex. Rennet, Animal liquid rennet from local Market, while powder rennet was imported from Semiram is International Trading, Cairo, Egypt.

Traditional Domiati cheese making

The mixed (cow + buffalo milk 1:1) was heated to 63±2°C for 20 minutes, then cooled to 42±1°C. 10% kitchen salt were added, after filtration through a tight mouslin, 0.01% CaCl₂ solution were added, left 30 minutes before the addition of liquid rennet (60 ml/100L.) of salted milk. After 100 minutes the coagulum was transferred into rectangular stainless steel moulds 80×60×20 Cm. The curd was left 8 hours before covering and lightly pressed overnight with a weight equal 1/4 of the weight of the milk. The whey also is collected for pickling. The mass of Domiati cheese was cut into cubes 9×9×9 Cm., which is filled into tins coated with polyethylene bags 14 Kg/one tin. The tins were filled with the clean salty, whey, let 4 days before closing. Tins left at room temperature for 6 months.

Processing of Feta-like and Tallaga-like cheese

Recombined Feta cheeses were processed according to Tamime and Ranbinson (1986) with some modifications: Table (A)





shows the required ingredients for processing 100 Kg of each "designed" recombined cheese separately. Both types of milk powder were dissolved in warm filtrated water at $45\pm 2^{\circ}\text{C}$., then the whey protein is added. The temperature of reconstituted milk was raised to $50\pm 2^{\circ}\text{C}$., for melting the palm oil, then kitchen salt was added. The admixture temperature was raised to 65°C ., then emulsifier was added and the stirring velocity, gradually increased to reach 1400 RPM, and continuous for

one hour, The hot admixture was poured into stainless steel trays, then citric acid and GDL were added to each tray. Rennet dissolved in tap water 5gms for /100 Kg. of admixture was distributed among trays at $46\pm 2^{\circ}\text{C}$., and left for complete coagulation and cooling. The resultant cheese was cut similarly like Domiati cheese, but only 8 kilo/Plastic container without adding any pickle (Hamad, 2002).

Chemical analyses

Moisture content of milk and cheese was determined according to the (AOAC, 2012). Fat contents of samples were determined according to (AOAC, 2012) by Rose-Gottlieb Method, (905.02). Titratable acidity was estimated according to Ling, (1963), while pH values were determined using glass electrode pH meter (Model 810) Fisher Scientific according to AOAC, (2012). Total volatile fatty acids (TVFA) were determined according to Kosikowski, (1978). Salt contents, the modified Volhards methods as described by Richardson, (1985) were used to determine the salt content of the cheese. Total nitrogen was determined by using semi micro Kjeldahl as described by AOAC, (2012). Ash was determined using the electric Muffle furnace at 550°C ., as described by Ling, (1963) 3-5 gm. Cheese sample were weighed then preaching after that transferred into the muffle. The samples gradually heated from $150-600^{\circ}\text{C}$..

Table (A) : Ingredients for cast cheese making

Ingredients (Kg.)	Feta	Tallaga
Skim milk Powder (American)	10	8
Skim milk Powder (Poland)	6	6
Palm oil	24	8
Emulsifier	0.300	0.300
Citric acid	0.08	0.06
Whey dried	9.5	-
GDL	2.5	0.5
Salt	2.5	3.0
Calcium chloride	0.04	0.04
Water added	53.58	62.10
Total cheese after Packaging	100	100

in 5 hours, then stayed at 600°C. for 3 hours. The next day, the samples were weighed to estimate the ash percentage.

Organoleptic evaluation

Samples of fresh and stored Domiati cheese were organoleptically evaluated according to the scheme described by El-koussy (1966), 15 points for color and appearance (condition of surface, presence of cracks and moulds). 35 for body and texture (dry, rubbery, pastry, grainy, greasy or spongy) and 50 points for the flavour (salty, bitterness, acid tastes, or any off-flavour). cheeses are judged by 10 persons who had experience in soft cheese varieties.

Yield calculation:

The actual yield of Domiati cheese was determined by weighing the cheese after removal from brine and expressed as a percentage of the milk weight is the respective vat (Shakeed *et al.*, 2003 d).

$$\text{Cheese yield} = \frac{\text{Weight of cheese}}{\text{Weight of cheese milk}} \times 100$$

The yield of designed cast cheese calculated as 96% of the total ingredients including water. Results are Mathematical average of 6 treatments.

Statistical analyses

Data were analyzed using SAS (2004) computer program, GLM analysis of variance (ANOVA). Differences between means were detected by Duncan's Multiple Range Test (Duncan, 1955).

Results and Discussion

Chemical analysis

The chemical composition of mixed cheese milk was 17.77% TS, 6.05% Fat, 3.72% protein, 0.18% acidity and pH 6.57.

Yield of the cheese

Domiati cheese marketing is done when fresh by middlemen who are responsible for ripening. After three months, the cheese is marketing as a semi ripening cheese and possibly to be consumed. The optimum maturity of Domiati cheese is after 6 months. The cheese had sharp attractive flavour and firm texture, the cheese is marketed under the name "Estambuli cheese".

From Table (1), it is clear that traditional Domiati cheese ripened through 6 months, as the ripening period progressed the yield of cheese decreased. Early research done by El-Sokkary *et al.* (1957) showed higher loss in cheese weight during the first 4 weeks of storage at room temperature. Approximately 4% of cheese weight lost per 4 weeks. It is well known that at room temperature 12% pickle able to withdraw the water out of cheese, so prices of Domiati cheese are dependent on the age of the cheese. The most important advantage of design cast soft cheese is the marketing when fresh, the yield to some extent is stable at refrigerator conditions. Statistical analysis showed significant difference between yield of Domiati cheese and the other two designed cheeses. No difference between Feta-like and Tallaga-like cheese. No deference in yield of Domiati cheese at 1 month or three month pickling time, but significant difference ($p < 0.001$) in detected when cheese pickled for 6 month.

Chemical composition of Domiati cheese and fresh designed cast cheese

Table (2) illustrates the main chemical composition of different cheeses:

Moisture content: At zero time Tallaga cheese had the highest moisture content (63.22%), while the lowest value was for Feta cheese 53.8%. Domiati cheese had 57.22% when fresh, the moisture content decreased as the ripening period advanced to reach 39.40% after three months of ripening and became 32.97% before marketing (6 months). Sharara (1959) reported that the average moisture content of cheese being made from buffalo milk and salted at the rate of 7% decreased from 55.76% when fresh to 53.16% after 4 months, reaching

Table 1 : Yield % of cheese.

	Domiati	Feta-like cheese	Talaga-like cheese	p-value
Zero time	^a 28.25±0.43 ^B	96±0.57 ^A	96±1.15 ^A	<0.001
1 Month	^b 25.23±0.44	Marketing freshly without ripening		
3 Month	^b 24.37±0.08			
6 Month	^c 19.40±0.17			
p-value	<0.001			

Table 2 : Chemical composition of Domiati cheese through 6 months and for fresh designed cast cheeses.

	Domati	Feta	Tallaga	p-value
Moisture				
Zero time	^a 57.22±0.06 ^B	53.80±0.23 ^C	63.22±0.10 ^A	<0.001
1 Month	^b 46.43±0.12	--	--	
3 Month	^c 39.40±0.40	--	--	
6 Month	^d 32.97±0.12	--	--	
p-value	<0.001			
pH value				
Zero time	^a 6.20±0.07 ^A	4.33 ±0.12 ^B	6.37 ±0.10 ^A	<0.001
1 Month	^b 5.11±0.37	--	--	
3 Month	^c 4.30±0.14	--	--	
6 Month	^d 3.32±0.14	--	--	
p-value	<0.001			
Protein%				
Zero time	^a 13.17±0.02 ^A	5.89±0.12 ^B	5.32±0.06 ^C	<0.001
1 Month	^b 12.75±0.14	--	--	
3 Month	^c 11.87±0.07	--	--	
6 Month	^d 11.02±0.01	--	--	
p-value	<0.001			
SN%				
Zero time	^d 0.015±0.001	0.01±0.001	0.011±0.001	0.064
1 Month	^c 0.25±0.04	--	--	
3 Month	^b 0.46±0.01	--	--	
6 Month	^a 0.74±0.01	--	--	
p-value	<0.001			
Fat%				
Zero time	^d 19.93±0.13 ^B	24.59±0.02 ^A	17.99±0.08 ^C	<0.001
1 Month	^b 22.99±0.08	--	--	
3 Month	^c 22.62±0.12	--	--	
6 Month	^a 23.96±0.08	--	--	
p-value	<0.001			
TVFA*				
Zero time	^d 8.80±0.06 ^B	9.80±0.00 ^A	7.20±0.00 ^C	0.01
1 Month	^c 10.20±0.11	--	--	
3 Month	^b 17.50±0.11	--	--	
6 Month	^a 20.10±0.06	--	--	
p-value	<0.001			
Ash %				
Zero time	^d 4.22±0.04 ^A	3.11±0.03 ^B	2.72±0.05 ^C	<0.001
1 Month	^c 4.55±0.03	--	--	
3 Month	^b 5.01±0.01	--	--	
6 Month	^a 6.12±0.05	--	--	
p-value	<0.001			
Salt %				
Zero time	^a 6.19±0.02 ^B	2.49±0.00 ^C	3.00±0.00 ^A	<0.001
1 Month	^b 5.33±0.01	--	--	
3 Month	^c 4.83±0.02	--	--	
6 Month	^d 4.17±0.03	--	--	
p-value	<0.001			

* Expressed as ml 0.1 NaOH 100 g-1 cheese

50.81% after 8 months of storage. However, Abou-Dawood (1964) found that in cheese made from buffalo milk salted at the rate of 10%, the moisture content decreased gradually from 62.33 to 58.45, 57.12, 56.05, 54.70 and 53.65% after 2, 4, 8, 12 and 18 weeks of storage, respectively. Statistical analysis showed significant differences ($p < 0.001$) for the moisture contents of the three cheeses and also clear differences ($p < 0.001$) for the moisture content of Domiati cheese at different ripening ages.

pH values: Domiati cheese had the highest pH values (6.05 - 6.32) for fresh cheese and decrease sharply as the ripening continued because the microflora adapted to hydrolyse lactose into lactic acid, gradually during 6 months of ripening pH values decreased to reach (3.05 - 3.52). The Tallaga cheese had higher pH value (6.2 - 6.55) as compared with Feta-like cheese (4.12 - 4.55). The lower pH values is owing to higher GDL addition (2.5%) against (0.5%) in Tallaga cheese. Wolfschoon and Furtado, (1997) mentioned that lactose mainly plays an important role in changing pH and acidity, the amino acids, peptides, peptones amino acids and fatty acids forming during protein and fat breakdown result in some changes in pH of cheese. For Feta cheese GDL also contribute in acidity and pH values, pH analysis of the six samples of Feta-like cheese collected by (Hamad, 2002), had 6.00/4.15, 6.20/4.00, 6.35/4.22, 6.10/4.13, 6.35/3.95 and 6.00 and 4.84 for fresh and thirty days old A, B, C, D, E and F cheese samples, respectively. Abdou et al. (1976) processed Domiati cheese from cow+ buffalo milk (1:1) traditionally, pH value for fresh and 4 months cheese were 6.7 and 3.8, respectively. Age of ripening had a highly significant effect ($p < 0.001$) on pH value of Domiati cheese. Furthermore, a highly significant differences ($p < 0.001$) were showed between three fresh cheeses at zero time.

Protein content: The very remarkable observation is the low protein content of designed cast cheese being 5.89 and 5.32 for Feta and Tallaga cheese respectively, while the protein content of fresh Domiati cheese is 13.17% which is equal 2.24 times the Feta cheese protein. As the ripening time progressed the protein content of the Domiati cheese decreased, this decrease is owing to the more syneresis of whey protein from the cheese into the pickle as well some protein hydrolysis. Sharara (1959) in an investigation on buffalo's milk cheese found that the soluble nitrogen content in fresh samples was 0.480% and increased to 0.596% and 0.654% after 4 and 8 months, respectively. The same author (Sharara, 1962) found that pasteurization resulted in an increase in the total, soluble, non-protein nitrogen and ammonia, while the addition of starter increased the total, soluble, non-protein nitrogen contents. The average of T.N. was 3.971% and 4.340% in raw and pasteurized milk cheese, respectively. According to Selim, (1993) protein is the major constituent of milk which undergoes chemical and physical changes during the ripening of cheese.

In Domiati cheese, salt concentration significantly affects the protein degradation which in turn affects the total nitrogen of cheese, as well as the nitrogen equilibrium between curd and whey. Total nitrogen analysis done by (Hamad, 2002) showed low content of TN being 1.08, 1.09, 1.24, 1.11, 1.18 and 1.13 for the survived Feta-like cheese samples A, B, C, D, E and F, respectively. He mentioned that the difference in total nitrogen content is due to the salt and moisture content and his results agreed with those obtained by Hefnawy et al. (1986) and El-Sawwah (1997). Abou-Donia (1981) who found 16.46% protein for fresh Domiati cheese and 21.12% for 1 month old cheese the protein content is to some extent related to TS. Moisture content were 62.6 and 50.2 for fresh and one month old cheese. The low protein content of designed cast cheese is owing to the amount of skim milk powder, 16 Kg were used for Feta cheese making, normally SMP contains $\approx 50\%$ lactose and $\approx 34 - 36\%$ protein, which equal to 5.44% in 16 Kgs SMP. Protein in cast cheese are casein and whey protein while protein in Domiati cheese are mostly casein since whey protein mostly drained off into whey. The ripening process for Domiati cheese usually takes place in an aqueous salt medium, or in a pickling solution which may be brine or salted whey. Various factors affect the cheese ripening; type of milk; pretreatment of the milk; season of milk production; addition of starter to the milk; type of coagulation used; percentage of salt in both the cheese curd and the pickling medium; microflora of the cheese milk; additives to the cheese milk to accelerate the cheese ripening (Robinson and Tamime, 1991). SN and TVFA are included among the indication of ripening. From Table 2. SN of the three white cheese, fresh cheeses had 0.015, 0.010 and 0.011% for Domiati, Feta and Tallaga-like cheese, respectively. Recombined Feta-like cheese are consumed freshly, while Domiati cheese store at room temperature for six months from the same (Table 2) as the ripening period advanced, the SN and TVFA also increased. Statistical analysis showed significant differences ($p < 0.001$) between protein contents of the three fresh white cheeses, also, differences ($p < 0.001$) are found between Domiati cheese at different ages, while, non significant differences ($p = 0.061$) were showed on SN% as printed in table 2.

Fat content: Table 2 shows the percentages of fat in the three cheeses. Feta cheese had the highest fat content (24.59%), while the lowest was for Tallaga cheese (17.99%). The fresh Domiati cheese had 19.93%. The apparent increase in fat content during ripening of Domiati cheese is owing to the increase in dry matter. Six samples of Feta-like cheese were collected by (Hamad, 2002) and stored either at room temperature or refrigerator conditions. Data showed low fat content in fresh cheese and increased after 15 days, then gradually decreased during the storage period for room temperature samples, while the refrigerator cheeses fat content decreased, fat content for fresh cheese were 19.20, 20.30, 19.40, 18.70, 19.80 and 16.50 for A, B, C, D, E and F treatments,

respectively. Robinson and Tamime (1991) summarized F/DM of Domiati cheese which ranged between 40.20 and 62.20%. From Table 2 it is clear, that there are significant differences ($p < 0.001$) in fat contents between the three white soft cheeses, on the other hand the difference ($p < 0.001$) is high for fat contents of the Domiati cheese at different storage times.

TVFA contents: Acids regarded as ripening indices, when increased the maturation of the cheese is accepted. The statistical analysis (Table 2) showed significant differences ($p < 0.001$) between the three fresh cheeses. Also, age of ripening had a highly significant effect ($p < 0.001$) on TVFA for Domiati cheese.

Ash content: Ash content of the cheese represents the added kitchen salt and minerals retained into the cheese. The increasing of ash content in Domiati cheese during ripening is due to the increase in dry matter. Ash content in white cheese is related to the salt content of the cheese, statistical analysis showed significant differences ($p < 0.001$) in ash content between the three white fresh cheeses. On the other hand, significant differences ($p < 0.001$) were detected between Domiati cheese at different ages.

Salt content: Salt content of designed cast cheese is lower than that in Domiati cheese, the higher salt content (10.0%) added to the cheese milk led to higher salt content in Domiati cheese nearly half the salt content retained into the cheese, the higher salt content in ripened cheese is due to the increase in total solids. The concentration of salt in white cheese depends mainly of the amount of added salt and the moisture content of the cheese, also the concentration of salt in the pickle of Domiati cheese. Results of salt in the six Feta-like cheese were 3.042/2.457, 2.691/2.34, 2.808/2.34, 3.1005/2.457, 2.925/2.399 and 3.1005 and 2.5155 for fresh and 30 days room temperature A, B, C, D, E and F, respectively (Hamad, 2002). To some extent salt content behaved similarly as ash content and the statistical analysis showed the same significant differences ($p < 0.001$) between the fresh cheeses and also the

highly significant ($p < 0.001$) is also high for the salt content of Domiati cheese under different ages.

Organoleptic properties of the three white cheese

The ten judges gave their opinion randomly without knowing the sample type. The average values were presented in Table (3). Colour and appearance of Domiati cheese decreased as the ripening period advanced, the cubes of cheese took another irregular shape, as well the bright colour turned to pale yellowish colour. While feta and Tallaga cheese had brighter whiteness because of the addition of palm oil as well, the cubes of cheese were similar in dimensions. Body and texture of Domiati cheese had nearer value of feta and Tallaga cheese when fresh, but by the ripening time body and texture, scoring points decreased gradually to reach 30.5 and 29.2 for 3 and 6 months old cheese.

Feta cheese gained the highest flavour scoring points (47.5) out of 50 for fresh cheese and Tallaga cheese had nearer value (46.0) out of 50. The lowest value was for fresh Domiati cheese. This is owing to the higher salty taste of the cheese and no ripening flavour was formed yet. On the other hand, the acid taste of cast cheese generated by the addition of GDL mostly and citric acid partly, shared the acceptable taste of cast cheese. Although ripening flavour advanced through 6 months, scoring points did not reach the flavour of cast cheeses.

Total scoring points were highly marked for cast Feta cheese 94.50 out of 100, while six-month-old Domiati cheese had only 84.37, the difference is approximately 10 scoring points. Tallaga cheese gained 90.68 points out of 100.

Organoleptic evaluation for the six samples collected by (Hamad, 2002) gained 78, 81, 85, 80, 73 and 73 for A, B, C, D, E and F Feta-like cheese, respectively. The scoring points increased after 7 days of refrigeration storage then decreased, while decreasing started early for samples stored at room

Table 3 : Organoleptic scoring of the fresh three cheeses and throughout ripening period of Domiati cheese.

	Coulour& Appearance (15)	Body & Texture (35)	Flavour (50)	Total (100)
Domiati cheese				
Zero time	13.30±0.05	32.30±0.17	38.20±0.17	83.80
1 Month	12.30±0.20	30.70±0.09	41.30±0.11	84.30
3 Month	13.20±0.03	30.50±0.05	43.70±0.17	87.40
6 Month	10.20±0.23	29.20±0.08	45.00±0.09	84.37
Feta				
Fresh	13.70±0.03	33.30±0.14	47.50±0.03	94.50
Tallaga				
Fresh	12.66±0.06	32.20±0.03	46.00±0.09	90.68

temperature. The organoleptic properties of Feta-like cheese depends mainly on the method of manufacture, type of skim milk powder, source of fat, salt concentration, added flavours and the amount and quality of GDL.

El-Koussy et al. (1975a) found that higher organoleptic properties of Domiati cheese was observed with cheese stored at high temperature and Ghaleb et al. (1998) reported that holding Domiati cheese made from recombined milk at 5 - 15°C improved its body, texture and flavour, compared with storage at room temperature (20°C). Both Sirry and Kosikowski (1959) and El-Koussy et al. (1975 b,c) reported that pasteurization of cheese milk gave a firm-bodied and typical flavoured cheese. From the above discussion ripening for months give Domiati cheese better quality and higher scoring points, while Feta cheese consumed with acceptability when it is fresh.

Comparative economic study between the three varieties of cheese:

No available detailed comparative study between traditional Domiati cheese and recombined Feta-like cheese. Since small dairies are the main producers of Domiati cheese, while recombined Feta cheese are produced by both small dairies a big modern dairies. Prices of ingredients of Feta cheese mostly imported from abroad and had changeable prices. A valuable attempt for economic evaluation was done by (Hamad, 2002) for the production of 100 kg. white Feta cheese produced from six small factories. Total prices were 227, 256, 252.90, 279.76, 237.35, 260.07 and L.E. 218.911 for the production of 100 kg. cheese. After adding 15% of total ingredients prices as a cost of processing the gain percentage for the six different cheeses were 34.664, 27.291, 19.566, 31.651, 25.230 and L.E. 37.063, respectively.

To study the feasibility study of the soft cheese the following items must be included:

- ◆ Amount of milk for Domiati cheese - 100 Kg.
- ◆ Amount of ingredients of designer cast cheese - 100 Kg.
- ◆ Yield of Damiami cheese:
 - Fresh (28.25%).
 - 3 months (24.37%).
 - 6 months (19.40%).
- ◆ Yield of recombined cheese = 98% of calculated yield.
- ◆ Lost of recombined cheese because of handling and filling =4%?
- ◆ Price of raw materials:

	L. E.
1 Kg. Mixed fresh milk	4.5
1 Kg. American skim milk powder	35.00
1 Kg. Polish skim milk powder	32.00
1 Kg. Sodium caseinate	84.00
1 Kg. Hydrogenated palm oil	10.25
1 Kg. Idonized kitchen salt	0.45
1 Kg. Potassium Sorbate	65.00
1 Kg. Glucono Delta Lactone	55.00
1 Litre Liquid Animal Rennet	20.00
1 Kg. Imported microbial Rennet	1500.00
1 Kg. citric acid	20.00
1 Kg. Emulsifier salts	35.00
One container for 12 Kg. Domiati cheese	15.00
One container for 8 Kg. cast cheese	15.00
Polyethylene bags for each container	2.00
Depreciation of equipment through 5 years	
Price of selling one Kg. Domiati cheese:	
1 Kg. Fresh	20.00
1 Kg. 3 months	25.00
1 Kg. 6 months	30.50
Price of one Kg. Tallaga cheese	12.50
Price of one Kg. Feta-like cheese	14.00

* One American Dollar (\$) = 8 Egyptian pounds (L.E.)
 ** 1 Egyptian pounds (L.E.) = 100 piasters (PT).

Approximate cost for manufacturing 100 Kg. mixed milk to Domiati cheese.

Items	L E.
100 Kg. cheese milk × 4.5	= 450
12 Kg. kitchen salt × 0.65	= 7.80
0.01 Kg. CaCl ₂ × 15	= 0.15
60 ml liquid rennet × 20	= 1.20
2 meter Mouslin × 4.50	= 9.00
Cost of water, electricity, fuel	= 2.00
Labour cost per 100 L. of milk	= 15.00
Packing 28 Kg. cheese ÷ 12 Kg. × L.E. 15	= 35.00
Marketing 1 pound for / 1 Tin: 2.3 Tin×1 L.E.	= 2.30
Total	522.45
Price of one Kg. fresh cheese	= 522.45/28
	= L.E. 18.66

After three months, yield is 23.60%. The sum 522.45 will rest 3 months, 3% interest should be gained.

$$522.45 \times 3\% = 15.67 \text{ (The interest)}$$

$$522.45 + 15.67 = 538.12 \text{ (The total costs for three months old cheese).}$$

$$\text{Price of one Kg. 3 months old Domiati cheese} = 538.12 / 26.50 = \text{L.E. } 20.31$$

After 6 months the sum would have 6% interest = $522.45 \times 6\% = \text{L.E. } 31.35$

Total cost = $5.22.45 + 31.35 = 553.80$ Pounds.

The yield of Domiati cheese after 6 months is 19.4%.

The cost of one Kg. = $553.80/19.40 = \text{L.E.}28.55$

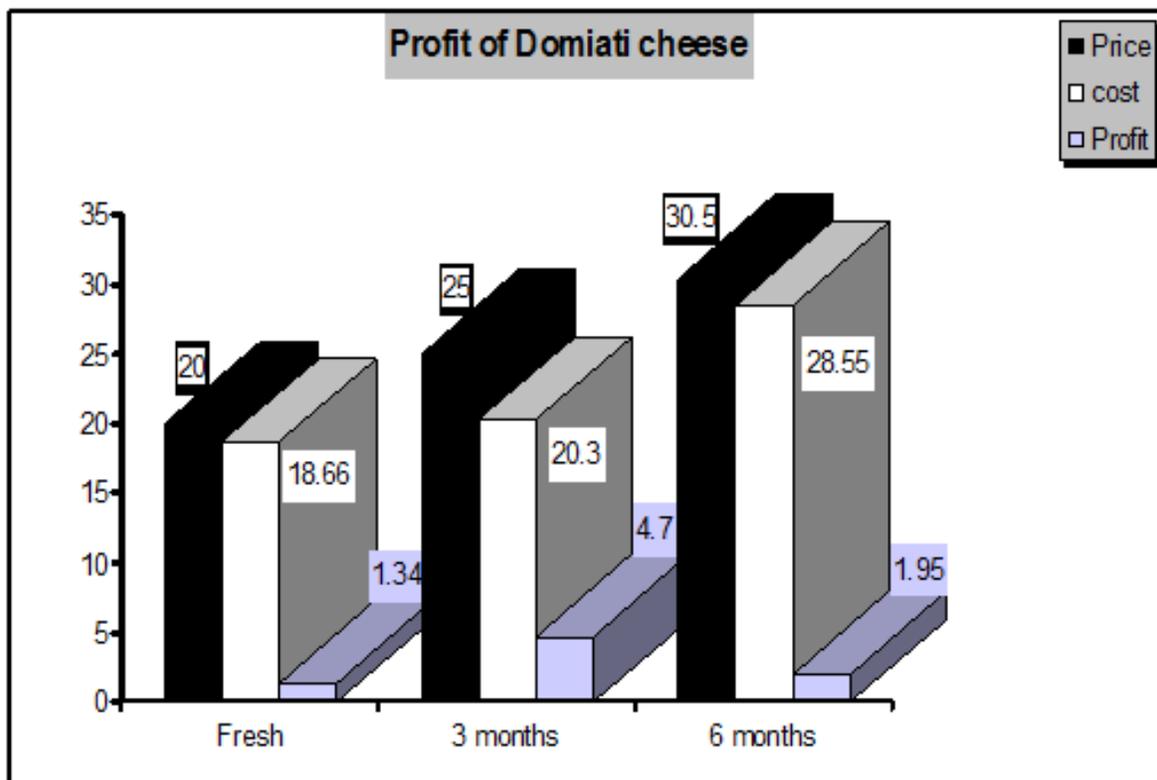
Profit of Domiati cheese:

Fresh	3 months	6 months
Price of selling L.E.20.00	L.E.25.00	L.E.30.50
Cost per Kg. L.E.18.66	L.E.20.30	L.E.28.55
Profit/Kg. L.E.1.34	L.E.4.70	L.E.1.95

Ingredients	Feta	Tallaga
	L. E.	
SMP (American)	$10 \times 35 = 350$	$8 \times 35 = 280$
SMP (Polish)	$6 \times 32 = 192$	$6 \times 32 = 192$
Palm oil	$24 \times 10.25 = 246$	$18 \times 10.25 = 184.50$
Emulsifier	$0.3 \times 35 = 10.50$	$0.3 \times 35 = 10.50$
Citric acid	$0.08 \times 20 = 1.60$	$0.06 \times 20 = 1.20$
Whey protein	$1 \times 84 = 84$	$2 \times 84 = 168$
GDL	$2.50 \times 55 = 137.50$	$0.50 \times 55 = 27.50$
Kitchen salt	$2.50 \times 0.45 = 1.125$	$3.00 \times 0.45 = 1.35$
CaCl ₂	$0.04 \times 15 = 0.60$	$0.04 \times 15 = 0.60$
Rennet	$0.005 \times 1500 = 7.50$	$0.005 \times 1500 = 7.50$
Labour	= 30	= 30
Containers	$12 \times 8 = 96$	$12 \times 8 = 96$
Polyethelene bags	$12 \times 2 = 24$	$12 \times 2 = 24$
Total	1180.825	1023.15

From above calculation, the best profit could be obtained from the selling of three old Domiati cheese. Normally this profit is gained by merchants who had the money to store the cheese and not for the processors, who need the current cost of processing 100 Kg.

Losses	4%	4%
Amount of cheese	96 Kg.	96 Kg.
Cost of price of 1 Kg.	12.30 L.E.	10.66 L.E.
Price of selling	14.00 L.E.	12.50 L.E.
Profit	1.70 L.E.	1.84 L.E.



From the above preliminary estimation for comparing between the cost, profit and advantages between the three types of cheese the following are:

- ♦ For Domiati cheese yield is not fixed through the year, the variation is very different between the spring (28 - 32%) and the summer (21 - 23%). At mean time prices of cheese milk are higher in summer and autumn as compared with winter and spring.
- ♦ Ripening of Domiati cheese requires higher capital investment to make the optimum profit when the cheese is three months old.
- ♦ The equipment for producing 300 Kg. cheese are three times of the equipment of recombined cheese, for example 1000 L. cheese milk give 300 Kg. Domiati cheese while 1000 recombined Feta cheese produce 960 Kg. Feta cheese. Without losing any whey, so price of working is less.
- ♦ Many people think deeply about Domiati cheese the bad side effects of the high salt content of Domiati cheese and the preferable salt taste of recombined cheese.
- ♦ The sure yield of recombined cheese with the very hygiene ingredients, highly encouraged cheese maker to move to recombined cheese than Domiati cheese.
- ♦ Spreadability of designer cast cheese with its low price (nearly the half of ripened Domiati cheese attracted the house wife to make more sandwiches from one Kg Feta-like cheese than from Domiati cheese.
- ♦ For fresh cheese it is clear that Feta cheese is more profitable than Domiati cheese.

Conclusions

- ♦ The main disadvantages of Feta-like cheese are the low protein content 4-6%, the standard specification is more than 9%, the second the high percentage of palm oil exceeds 22%. To fulfill the legal requirements it is of great importance to raise the milk powder, selection of whey protein concentrates with high organoleptic properties. Also possibly the use of liquid skim milk of cow or buffalo milk with lowering the palm oil.
- ♦ The markets require recombined Feta cheese with less palm oil, even with higher prices (Hamad, 2002) succeeded to substitute part of palm oil with natural milk fat.
- ♦ More studies are required to use the whole milk powders instead of SMP to reduce palm oil. Prices in Egyptian markets showed little differences between prices of whole and skim

milk powders. The economic studies will show the differences in prices of resultant recombined Feta-like cheese.

- ♦ For Domiati cheese which is regarded as a part of culture of most Egyptian citizens, to continue its role, improvements are required to raise the yield and lowering the salt content (4-8%). On the other hand shortening time of ripening (6 months). Processors should apply the successful results obtained by various researches through 60 years. Pasteurization of milk will answer the legal requirements and raise the yield of resultant cheese. Pasteurization or heat treatments will permit the use of starters to the ripening of cheese milk, lowering the salt cost which is regarded as preservative. The use of ultrafiltration of Domiati cheese milk will led to high yield to reduce the prices of cheese.
- ♦ Salt tolerance lactic acid bacteria is an important field of research to find lactic acid bacteria ferment lactose in salty milk. Such research will encourage processors to use the salt tolerance starter to have the sharp characteristic flavour of Domiati cheese in shorter time.

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