

RESEARCH MEMORY ON DOMIATI CHEESE (1947 - 1977)

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**This article is dedicated to the soul of
Prof. Dr. M. H. Abd El-Salm**

SUMMARY

The current review describes the earlier studies done on Domiati cheese taking into consideration cheese milk, the manufacture, yield, composition and quality of such unique pickled soft cheese originated in Egypt and well-known in most of the Arab countries. Moreover, Domiati cheese is regard as one of the major Egyptian dairy product in terms of its economic value, volume of production and contribution towards nutrition of the Egyptians.

Key words: Domiati cheese, Research memory.

INTRODUCTION

Domiati or Domietta is well-known cheese since this indigenous variety is named after the Domiat city belonging to governorate of the same name in the north of Egypt. Domiati cheese (DC) is belonging to pickled soft cheeses that of great importance in warm climates and storage of pickle (salted whey) is quite inevitable step for preservation. However, manufacture of pickled cheeses is traditionally well-known in the Mediterranean basin and the Balkan area. In Egypt, manufacture of pickled cheeses has been dated to the First Dynasty (3200 BC) since earthenware cheese pots were found in the tomb of Hor Aha at Saqqara (**Zaky and Iskander, 1943**).

Domiati cheese (DC) is unique among soft cheese varieties in the addition of large amount of sodium chloride to milk (8-15%) before renneting and the amount of salt

depends on many factors such as quality of milk, season of production and the period and conditions of storage. However, in all cases, DC is usually packed in layers into rectangular tins. The tins are soldered and stored but blowing of tins is one of the main problems. Some studies were carried out in this respect (**Abo Elnaga, 1968, 1969 and 1971**) and revealed that blowing of tins containing 10% salt was primarily caused by electrochemical corrosion, but when salt was 7% clostridia and *Aerobacter aerogenes* were found to cause blowing and the use of potassium nitrate was not effective in this respect and 10% salt was necessary. Some studies pointed out possibility of making DC from unsalted milk (**Safwat et al. 1960; Sharara, 1961 a; Sholkami, 1965; El-Koussy, 1966; Attia, 1970; Mostafa, 1976**), but such attempts did not give a clear picture

of the technological steps to be applied on factory scale to get typical quality of DC.

The best quality DC is made from buffalo's milk, though it can be made from cow's milk or from a mixture of both milks (Abou Dawood, 1964; Abd El-Salam et al. 1976). DC is also made from sheep's milk (Sirry and Rakshy, 1954 a, b) and from goat's milk (Rakshy and Hassan, 1971 a). Also, reconstituted milk may be mixed with liquid milk or used alone to make good quality DC (El-Safty, 1969; Hagrass, 1971; El-Atawy, 1973).

On the other hand, yield of cheese was found to be affected by many factors such as type of milk, rate of salting, the heat treatment applied and ladling type, while the net weight of pickled cheese was also found to be affected by some factors and its decrease due to the losses in the pickling solution ranged between 25 and 40% (El-Sokkary et al. 1957; Sharara, 1959; El-Koussy, 1966; Naguib, 1968).

The Research Memory:

Sharara (1947) in his M. Sc. Thesis revealed the importance of acidity in controlling the moisture content of Domiati cheese (DC). He found that the yield of cheese was greatly affected by milk salting and the average yield was 26.37% when cheese was made from salted buffalo's milk and such value was accompanied with value of 17.19% total solids in the resultant whey from 10% salted DC while the fat in whey was only 0.48%. The same author in his Ph. D. Thesis (Sharara, 1957) mentioned that the moisture content was 59.66% when DC was made from 7% salted buffalo's milk, whereas

decomposition of milk proteins during cheese pickling was decreased by high salting.

Fahmi and Sharara (1950) were the first who gave details on making and properties of DC. They mentioned that DC is either sold fresh or ripened for 4-8 months or longer. They reported and concluded also the following:

- Increasing the amount of salt added to cheese milk delayed coagulation and gave softer

cheese with higher moisture and lower acidity.

- The yield of buffaloes DC was always higher than that of cow's cheese and in both cases

increased with the increase of salt added to cheese milk.

- Fat in cheese was greatly decreased with increasing salting level when cheese was made

from salted milk and the loss in whey was not strictly proportional to fat content in milk

but proportional to the amount of salt added.

- Total and soluble nitrogen contents in cheese decreased progressively with the increments

of salt added to cheese milk. Cheese made from cow milk showed a faster rate of protein breakdown than that made from buffalo milk.

- Coagulation of cheese milk should be carried out in 2.5-3.0 hours to ensure a good coagulation and proper firmness.

- Excess salting, the severe heat treatment and subnormal amount of rennet retard the

coagulation time and give inferior quality for cheese.

Sadek and Hassan (1953) found that the addition of an adequate amount of salt to DC milk inhibited the gassiness due to presence of coliforms.

Ismail and Onsy (1954) suggested the following equation after analysing 27 DC samples for calculating the yield of cheese: $\text{Yield} = (\% \text{ fat} + 3) + 2.989$. They observed decrease in cheese moisture from 62.1 to 47.4%, and increases in fat from 22.5 to 25.0% and in protein from 7.92 to 13.35% when DC was made from buffalo's milk and pickled for one month.

Sirry and Rakshy (1954 a, b) manufactured Danni cheese from sheep's milk. This cheese is considered as valuable variant of DC made from sheep's milk. The average of fat content (per se) was 18.02% when cheese was made from 6% salted milk, while the loss in whey was only 0.257%.

Hamed (1955) found that the yield of DC was 33.62% when cheese curd was ladled in moulds and was 29.94% when ladled in cloth. This was accompanied by corresponding moisture values of 60.34 and 55.70% respectively which decreased to 53.99 and 49.79% at the end of 4th week of pickling at room temperature. Acidity, fat and other constituents of cheese as well as loss of TS in whey were affected by ladling type.

Sadek and Hamed (1955) analysed 100 samples of market DC and found that the mean value of sodium chloride content was

6.27% which was equivalent to 14.15% on dry matter basis.

Ghoneim et al. (1956) found that yield of DC increased as the percentage of fat in milk increased, while the loss in cheese weight was most marked throughout the first 4 weeks of pickling at room temperature.

Helmy (1956) mentioned that the increase in coagulation time of DC milk increased the moisture retention in the resultant cheese. She also pointed out that coagulation should be accomplished within a suitable normal period. She gave moisture content of 68.20 and 69.20% in cheese made from salted milk of 7.5 and 15.0% salt content respectively. However, Helmy in her M. Sc. (1956) and her Ph. D. (1960) was interested in bacteriological changes and quality of DC and found that with low-salt content (7.5% in milk) the predominant microorganisms in the early stage of pickling were streptococci, which were later replaced by lactobacilli. In the higher salt content (15% in milk), micrococci shared the dominance with the lactobacilli. *S. lactis* and *S. cremoris* were the only streptococci spp. that were isolated and the most commonly found lactobacilli were *L. casei*, *L. plantarum*, *L. brevis* and *L. fermenti*. Staphylococci were the dominant micrococci found in the cheese, while *M. luteus* was the only micrococcus isolated from the cheese.

Sadek and Eissa (1956) found a relation between the presence of coliforms and the flavour and texture of cheese

Sharara (1956) mentioned that buffaloes' cheese contained higher percentages of calcium and phosphorus

compared with cows' cheese after the same period of ripening and that was naturally due to the higher percentages of both minerals in buffaloes' milk.

El-Sadek and Eissa (1957) studied the incidence of coliforms in market DC in relation to acidity and salt content and concluded importance of adding at least 9.5% salt to raw milk to suppress growth of such bacteria.

El-Sokkary *et al.* (1957) stated that the yield of DC was higher in cheese ladled into moulds than cloth ladled cheese. They attributed the weight losses of cheese during pickling to biochemical changes that result in curd contraction and exclusion of moisture and soluble constituents in pickling brine.

Sharara (1959) studied the changes in the chemical composition of DC made from

cow's milk and from buffalo's milk during the pickling period of 4 and 8 months. He found that increasing time of pickling decreased moisture, chlorine and TN content and increased fat, SN, amonical N (AN) and their values on TN (SN/TN, AN/TN). Acidity gradually increased during pickling of DC from both milks, while the values were always higher in cow's milk cheese. Cow's milk cheese had higher values for moisture, TN, SN and NPN and lower values for fat when compared with buffalo's milk cheese. The author mentioned that the average of calcium and phosphorus content of both cheeses decreased gradually as the pickling period advanced, while the Ca/ P ratio increased.

Table (1): Average composition (%) of milk used for making Domiati cheese (Sharara, 1959).

	Buffalo's milk	Cow's milk
Water	84.60	87.97
fat	5.80	3.63
Solids not-fat	9.60	8.40
Total nitrogen	0.593	0.473
Casein nitrogen	0.189	0.369
Protein nitrogen	0.571	0.453
Chloride in		
fresh milk	0.070	0.082
salted milk	4.152	4.010
Calcium	0.2254	0.1376
Phosphorus	0.1116	0.0532
Acidity	0.157	0.171

Sirry and Kosikowski (1959) added H₂O₂ to DC milk and reported that such treatment did not prevent development of the typical flavour

in cheese made from raw milk or from milk heated to 55°C for 20 sec., while HTST pasteurization produced a DC of fair body but

without flavour. The same authors made DC from pasteurized milk with adding 1% commercial lactic acid starter type and enterococci type. They found that the resultant cheese was firm and compact, but at the end of ripening period, the use of enterococci alone improved cheese quality.

Safwat *et al.* (1960) produced good quality DC from milk treated with antibiotics and renneted at 39°C. Whey drainage was undertaken at about 4°C and the curd was soaked at the same temperature in 20% brine for 24 hours.

Safwat *et al.* (1961) studied effect of adding some alkaline salts to DC milk of normal acidity and recorded pronounced increase in yield of cheese. The authors mentioned that some cheese makers used such salts to neutralize down the acid milk to proper level but such treatment may cause defect in the flavour of cheese.

Sharara in his studies in 1961 gave detailed composition of DC made from cow's and buffalo's milk when milk was raw or heated (**Sharara, 1961 a**). He (**Sharara, 1961 a, b**) mentioned that cheese made of milk salted at the rate of 10 Lb/100 Lb milk contained higher salt than that of milk salted at the rate of 7 Lb/100 Lb milk. On the other hand, he suggested a special technique for making DC from unsalted milk including pasteurization of cheese milk and renneting at 37°C.

Sharara (1962) found that pasteurization of DC milk (145°F/30 min) increased holding moisture, gave softer curd and retained more fat and this finding was also recorded when starter was used in making DC from raw or pasteurized milk. He also mentioned that cheese with added starter had higher acidity in both cases.

Hofi *et al.* (1963) noticed that the acidity of cheese fat (acid value) increased gradually

during pickling of DC made from buffalo's or cow's milk. Also, after 3 months of storage the values of total volatile fatty acids were 30.80 and 22.15 ml for the prementioned cheese samples in order.

Ibrahim (1963) in his Ph. D. from Cornell University on ripening of DM made from raw (A), plain pasteurized (B) and pasteurized milk with 1% added lactic starter (C) observed that the rate of acid development was the lowest in A followed by B. Cheese made from C showed the highest rate of acid development in the first 4 weeks followed by a slower rate. At the end of the storage (20 weeks) all treatments had almost the same acidities. In general, the author claimed that pickled white cheese could not be manufactured from pasteurized milk without the addition of suitable starters.

Abou-Dawood (1964) mentioned that the yield of DC was affected by milk type, while cheese ladled in moulds had higher yield than that moulded in frames. Storage of cheese at low temperature not only minimized the loss in yield but also increased cheese weight, however cheese made from 10% salted buffalo's milk had average value of 62.33% for moisture that decreased gradually to 58.45, 57.12, 56.05, 54.70 and 53.65% after 2, 4, 8, 12 and 18 weeks of storage respectively. The slope of decreases in salt was almost parallel to that of moisture, while TN was gradually decreased and fat increased during pickling and the rate was higher especially in TN in case of storage at room temperature than at 4°C. In general, the author mentioned that DC made from cow's milk had higher acidity and ripening degree than the buffalo's one at the same ripening period but all samples suffered

from weight loss during pickling with higher rate when cheese was stored at room temperature.

Table (2): Gross chemical composition (%), acidity (%) and pH of fresh Domiati cheese made from cow's or buffalo's milk.

Moisture	Fat	Fat/DM	Protein	Salt	Acidity	pH	References
Cow's milk							
59.00	18.00	43.90	—	4.50	—	—	Fahmi and Sharara (1950)
59.90	17.30	43.00	13.01	7.00	—	—	Sharara (1961 a)
70.07	11.53	38.73	7.66	5.26	0.53	—	Fahmi <i>et al.</i> (1973 b)
61.20	16.20	—	10.08	5.25	0.17	—	Ibrhim <i>et al.</i> (1974)
Buffalo's milk							
55.00	24.00	53.30	—	4.50	—	—	Fahmi and Sharara (1950)
62.10	22.50	59.40	7.92	—	—	—	Ismail and Onsy (1954)
57.30	20.90	48.90	11.93	6.90	—	—	Sharar (1961 a)
59.17	—	48.97	—	7.21	0.20	—	El-Safty (1969)
58.81	18.30	44.40	12.95	6.60	0.07	6.90	El-Shibiny <i>et al.</i> (1972)
66.89	15.02	43.37	7.91	5.67	0.41	—	Fahmi <i>et al.</i> (1973 b)
68.07	11.51	36.05	—	6.06	0.11	6.50	Khalafalla <i>et al.</i> (1973)
62.03	17.41	—	8.61	5.04	0.13	—	Ibrhim <i>et al.</i> (1974)

Table (3): Average composition of fresh and pickled Domiati cheese made from cow's or buffalo's milk (Percentages on dry matter basis) *.

	Cow's milk cheese			Buffalo's milk cheese		
	Fresh	4 mon.	8 mon.	Fresh	4 mon.	8 mon.
Moisture	60.00	55.53	52.24	55.76	53.16	50.81
Fat	40.83	47.53	49.15	48.01	54.39	55.15
Total N	5.68	5.65	5.33	4.33	4.255	4.058
SN/TN	19.56	19.90	22.52	11.09	14.01	16.05
Chlorine	7.98	6.44	5.77	7.30	4.685	4.55
Calcium	1.08	0.74	0.62	1.60	1.50	1.13
Phosphorus	0.88	0.50	0.43	0.875	0.815	0.74
Acidity	1.16	2.70	4.32	0.71	1.66	3.07

* Source: Sharara (1959).

Table (4): The yield (%), gross chemical composition (%), acidity (%) and pH of fresh and pickled (in parentheses) Domiati cheese as affected by the level of sodium chloride added to cheese milk.

	NaCl (%)							References
	0.0	5	7	8	10	12	15	
Yield	—	—	34.0 (23.39)	—	38.25 (29.02)	—	42.35 (32.21)	El-Koussy (1966)
Moisture	—	—	59.11 (53.88)	—	57.91 (57.60)	—	60.54 (55.59)	
Fat	—	—	17.16 (25.16)	—	16.88 (21.83)	—	14.08 (19.83)	
Fat/DM	—	—	41.79 (54.55)	—	40.16 (51.22)	—	33.69 (44.80)	
Total N.	—	—	2.037 (1.821)	—	1.978 (1.688)	—	1.714 (1.645)	
Soluble N.	—	—	0.168 (0.502)	—	0.143 (0.372)	—	0.123 (0.262)	
Salt	—	—	4.54 (4.07)	—	6.19 (5.63)	—	8.82 (7.57)	
Acidity	—	—	0.20 (2.56)	—	0.16 (1.94)	—	0.17 (1.73)	
pH	—	—	6.3 (3.73)	—	6.50 (4.00)	—	6.36 (4.12)	
Moisture	—	—	—	58.60 (51.40)	59.50 (52.20)	60.90 (54.50)	61.70 (55.80)	
Fat/DM	—	—	—	34.60 (49.70)	35.00 (48.20)	32.80 (48.70)	31.80 (45.50)	

Acidity	—	—	—	0.27 (2.24)	0.24 (2.02)	0.21 (1.42)	0.11 (1.00)	
Yield	16.33	20.28	—	—	23.18	—	—	Ibrahim <i>et al.</i> (1973)
Moisture	60.97	65.60	—	—	66.15	—	—	
Fat	19.57	14.36	—	—	11.96	—	—	
Total N.	2.18	1.61	—	—	1.40	—	—	
Acidity	1.37	0.15	—	—	0.12	—	—	
Yield (R)*	—	—	—	25.4 (16.71)	26.86 (16.89)	27.80 (18.52)	29.13 (20.74)	Zaki <i>et al.</i> (1974)
Yield (H)*	—	—	—	27.22 (15.65)	27.77 (17.48)	29.00 (18.48)	30.00 (18.89)	

*Yield (R) = Yield from raw milk.

*Yield (H) = Yield from heated milk (74°C).

Ibrahim (1965) used some alkaline salts (magnesium oxide, magnesium carbonate, calcium carbonate, calcium hydroxide, soda - lime, sodium carbonate and sodium bicarbonate) to neutralize acidity of high acid DM cheese. She mentioned that the used alkaline salts reduced acidity to 0.15% but had no effect on cheese yield and its quality. A slight harsh body was noticed in case of using calcium salts.

Naguib (1965) found that the predominant bacteria in market DC were *S. faecalis*, *S. cremoris*, *S. lactis*, *L. casei*, *L. plantarum*, *L. lactis* and *Leuconostoc cremoris*. Most of the tested samples were positive to coliform test and a few contained proteolytic and saccharolytic anaerobes.

Sholkami (1965) observed that the amount of fat lost in whey during DC making was proportional to the amount of salt added to cheese milk before renneting.

El-Koussy (1966) in her comprehensive study tried to modify the traditional method

of DC making by using pasteurized milk (74 and 85°C) instead of raw milk. She found that application of the traditional method was unsatisfactory with pasteurized milk. So, she recommended suitable quantity of rennet and calcium chloride should be used and application of suitable lading conditions. Comparing the results of making DC from pasteurized milk (A) with those of cheese from 7% salted raw milk (B) revealed that cheese from (B) was organoleptically better, while yield was higher in (A) with slightly slower acidity and pH development. The author also salted the pasteurized milk with levels of 7, 10 and 15% and used also sodium nitrate to overcome gassiness and sourness observed in pasteurized milk cheese. Her results revealed that no gassiness and sourness were detected in fresh cheese from the prementioned trials but after pickling at room temperature for 3 months, the best cheese was that made from 7% salted milk and pickled in extra 4% salted solution. Finally, the author modified

DC method to produce a white soft cheese similar to DC from unsalted milk aiming the resultant unsalted whey to be suitable for the industry. However, the detailed data and results of the prementioned study were published by **El-Koussy et al. (1970) (1974) (1975 a, b)**.

Factors affecting the yield and ripening of DC were studied by **Teama (1967)** and one can conclude the following from the study: (1) The cheese yield increased with increase in percentage of salt added to cheese milk and the storage of cheese at low temperature had a beneficial effect on decreasing loss of weight during pickling, (2) At low temperature, the cheese retained high moisture over a long period, (3) Fat hydrolysis was slow and greatly affected by salting and pickling temperature and (4) Protein N was gradually decreased during pickling with corresponding increase in soluble N and non-protein N and liberation of many amino acids after two months storage.

Abou-Dawood (1968) found that trypsin coagulated cheese showed higher values of moisture, salt (on dry basis), acidity, SN, NPN and amonical N than those of cheese made by rennet only. The degree of ripening was also higher, while the cheese made by trypsin gained higher scores for the sensorial properties.

Gewaily (1968) found that the higher was the amount of salt added to Domiati cheese milk (8.0 - 15.0%), the higher was the moisture content and the lower was the acidity value. This was true in case of fresh cheese and pickled cheese of 3 months old. The moisture decreased, whereas acidity

increased during pickling with different rates depending on salt content. This was accompanied by increase in FDM during pickling.

Naguib (1968) isolated the predominated organisms from good quality cheese and used the organisms in making DC from pasteurized milk containing 8% salt. Good quality DC was obtained by the use of 0.2 - 0.3% of *S. diacetylactis*, *S. faecium* var. *durans* and *S. faecalis*.

El-Safty (1969) in his M. Sc. Thesis used dried skim milk either to increase the solids of fluid milk or as the sole source of solids for making DC. Toning was carried out by adding 20, 30 and 40% of reconstituted milk (1: 9) to buffalo's milk. The results revealed that the higher was the ratio of casein / fat, the higher was the yield of cheese due to the higher moisture content. Acidity, total protein, soluble protein and soluble protein coefficient were higher and fat was lower in cheese as the toned milk was used. The technological results and scores were more satisfactory with 20% treatment. However, the detailed results and date of the thesis were given in the published papers by **Hamdy et al (1970 a, b)**, **Hofi et al. (1970 a, b)** and **Mahran et al. (1970)**.

Hamdy and El-Koussy (1969 a) studied the relationship between fat, casein and total solids of DC milk and the yield and found it increased by increasing their percentages in milk. They also (**Hamdy and El-Koussy, 1969 b**) found that addition of glycerol and sorbitol to the milk increased also the yield of DC.

Attia (1970) modified the salting step of DC by soaking the curd after drainage in brine instead of adding salt directly to milk.

Abdel-Kader (1971) used mixtures of reconstituted and buffalo's milk in making DC. He found that the best results were obtained with 100°F renneting temperature and 80 ml rennet / 100 kg of mixture 1:1 reconstituted and buffalo's milk. He recommended addition of 0.2% sodium citrate to improve cheese quality and pickling of cheese in whey containing 10% salt.

El-Magdoub (1971) found that the acidity during pickling of DC was always higher when cheese was prepared from H₂O₂ - catalase treated milk than that made from

pasteurized milk. They attributed such finding to higher population of lactic acid bacteria in the former treated milk.

Ismail and El-Hifnawi (1971) found that pasteurization of milk before making DC increased yield of fresh cheese from 20.5 to 21.5%, moisture from 63.1 to 64.5%, fat from 15.1 to 16.5% and pH from 6.22 to 6.35, but decreased acidity (SH value) from 8.5 to 6.2, free fatty acids from 1.6 to 1.45% and total volatile fatty acids from 11.29 to 10.25%.

Korshid and Rao (1971) mentioned that the use of protein hydrolyzates had favourable effect on both yield and quality of DC and improved its organoleptic characteristics.

Table (5): Impact of heating milk to 74 and 85°C on the yield, moisture content and body & texture of Domiate cheese ladled in frames or moulds (Average of 3 experiments) *.

Treatment	Milk	Yield (%)	Moisture (%)	Body and Texture
In frames				
A	Raw	30.90	60.84	Firm, Satisfactory.
B	Heated to 74°C	36.65	65.33	Moderately soft, less firm than A.
C	Heated to 85°C	46.68	71.70	Very weak, Easily broken
In moulds				
A	Raw	34.33	64.44	Satisfactory, firmer than B and C
B	Heated to 74°C	41.77	68.11	Soft but firmer than C
C	Heated to 85°C	33.57	68.14	Very weak curd, Most of it lost during ladling.

* Adapted from El-Koussy (1966).

Table (6): Changes in the concentration (mg/100g) of calcium and inorganic phosphorus during pickling of Domiate cheese made from homogenized and unhomogenized buffalo's milk *.

Storage period (days)	Homogenized		Unhomogenized	
	Ca	P	Ca	P
Fresh	358.9	197.0	376.1	184.6
15	343.5	171.0	352.3	178.0

30	340.0	162.0	343.4	161.3
60	342.3	158.3	352.2	170.0
90	347.6	144.0	361.7	154.0
120	369.1	157.0	378.3	166.0

* Source: El-Shibiny *et al.* (1972).

Table (7): Changes in the concentration (g/litre) of calcium and inorganic phosphorus in pickling solution of Domiati cheese made from homogenized and unhomogenized milk.

Storage period (days)	Homogenized		Unhomogenized		
	Ca	P	Ca	P	Ca
Fresh	0.87	0.32	0.70	0.30	0.64
15	1.80	0.72	1.91	0.83	1.94
30	1.99	0.80	2.24	0.80	2.33
60	2.46	0.94	2.55	0.99	2.79
90	2.65	1.03	2.65	0.97	2.64
120	2.47	1.03	2.69	1.07	—
References*	(a)	(a)	(a)	(a)	(b)

* References (a), Ahmed *et al.* (1972); (b), El-Shibiny *et al.* (1973 b).

Abd El-Salam and El-Shibiny (1972) found that α_s - Casein was extensively degraded in DC during pickling and the maximum production of amino acids was recorded after one month of storage.

Ahmed *et al.* (1972) reported that homogenization of DC milk at 500 Lb/sq. inch had little effect on cheese yield during pickling. The same authors in 1973 (Ahmed *et al.* 1973) found that cheese from the low reconstitution percentage of milk had much less lactose content than that reported for DC.

Naguib (1972) reported that DC made from milk treated with H₂O₂ had firm, soft texture and desirable typical flavour.

Youssef (1972) reported in his American Patent that non of the white pickled cheeses made from uncultured pasteurized milk developed characteristics

flavour of DC or Feta cheese even after 4 weeks of ripening.

Abdel-Baki (1973) studied flavour components of white soft cheese and found that for example total volatile fatty acids increased until the third month of storage and slightly decreased by the end of storage period.

Abd El-Salam and El-Shibiny (1973 a) mentioned that the internal structure of DC was greatly changed during pickling. In fresh cheese, caseinate formed large aggregates and changed to a loose structure of fine particles in the pickled cheese. The same authors (Abd El-Salam and El-Shibiny, 1973 b) found that the addition of phosphate enhanced protein breakdown in DC.

Abd El-Salam *et al.* (1973) after carrying out some determinations in assessment of DC ripening mentioned that

of all the possible indices of extent of DC ripening, the formol index was the best.

El-Atawy (1973) found that when DC milk was standardized to contain 4.0, 5.0 and 6.0% fat, the resultant fresh cheese contained values of 62.25, 61.08 and 60.68% for moisture, 2.32, 2.18 and 2.08% for TN and 0.28, 0.24 and 0.21% for acidity respectively. The corresponding moisture values at the end of 90 days of storage were 56.04, 55.61 and 55.12% in order.

El-Shibiny *et al.* (1973 a) made DC from pasteurized milk without (A) and with adding whey proteins (B). The yield in (B) was higher than (A) and the weight losses during pickling was less. The chemical composition and the organoleptic properties were almost the same.

El-Shibiny *et al.* (1973 b) used buffer salts to improve yield of DC and to minimize weight losses during cheese pickling, but non of the used salts had significant effect in this respect.

Fahmi *et al.* (1973 a) found that increasing the amount of rennet speeded up milk coagulation and decreased the yield and moisture content of DC, but increased FDM. They also mentioned that the increase in renneting temperature increased cheese yield and decreased FDM. The same authors (**Fahmi *et al.* 1973 b**) mentioned that DC could be made from 7% salted pasteurized milk with acidity of 0.26% in cow's milk and at 0.30 - 0.35% acidity of buffalo's milk.

Hofi *et al.* (1973) mentioned that pickling period of DC was reduced to 2 weeks by treating cheese milk with casein acid hydrolysate, to 4 weeks by using whey protein acid hydrolysate and to 8 weeks by

using casein or whey protein tryptic hydrolysate.

Ibrahim *et al.* (1973) salted DC milk by adding 5, 7.5, 10 and 12.5% salt before the heat treatment applied. The cheese yield increased by increasing salt addition, while fat, TN and acidity decreased. Moisture content increased only with 5% salt.

Khalafalla *et al.* (1973) found that DC made from pasteurized milk (145°F/30 min.) was higher in moisture, salt and SN/TN than cheese made from H₂O₂-catalase treatment (0.02%), but contained lower fat, acidity, TVFA and formol nitrogen. Cheese produced with H₂O₂ was organoleptically better than that made from pasteurized milk.

El-Dairy (1974) found that homogenization of DC milk at 500Lb/sq. inch had a negligible effect on pickled cheese yield in spite of some increase was recorded on moisture contents of fresh cheese. However, homogenization increased the weight losses during pickling.

El-Erian *et al.* (1974) found that market DC had ranges of 3.80 - 6.45 for pH, 48.30–60.25% for moisture, 20.55 - 26.00% for fat, 4.8- 11.20% for salt and 13.40 – 36.9% for SN/TN, whereas amino acids content varied from sample to sample.

El-Shibiny and Abd El-Salam (1974) mentioned that better separation of proteins of pickled DC was obtained by chromatography on DEAE -cellulose than on Sephadex G100 and G200. DEAE -cellulose chromatography was successful to

follow changes in DC proteins during pickling.

Naguib *et al.* (1974 a) recommended the use of 72°C for 15 sec. rather than 85°C for 15 sec. for pasteurization of DC milk. The resultant cheese contained higher moisture, lactose, pH, salt and TN than the raw milk cheese which showed higher rates of acidity development and proteolysis with lower bacteriological quality. The same authors (**Naguib *et al.* 1974 b**) mentioned that in case of using lactic starters and pasteurized milk in making DC, salting of milk should be within the rate of 8%.

Zaki *et al.* (1974) salted raw and heated cheese milk at levels of 8, 10, 12, 15 and 20%. They mentioned that 15% salted raw milk gave the best quality DC during storage at room temperature for 24 weeks followed by 12% salt treatment, while 20% salt caused the least loss in cheese weight during pickling. Heated milk of 12% salt gave the highest scores for flavour and body & texture, whereas 20 and 15% salt treatments caused the minimum loss in cheese weight during pickling but such cheese was organoleptically rejected.

El-Abd *et al.* (1975) prepared media containing whey and brine for pickling of DC for 2 months. Their results revealed rapid disappear of lactose from the media containing 50% or more whey and increase in the brine and the media containing less than 50% whey. Organoleptically, cheeses pickled in whey-free medium or that containing 25% whey were the best.

Hofi *et al.* (1975) analyzed 30 samples of market DC and found that the

best samples had higher values for acidity, soluble N, SN/TN, TVFA and ripening indices.

Ibrahim *et al.* (1975) used standardized cow's milk of 3.1, 4.1, 5.3 and 6.3% fat content and 7.5% salt content in making DC. They found that for every 1% fat increase, cheese yield and cheese fat increased by 1.7 to 2.4% and 2.7 to 3.0% respectively, while moisture decreased by 1.6 to 2.0%.

Nofal and Abou-Dawood (1975) mentioned that adding trypsin milk protein hydrolysate to DC milk improved quality of cheese and accelerated its pickling.

Shehata *et al.* (1975) studied distribution of lactic acid bacteria in DC made from H₂O₂ - treated milk and from pasteurized milk. They found that *lactobacilli* species were found in both cheeses throughout the pickling period while *streptococci* species disappeared after 30 days.

Tawab *et al.* (1975) found that the changes in acidity and pH were parallel to lactose changes during DC pickling, whereas the higher loss in lactose being about 54% for raw cheese and 40% for heated cheese took place during the first 2 weeks of storage. About 10 - 12% of the original lactose were found in cheese pickled for 6 months.

Abd El-Salam *et al.* (1976) published the first review article on DC and mentioned that this cheese is a very suitable variety for manufacture in Egypt because the bacteriological quality of the milk is usually poor and the addition of salt to the fresh raw

milk inhibits bacterial growth to a considerable extent. The earlier studies done on microbiological quality of market Domiati cheese were reviewed by the prementioned authors who revealed presence of coliforms in market samples tested by **El-Sadek and Eissa (1957)**, presence of *streptococci* in 19% of the samples tested by **Ghoneim (1963)** and presence of some species that were predominant in cheese examine by **Naguib (1965)** including *S. faecalis*, *S. cremoris*, *S. lactis*, *L. casei*, *L. plantarum*, *L. lactis* and *Leuconostoc cremris*, but most of the tested samples gave a positive coliform test. *Staphylococci* detected by **Mahmoud (1969)** were found to be stimulated in the presence of salt up to 5%, but higher salt content retarded their growth.

Hofi et al. (1976) made DC from a mixture of buffalo's and soy milk (4:1) and found that the yield of cheese from the mixture was 28.09% and that from buffalo's milk was 31.0%, while the corresponding values of loss in weight after 3 months of pickling were 31.0 and 39.5% in order. The quality of cheese from the mixture was less than the control cheese, whereas the changes in composition during pickling were almost the same.

Farag and Moneib (1977) made DC from homogenized milk (cow's and buffalo's) of different homogenization pressure (1000- 4000 Lb/sq. in.) and found that the yield and the moisture content of the fresh cheese increased with increasing homogenization pressure, whereas renneting time and fat content decreased. After pickling, the homogenized cheese

retained higher yield with lower losses in cheese weight than unhomogenized cheese.

Ghaleb (1977) in his comprehensive studies on DC tried to minimize the loss in cheese weight during pickling by applying different treatments on cheese milk or pickling whey. He (**Ghaleb, 1977 a**) treated milk with glutamate, glycerol or sorbitol and mentioned that sorbitol treatment had the highest yield and the lowest weight loss. **Ghaleb (1977 b)** used pectin, gelatin and agar and found that the used stabilizers agreed in increasing the yield of cheese especially pectin but pectin was prosperous in minimizing the loss during cheese pickling. **Ghaleb (1977 c)** found that adding H_2O_2 increased the yield of fresh cheese. The use of pectin and H_2O_2 was more effective in this respect (**Ghaleb, 1977 d**). Concerning treatments of pickling whey, **Ghaleb (1977 e)** used agar, cremodan, gelatin, pectin or starch and studied also impact of increasing salt in the pickling whey from 10 to 20% and found that salt treatments especially 20% one succeeded in improving loss in weight reasonably, while other treatments failed in this respect. On the other hand, **Ghaleb (1977, f)** standardized cheese milk to 8.5% SNF and 4.4% fat (T_1) and to 10% SNF and 5.2% fat (T_2) and found that T_2 produced more convenient coagulum, more yield and better cheese quality.

Rasheed and Alami (1977) found that the yield of DC made from Jersey milk was higher than that of cheese made from milk of Swiss breeds.

Finally, it may be of benefit to reveal that some studies were done to improve quality of DC or prolong its shelf life by means of some preservatives such as H₂O₂ (Sirry and Kosikowisk, 1959; El-Magdoub 1971; Naguib, 1972; Ghaleb, 1977 c) and formalin and or formaldehyde at very low level (Rakshy and Hassan, 1971 b, c; El-Shibiny *et al.* 1972; Nofal *et al.* 1974). Some other studies used calf rennet substitutes in making DC to overcome its shortage in Egypt (Hamdy, 1970 and 1972;

Abdou *et al.* 1976; Amer *et at.* 1977; EL-Koussy *et al.* 1977).

On the other hand, from the economic point of view some studies replaced milk fat with vegetable oils to make filled soft cheese resemble to Domiati cheese (Hofi *et al.* 1963; Abdel-Kader, 1971; Abd El-Salam *et al.* 1973; Hefny, 1975; El- Morshidy, 1976; El-Kenawi, 1977) but unfortunately this trend is continued and applied with great and huge extend in the industry until now.

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ذاكرة البحوث عن الجبن الدمياطى
(1947 – 1977م)
مهدها إلى روح أستاذى العالم الجليل
أ.د / محمد الحسينى عبد السلام

إحقاقاً لحق وفضل أساتذتى وزملائى الأوائى فضلت كتابة هذا المقال عن دراساتهم القيمه عن الجبن الدمياطى وفى الحقيقه لم يكن دورى مجرد تجميع مادة علمية أو مجرد كتابة مقال علمى ولكن إعاده عرض دراساتهم وبحوثهم فى صورة مختصرة مرتبة ترتيباً زمنياً إبرازاً لإسم الباحث وليس مجرد عرض الدراسات تحت عناوين جانبية كما جرت العاده عند كتابه المقال العلمى المرجعى

Review Article مع إهداء هذا العمل المتواضع إلى روح أستاذى الجليل المرحوم بإذن الله تعالى أ.د/ محمد الحسينى عبد السلام الذى كان له السبق مع آخرين (أ.د/ صافيناز الشيبينى ، أ.د/ على حسن فهمى) فى نشر أول مقالة علمية عن الجبن الدمياطى فى إحدى الدوريات العالمية عام 1976

(New Zealand J. Dairy Sci. Technol., 11: 57 – 61) وعلى ضوء هذه المقالة كتبت هذا العمل المرجعى محاولاً ذكر أكبر عدد ممكن من أسماء أساتذتى وزملائى الأوائى حتى يتمكن الزملاء وشباب الباحثين من الرجوع إلى هذه الدراسات القيمة للإستفادة العلمية داعياً المولى سبحانه وتعالى أن يتغمد من فقدناه من أساتذتى وزملائى الأوائى بواسع رحمته وأن يتمتع من بقى على قيد الحياه بموفور الصحه (اللهم امين ... امين).