

MANUFACTURE OF DOMIATI CHEESE FROM RECONSTITUTED SKIM MILK AND DIFFERENT TYPES OF CREAM

BY

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SUMMARY

Domiate cheese was made from mixed buffalo's and cow's milks (5% fat) as control and reconstituted skim milk (RSM) mixed with cream from buffalo's, cow's, goat's milks and with whey cream. Cheese from different treatments were stored in pickle at $10\pm 2^{\circ}\text{C}$ for 90 days and analyzed after 15 and 30 days and then at monthly intervals. Mixed RSM and goat's milk cream showed the highest rennet coagulation time, control milk the highest curd tension whereas mixed RSM and whey cream showed the highest syneresis compared to other treatments. Fresh Domiate cheese from mixed RSM and whey cream had the highest titratable acidity and fat content and lowest pH compared to other treatments. On the other hand, cheese from mixed RSM and cow's milk cream showed the highest yield compared to other treatments. The total solids, fat, total nitrogen and water soluble nitrogen contents of Domiate cheese from mixed RSM and goat's milk cream were higher than that of other treatments. Domiate cheese from RSM and all types of cream had highest TVFA than the control. The cheese made from mixed buffalo's and cow's milk (control) and mixed RSM and buffalo's milk cream gained higher scores than cheese from other treatments.

Key words: Domiate cheese- buffalo's milk, cow's milk, goat's milk, reconstituted skim milk, cream, rennet coagulation time, curd tension, syneresis, cheese yield.

INTRODUCTION

Cheese varieties matured in brine are the most popular cheeses in the Middle East. This group includes the Feta, Teleme, Salamora and Domiate cheese (Robinson and Tamime 1991). The latter is the most popular cheese variety made in Egypt (Rakshy and Attia 1979). It is made from milk salted with 5-14% NaCl, to control the harmful indigenous microflora in raw milk.

Using skim milk powder and cream, butter or butter oil, it is possible to recombine these ingredients to produce several varieties of milk products such as Domiate cheese. In Egypt, production of milk is seasonal as it increases in winter and decreases in summer.

The aim of the present work was to study the effect of making of Domiate

cheese from reconstituted skim milk and buffalo's, cow's, goat's milk creams or

whely cream on its rheological, chemical and organoleptic properties.

MATERIALS AND METHODS

Materials:

Cow's and goat's milks and Ras cheese whey were obtained from El-Serw Animal Production Research Station, Animal Production Research Institute, Ministry of Agric., whereas buffalo's milk was supplied by private farm in Dakahlia Governorate. Buffalo's, cow's and goat's milk and whey were warmed to 40°C, separated with cream separator (α -Laval, Sweden). Fresh cream preparations were used in Domiati cheese manufacture. Skim milk powder (France) was obtained from private cheese factory in Dakahlia Governorate.

Liquid calf rennet was obtained from local market and was added to milk at a ratio of 1 mL kg⁻¹ milk. Dry coarse commercial food grade salt was obtained from El-Nasr Company of Alexandria. Calcium chloride and all chemicals were of laboratory grade.

Domiati cheese manufacture:

Domiati cheese was made from mixed buffalo's and cow's milks (5% fat) as described by Fahmi and Sharara (1950).

Skim milk powder was thoroughly dispersed in water to give 10% total solids in the reconstituted milk, heated to 40°C, held for about 20 min to allow hydration of the powder and then

heated to 60°C for 5 min. Aliquots of buffalo's, cow's and goat's milk creams or whey cream were mixed with reconstituted skim milk (RSM) in order to give 5% fat in the obtained recombined milk.

Fresh and recombined milks were pasteurized at 63°C/30min, 0.05% CaCl₂ and 6% NaCl were added. Salted milks were used for manufacture of Domiati cheese as follow:

Treatment A: Mixed buffalo's and cow's milk (1:1) (control).

Treatment B: Reconstituted skim milk and buffalo's milk cream (10% SNF + 5% fat).

Treatment C: Reconstituted skim milk and cow's milk cream (10% SNF + 5% fat).

Treatment D: Reconstituted skim milk and goat's milk cream (10% SNF + 5% fat).

Treatment E: Reconstituted skim milk and whey cream (10% SNF + 5% fat).

(The chemical composition of used milks is recorded in Table 1).

The resultant cheese of all treatments were weighed and pickled into their own whey, and stored in plastic jars at 10°C ± 3 for 3 months. Samples were analyzed when fresh and after 15, 30, 60 and 90 days of ripening period.

Table (1): Chemical composition of milk used in Domiati cheese manufacture.

Type of milk	Acidity	pH	T.S. %	Fat %	TP%
Buffaloe's milk+cow's milk (50%+50%) A	0.15	6.68	14.75	5.1	3.71
Treatment B	017	6.61	16.08	5.0	3.89
Treatment C	017	6.60	15.78	5.1	3.90
Treatment D	016	6.62	15.21	5.1	3.86
Treatment E	018	6.60	15.19	5.0	3.95

Methods of Analysis:

Milk samples were analysed for titratable acidity (TA), total solids (TS), fat and total protein contents according to Ling (1963). The pH values were determined using a pH meter type CG 710. The curd tension was determined using the method of Chandrasekhara *et al.*, (1957). The rennet coagulation time (RCT) was determined according to Davies and White (1958) whereas the curd syneresis was measured as given by Mehanna and Mehanna (1989). Titratable acidity (TA), and fat values of cheese whey were estimated according to Ling (1963). Cheese was analysed for total solids (TS), titratable acidity (TA), pH, fat, total nitrogen (TN), water soluble nitrogen (WSN) and ash contents according to Ling (1963). Salt contents of Domiati cheese were estimated using Volhard method according to Richardson (1985). Total volatile fatty acids (TVFA) was determined as described by Kosikowski (1978), and expressed as ml of 0.1N NaOH, 100 g⁻¹ cheese. Milk fat was extracted from fresh cream using chloroform-methanol (2:1v/v), methyl esters were prepared, and the fatty acids composition was determined according to Radwam (1978). The methyl esters of the fatty acids were analysed using GLC Pye Unicam Gas-Liquid Chromatograph

equipped with a flame ionization detector and fitted with glass column (15m x 4mm) packed with 10% of poly ethylene glycoliadepate (PEGA) supported on an alkali-acid washed and silanized Diatomite C (100-120 mesh). The gas chromatographic conditions used for the analysis were temperature programmed from 60-190°C at the rate of 8°C/min., with a nitrogen flow rate of 30 l/min., hydrogen 33 l/min. and air 330 l/min. Also, the detector temperature was 220°C. The peak areas were measured using an integrator. Identification and percent composition of the fatty acids were determined by the reference to a standard known composition. The cheese samples were scored for flavour (50 points), body and texture (35 points) and appearance and colour (15 points) by ten panelists in El-Serw Animal Production Research Station.

The obtained results were statistically analysed using a software package (SAS, 1991) based on analysis of variance. When F-test was significant, least significant difference (LSD) was calculated according to Duncan (1955) for the comparison between means. The data presented, in the Tables, are the mean (\pm standard deviation) of 3 experiments.

RESULTS AND DISCUSSION

Some rheological properties of cheese milk:

The average rennet coagulation time (RCT) of treatments D and A were higher than that of other treatments (Table 2). Also, the highest curd tension values (39.48 gm) was found with control treatment (A) followed by treatment containing buffalo's milk cream treatment (29.12 gm) whereas the lowest value was in recombined milk containing whey cream i.e. 20.41 gm.

Results in table (2) show that as time of syneresis increased, separated whey increased. The higher curd syneresis values were obtained with recombined milk according to the following order: whey cream (E) > cow's milk cream (C) > goat's milk cream (D) > buffalo's milk cream (B) > control (A). Ismail (1997) reported that coagulation time and syneresis were higher but curd tension was lower in cow milk as compared with that of buffalo milk

Statistical analysis of variance (Table 8) showed that the differences in RCT, curd tension and syneresis between treatments were highly significant ($p < 0.001$).

Chemical composition of cheese whey:

Table (3) show that cheese from treatment A (control) had the lowest and that from treatment E (cheese with whey cream) had the highest acidity than that of other treatments when fresh and during storage. pH values had an opposite trend of acidity. On the other hand, the fat content of cheese whey from treatment E was higher than that from other treatments.

As a general, the titratable acidity values and fat content of cheese whey from different treatments increased significantly ($p < 0.001$) whereas pH values decreased significantly ($p < 0.001$) during storage period. Similar results were found by Ammar (1999).

Yield and Chemical composition of Domiati cheese:

Utilization of RSM and cow's milk cream in Domiati cheese manufacture was found to increase the fresh and pickled cheese yield throughout the storage time (Table 4) which may be attributed to increased moisture retention. The yield of control and experimental cheeses decreased gradually as storage period progressed. These results coincided with those of Abdel-Kader (2003). The differences in the yield between treatments as well as the effect of storage time (Table 8) were highly significant ($p < 0.001$).

From Table (4), it is observed that the acidity values of Domiati cheese made using RSM and various types of cream were higher than that of the control. These results confirmed with the results of whey acidity (Table 3). During storage, the titratable acidity of cheese from different treatments increased significantly ($p < 0.001$) as storage period progressed, while the pH values of all samples decreased significantly ($p < 0.001$). The changes in the acidity of the different cheeses followed the pattern for acidity in pickled cheese (Abd El-Salam *et al* 1981 and El-Safty *et al* 2004)

Table (2): RCT, curd tension and curd syneresis of milk used in Domiati cheese manufacture.

Treatments	RCT (sec.)	Curd tension (gm)	Curd syneresis (gm/15 gm of curd)*			
			Time			
			10	30	60	120
Treatment (A)	294	39.48	2.91	4.83	5.73	6.80
Treatment (B)	233	29.12	3.16	5.66	6.78	7.54
Treatment (C)	254	26.80	3.42	6.01	7.41	8.11
Treatment (D)	297	28.35	3.31	5.87	7.13	8.04
Treatment (E)	229	20.41	3.95	6.48	7.89	8.93

*Whey excluded (grams) from 15 gm of curd kept at room temperature after 10, 30, 60 and 120min.

Analysis of fresh cheese and during storage period indicated higher total solids, fat and TN contents in treatments D and A and lowest in treatment E. During storage period, the TS, fat and TN contents of all cheese samples increased till 30 days, thenafter the slight decrease was found until the end of pickling period (Table 4). Similar trend was observed by El-Abd *et al* (2003)

Results in Table (8) indicated that the differences in TS, fat and TN values between treatments were highly significant ($p < 0.001$)

The ash and salt contents were not significantly different between Domiati cheese from different treatments (Table 4 and 8) Ash and salt contents of various treatments increased gradually during storage period.

Ripening indices of Domiati cheese:

Data in Table (5) revealed that treatments D and A had higher WSN and WSN/TN values than those of other treatments Values of WSN and WSN/TN of cheese from all treatments increased gradually during storage period, indicating continuous degradation of cheese protein

Table (5) shows that the total volatile fatty acids (TVFA) of cheese from treatments C and D were higher than that other treatments. TVFA contents of cheese samples gradually increased during storage period. Similar results were found by Salama (2004).

Analysis of variance (Table 8) showed that the differences in WSN, WSN/TN and TVFA values between treatments and the effect of storage time were highly significant ($p < 0.001$).

Fatty acids of cheese fat:

Results of fatty acids of fresh Domiati cheese and after 90 days of storage period were shown in Table (8).

Saturated fatty acids (SFA) contents were higher than unsaturated fatty acids (USFA) for all fresh and 90 days old cheese Cheese from, B and C treatments had 73.03 and 70.00% SFA respectively, while USFA were 27.01 and 29.89%at 90 days respectively On the other hand, SFA contents increased as the storage period advanced. The rate of increase was higher in cheese from treatment B (7.35%) followed by that from treatment D (6.02%)

Table (3): Chemical composition of whey of Domiati cheese made from reconstituted milk powder and different types of cream.

Treatments	Storage period (days)	Titrateable acidity %	pH	Fat %
A (control)	Fresh	0.20	6.61	0.5
	15	0.68	5.60	0.4
	30	0.85	5.12	0.5
	60	1.17	4.94	0.6
	90	1.36	4.85	0.6
B (buffaloe'smilk cream)	Fresh	0.26	6.40	0.4
	15	0.87	5.20	0.4
	30	1.24	4.89	0.4
	60	1.31	4.82	0.5
	90	1.43	4.73	0.6
C (cow'smilk cream)	Fresh	0.25	6.45	0.3
	15	0.80	5.31	0.4
	30	1.21	5.09	0.4
	60	1.33	4.81	0.4
	90	1.41	4.73	0.5
D (goat'smilk cream)	Fresh	0.26	6.38	0.5
	15	0.88	5.21	0.5
	30	1.25	4.87	0.6
	60	1.39	4.78	0.7
	90	1.50	4.69	0.7
E (whey cream)	Fresh	0.31	6.30	0.6
	15	0.92	5.08	0.6
	30	1.35	4.84	0.8
	60	1.58	4.70	0.8
	90	1.70	4.59	0.9

Fresh Domiati cheese from treatments A and E had higher SFA contents than other treatments, while cheese from treatment C had higher USFA. After 90 days of storage in pickle, changes in SFA and USFA were occurred. Cheese from treatments B and E had the highest SFA contents while that from treatment C had the highest value of USFA.

The volatile free fatty acids (C2 - C5) except butyric acid (C4) were not detected in fresh and 90 days old cheese. Butyric acid was detected in C treatment after 90 days. The absence of these acids may be due to consumed them by some organisms in the cheese (Kosikowski, 1978 and Foster *et al.*, 1983) or to transformation of them to another fatty acids

Table (4): Yield and chemical composition of Domiati cheese made from reconstituted milk powder and different types of cream.

Treatments	Storage period (days)	Yield* %	Titratable acidity %	pH	TS%	Fat %	TN%	Ash%	Salt%
A (control)	Fresh	26.69	0.41	6.55	39.88	20.3	2.29	5.44	3.95
	15	24.22	0.79	6.01	41.38	20.9	2.40	5.60	4.11
	30	22.02	1.09	5.62	42.81	21.2	2.47	5.67	4.25
	60	22.64	1.53	5.16	41.57	21.2	2.40	5.73	4.41
	90	23.99	1.81	4.91	40.70	20.8	2.35	5.80	4.52
B (buffaloe 'smilk cream)	Fresh	27.00	0.73	6.31	38.48	19.9	2.25	5.57	4.06
	15	25.40	1.43	5.49	39.94	20.5	2.34	5.73	4.22
	30	23.39	1.80	5.03	40.95	21.0	2.40	5.78	4.27
	60	23.50	1.93	4.72	40.16	20.8	2.36	5.82	4.40
	90	23.63	2.06	4.47	39.53	20.4	2.33	5.85	4.53
C (cow'smi lk cream)	Fresh	28.05	0.60	6.42	37.22	18.4	2.20	5.60	4.12
	15	26.82	1.39	5.56	39.01	19.1	2.32	5.78	4.25
	30	25.73	1.65	5.11	40.11	19.6	2.37	5.81	4.30
	60	25.90	1.85	4.83	39.31	19.2	2.34	5.84	4.41
	90	25.18	1.94	4.56	38.89	19.0	2.30	5.88	4.50
D (goat'sm ilk cream)	Fresh	26.09	0.77	6.27	40.03	20.3	2.30	5.50	4.10
	15	24.11	1.47	5.41	41.97	21.0	2.43	5.67	4.21
	30	23.61	1.87	4.77	42.30	21.2	2.48	5.74	4.26
	60	23.80	1.96	4.58	41.29	21.1	2.42	5.77	4.39
	90	23.97	2.11	4.40	40.56	20.7	2.38	5.81	4.53
E (whey cream)	Fresh	25.09	0.78	6.24	36.08	16.9	2.21	5.61	4.15
	15	23.91	1.46	5.45	38.13	17.4	2.29	5.78	4.26
	30	22.59	1.89	4.73	39.09	17.9	2.34	5.84	4.31
	60	22.91	1.98	4.56	38.44	17.5	2.30	5.88	4.43
	90	22.93	2.10	4.40	38.01	17.3	2.27	5.91	4.54

*yield= wight of cheese/ wight of milk x 100

As it is expected, the concentrations of caproic, caprylic, capric and lauric acids (short chain fatty acids) were higher in cheese from treatment D than that of other treatments. Capric acid concentration was the highest of short chain fatty acids of fresh cheese from treatment D and after 90 days of storage,

whereas lauric acid was the highest in other treatments. Riel (1985) reported that goat's milk was richer in fat, smaller in fat globules size and higher in short chain fatty acids than those of cow's milk. Mohamed (1996) stated that goat's milk contained short chain fatty acids higher than cow's and buffalo's milk.

Manufacture of Domiati cheese from RSM and whey cream raised its myristic acid content. Palmitic acid was the corresponding one of SFA in different cheese treatments at fresh or 90 days. Level of palmitic acid was higher in fresh cheese of treatment A (control) but higher after 90 days in cheese from treatment B. Different samples had nearly the same stearic acid content when fresh while after 90 days stearic acid content increased in cheese from treatment C and decreased in that from treatments B and D.

Oleic acid was the predominant fatty acid of USFA in various cheese treatments during pickling stage and its concentration was higher in treatment C compared to other treatments.

Organoleptic properties of Domiati cheese:

Table (7) shows the organoleptic evaluation of various treatments of resultant cheese. As ripening advanced, the flavour, body & texture, colour and appearance of cheese were improved.

Table (5): Some ripening indices of Domiati cheese made from mixed RSM and different types of cream.

Treatments	Storage period (days)	WSN %	WSN/TN %	TVFA *
A (control)	Fresh	0.17	7.42	3.8
	15	0.33	13.75	5.6
	30	0.50	20.24	8.2
	60	0.67	27.92	13.4
	90	0.80	34.04	18.8
B (buffaloe's milk cream)	Fresh	0.17	7.55	4.8
	15	0.30	12.82	6.8
	30	0.46	19.17	10.0
	60	0.62	26.27	14.8
	90	0.76	32.62	19.2
C (cow's milk cream)	Fresh	0.16	7.27	5.2
	15	0.28	12.07	7.4
	30	0.43	18.14	11.2
	60	0.62	26.50	15.6
	90	0.75	32.61	20.0
D (goat's milk cream)	Fresh	0.18	7.83	4.8
	15	0.33	13.58	7.0
	30	0.52	20.97	10.4
	60	0.70	28.92	15.0
	90	0.82	34.45	19.8
E (whey cream)	Fresh	0.15	6.79	4.6
	15	0.26	11.35	6.0
	30	0.43	18.38	9.8
	60	0.59	25.65	14.2
	90	0.72	31.72	19.2

*expressed as ml 0.1N NaOH 100 g⁻¹ cheese.

In fresh Domiati cheese and after 90 days of storage period, cheese from treatments A (control) and B gained higher total scores as compared to other treatments. Scores of appearance and colour of cheese from treatments A,B and

D were almost the same and higher than that of treatment of C and E. This may be due to the yellowish colour of cheese for this treatments which not favorable in Domiati cheese for Egyptian consumers.

Table (6): GLC composition of free fatty acids (F.F.A.) contents (as percent of total fat) in Domiati cheese as affected by type of cream.

Fatty acids	C	Treatments				
		Zero time				
		A	B	C	D	E
Saturated						
Bytyric	C4:0	-	-	-	-	-
caproic	C6:0	1.04	1.462	1.58	1.55	1.51
Caprylic	C8:0	0.73	0.88	1.12	2.21	1.95
Capric	C10:0	1.86	1.94	2.93	8.04	3.66
Lauric	C12:0	2.27	2.345	3.42	3.93	3.82
Myristic	C14:0	12.34	11.53	11.34	9.28	12.99
	Iso 14			0.14		
Pentadecanoic	C15:0	1.67	1.70	1.16	0.71	1.12
Palmitic	C16:0	37.74	31.45	28.38	28.62	31.90
	Iso 16		1.79	1.50		
	17	0.86	0.79	0.70	0.50	0.58
Stearic	C18	12.99	13.51	13.83	12.86	13.27
Total		71.50	68.03	66.10	67.70	70.96
Unsaturated						
Myristeic	C14:1	1.27	1.12	0.95	0.46	1.04
Palmitoleic	C16:1	1.38	1.18	1.36	0.97	1.54
Oleic	C18:1	25.60	29.91	31.60	30.87	26.65
Total		28.26	32.22	33.90	32.30	29.23
		90 days				
Saturated						
Bytyric	C4:0	-	-	3.40	-	-
caproic	C6:0	1.154	1.53	2.07	2.37	2.27
Caprylic	C8:0	0.737	0.95	1.05	3.02	1.86
Capric	C10:0	1.765	1.91	2.54	9.78	4.35
Lauric	C12:0	2.217	2.42	2.96	4.61	4.57
Myristic	C14:0	11.758	12.78	10.38	11.62	13.80
	Iso 14	0.278				0.17
	C15:0	1.629	1.97	0.87	0.97	1.14
Pentadecanoic	C16:0	37.672	41.64	30.79	30.78	32.11
Palmitic	Iso 16					
	17	1.042	0.95		0.64	0.45
Stearic	C18	13.691	8.88	15.35	7.98	13.04
Total		71.943	73.03	69.99	71.77	73.76
Unsaturated						
Myristeic	C14:1	1.438	1.20	0.51	0.71	0.95
Palmitoleic	C16:1	1.579	1.42	0.52	1.19	0.85
Oleic	C18:1	25.039	24.39	28.86	26.32	24.44
Total		28.056	27.01	29.89	28.23	26.24

From Table (7) it is clear that cheese from various treatments gained nearly the same scores of body and texture except treatment E which get lower scores for body and texture.

However, cheese from treatment D had higher scores than that from treatment E for appearance, colour, body

and texture but low score for flavour. This may be attributed to goaty flavour which is not accepted by most Egyptians.

From the foregoing one can conclude that Domiati cheese could be made using mixture of reconstituted skim milk and buffalo's, cow's or goat's milk creams specially buffalo's milk cream.

Table (7): Organoleptic properties of Domiati cheese made from RSM and different types of cream.

Treatments	Storage period (days)	Appearance & Colour (15)	Body & Texture (35)	Flavour (50)	Total score (100)
A (control)	0	10	26	39	75
	15	10	29	41	80
	30	12	30	44	86
	60	13	31	45	89
	90	13	33	45	91
B (buffaloe's milk cream)	0	9	24	38	71
	15	10	29	38	77
	30	12	30	42	84
	60	12	30	44	86
	90	13	33	44	90
C (cow's milk cream)	0	7	23	37	67
	15	8	27	38	73
	30	11	29	40	80
	60	11	30	43	84
	90	11	31	42	84
D (goat's milk cream)	0	9	23	35	67
	15	9	28	36	73
	30	11	29	40	80
	60	12	30	40	82
	90	12	31	40	83
E (whey cream)	0	7	20	36	63
	15	7	21	37	65
	30	8	23	40	71
	60	8	27	40	75
	90	9	28	40	77

Table (8): Statistical analysis of Domiati cheese treatments.

Analysis	Effect of cheese treatments					
	A	B	C	D	E	LSD
Whey acidity	0.844 ^d	1.020 ^c	1.002 ^c	1.055 ^b	1.173 ^a	0.033 ⁸⁸⁸
Whey pH	5.42 ^a	5.21 ^c	5.28 ^b	5.19 ^c	5.10 ^d	0.032 ⁸⁸⁸
Whey fat	0.42 ^d	0.49 ^c	0.51 ^c	0.63 ^b	0.74 ^a	0.034 ⁸⁸⁸
Yield	23.91 ^{cd}	24.79 ^b	26.34 ^a	24.31 ^{bc}	23.48 ^d	0.565 ⁸⁸⁸
Cheese acidity	1.12 ^d	1.59 ^b	1.49 ^c	1.63 ^a	1.64 ^a	0.031 ⁸⁸⁸
Cheese pH	5.65 ^a	5.20 ^{bc}	5.30 ^b	5.15 ^{cd}	5.08 ^d	0.095 ⁸⁸⁸
TS	41.25 ^a	39.81 ^b	38.91 ^c	41.23 ^a	37.95 ^d	0.409 ⁸⁸⁸
Fat	20.88 ^a	20.51 ^b	19.09 ^c	20.87 ^a	17.33 ^d	0.192 ⁸⁸⁸
TN	2.38 ^{ab}	2.34 ^{bc}	2.31 ^{cd}	2.40 ^a	2.28 ^d	0.049 ⁸⁸⁸
WSN	0.50 ^{ab}	0.46 ^{bc}	0.45 ^{bc}	0.51 ^a	0.43 ^c	0.047 ⁸⁸⁸
Ash	5.61 ^b	5.75 ^{ab}	5.78 ^{ab}	5.69 ^{ab}	5.80 ^a	0.168
Salt	4.25 ^a	4.33 ^a	4.32 ^a	4.37 ^a	4.34 ^a	0.188
TVFA	9.97 ^d	11.11 ^{bc}	11.89 ^a	11.40 ^b	10.76 ^c	0.386 ⁸⁸⁸
Appearance&color	11.47 ^a	11.40 ^a	9.53 ^b	10.60 ^a	7.87 ^c	0.943 ⁸⁸⁸
body&Texture	29.93 ^a	29.20 ^{ab}	27.87 ^b	28.00 ^{ab}	23.60 ^c	2.045 ⁸⁸⁸
Flavor	42.67 ^a	41.20 ^{ab}	40.13 ^{bc}	38.27 ^c	38.60 ^c	2.472 ⁸⁸⁸
	Effect of storage time (days)					
	0	15	30	60	90	LSD
Whey acidity	0.25 ^c	0.83 ^d	1.18 ^c	1.354 ^b	1.48 ^a	0.033 ⁸⁸⁸
Whey pH	6.43 ^a	5.28 ^b	4.96 ^c	4.81 ^d	4.72 ^c	0.032 ⁸⁸⁸
Whey fat	0.45 ^d	0.48 ^d	0.56 ^c	0.62 ^b	0.67 ^a	0.034 ⁸⁸⁸
Yield	26.78 ^a	24.89 ^b	23.46 ^c	23.73 ^c	23.95 ^c	0.565 ⁸⁸⁸
Cheese acidity	0.66 ^c	1.31 ^d	1.66 ^c	1.85 ^b	2.00 ^a	0.031 ⁸⁸⁸
Cheese pH	6.36 ^a	5.58 ^b	5.05 ^c	4.83 ^d	4.55 ^c	0.095 ⁸⁸⁸
TS	38.34 ^d	40.09 ^b	41.06 ^a	40.15 ^b	39.52 ^c	0.409 ⁸⁸⁸
Fat	19.16 ^d	19.79 ^{bc}	20.12 ^a	19.95 ^{ab}	19.65 ^c	0.192 ⁸⁸⁸
TN	2.25 ^c	2.36 ^b	2.41 ^a	2.37 ^{ab}	2.33 ^b	0.048 ⁸⁸⁸
WSN	0.17 ^c	0.30 ^d	0.47 ^c	0.64 ^b	0.77 ^a	0.047 ⁸⁸⁸
Ash	5.55 ^b	5.70 ^{ab}	5.77 ^a	5.77 ^a	5.85 ^a	0.168 ⁸⁸⁸
Salt	4.13 ^c	4.21 ^{bc}	4.28 ^{bc}	4.39 ^b	4.59 ^a	0.188 ⁸⁸⁸
TVFA	4.64 ^c	6.56 ^d	9.92 ^c	14.60 ^b	19.41 ^a	0.386 ⁸⁸⁸
Appearance&color	8.27 ^b	9.00 ^b	10.80 ^a	11.33 ^a	11.47 ^a	0.943 ⁸⁸⁸
body&Texture	23.27 ^d	26.67 ^c	28.27 ^{bc}	29.73 ^{ab}	30.67 ^a	2.045 ⁸⁸⁸
Flavor	37.07 ^b	37.93 ^b	41.20 ^a	42.33 ^a	42.33 ^a	2.472 ⁸⁸⁸

Significant different at $p > (0.05, **0.01, ***0.001)$. For each effect the different letters in the means the multiple comparison are different from each. Letters a is the highest means followed by b, c etc

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صناعة الجبن الدمياطى من اللبن المجفف المسترجع وأنواع مختلفة من القشدة

تم تصنيع الجبن الدمياطى من خليط من اللبن الجاموسى والبقرى (5% دهن) كمينة مقارنة، وأيضاً من اللبن المجفف المسترجع والمضاف له قشدة لبن جاموسى أو قشدة لبن بقرى أو قشدة لبن ماعز أو قشدة شرش (نتائج من صناعة الجبن الراس)، وخزن الجبن الناتج على درجة حرارة 10±2° م لمدة 90 يوم.

أظهرت النتائج زيادة وقت التجبن بالمنفحة فى اللبن المسترجع والمضاف له قشدة لبن الماعز بينما زادت قوة الخثرة فى لبن المقارنة. وقد زاد معدل انفصال الشرش فى اللبن المسترجع المضاف إليه قشدة الشرش .

وقد ارتفعت قيم الحموضة والدهن فى شرش الجبن الدمياطى المصنع من لبن مسترجع وقشدة شرش. وقد أدى استخدام لبن مسترجع ومضاف له قشدة لبن بقرى إلى زيادة تصافى الجبن الدمياطى الناتج. فى حين ارتفعت قيم الحموضة بالجبن المصنع من لبن مسترجع وزادت أنواع مختلفة من القشدة. وزادت نسب المادة الصلبة والدهن والنتروجين الكلى والنتروجين الذائب فى الماء والنتروجين الذائب فى الماء/النتروجين الكلى بالجبن الدمياطى المصنع من لبن مسترجع مضاف له قشدة لبن ماعز. وكانت نتائج الرماد والملح متشابهة تقريباً فى كل المعاملات. ارتفعت قيم الأحماض الدهنية الطيارة بالجبن المصنع من لبن مسترجع وقشدة لبن بقرى. واحتوى جبن المقارنة الطازج على نسب مرتفعة من الأحماض الدهنية المشبعة بينما ارتفعت نسب هذه الأحماض فى الجبن المصنع من لبن مسترجع وقشدة لبن جاموسى بعد 90 يوم من التخزين. أما الأحماض الدهنية الغير مشبعة فقد ارتفعت نسبتها بالجبن الطازج والمخزن لمدة 90 يوم والمصنع من لبن مسترجع مضاف له قشدة لبن بقرى وقد حصل جبن المقارنة أو الجبن المصنع من لبن مسترجع وقشدة لبن جاموسى على أعلى درجات التقييم الحسى.