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PROPERTIES OF DOMIATI CHEESE AS AFFECTED BY BLENDING VARIOUS MILKINGS AND COLD STORAGE OF BUFFALO'S MILK

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ABSTRACT

The effects of mixing milk from different lactations and refrigerating storage of buffalo's milk for 24 or 48 hours on the characteristics of Domiati cheese were studied. Data showed that mixing evening and morning milks with raw or pasteurized cold stored milk increased the yield, TS, fat, salt, TN and decreased the acidity, WSN, NPN and TVFA values of Domiati cheese. Cold storage of raw or pasteurized milk slightly decreased the yield, TS, fat, TN and increased the acidity, salt, WSN, NPN and TVFA contents of the resultant Domiati cheese. Adding evening and morning milks to cold stored milk or cold preservation of raw or pasteurized milk decreased the concentrations of the majority of free amino acids (FAA) of Domiati cheese after 90 days of ripening while slightly increased the counts of total viable bacteria, lactic acid bacteria, psychrophilic bacteria, proteolytic bacteria, lipolytic bacteria, coliform, sporeformers, moulds and yeast of the resultant cheese. Blinding evening and morning milks with cold stored milk slightly increased scores of body, texture and flavour of Domiati cheese. Cold storage of milk had no pronounced effects on body, texture and flavour of cheese.

Keywords: Various lactations- cooling milk- Domiati cheese

INTRODUCTION

At lower temperatures, chemical changes in milk are slowed down and chemical spoilage is delayed. Milk contains several nutrients that are necessary for the life. In the first human societies, snow and water were used for cooling food. Later, the theory of cooling by evaporation was developed and practiced for a long time. Refrigerating milk on the farm has two main aims, firstly to inhibit bacterial spoilage and secondly to extend storage time on the farm so as to decrease milk transport costs.

Rapid cooling to below 4 °C greatly contributes to the quality of the milk on the farm. This treatment slows down the growth of the bacteria in the milk, thereby greatly improve its keeping qualities. However, it is vital to recognize that cooling is a compliment, not a substitute, for hygienic working conditions. Avoiding infections through good hygiene practices, and cooling the milk as soon as possible after milking, combine to ensure high milk quality. Cooling is a good expedient, and with efficient cooling you can help win the battle against micro-organisms. Also, effective milk cooling is essential to ensure the quality of the end product.

Most farmers in the world especially in the developed countries have a requirement that their milk must be cooled to 4 °C within 3½ hrs from the start of milking, so cooling milk quickly for storage is an integral part of every

farm's quality assurance / food safety plan. In contrast, using cooling for milk preservation goes slow in developing countries because of the high coasts of equipments but in the last two decades refrigerating milk was applied particularly in large farms in Egypt.

On the other side, many of cheese makers in Egypt believe that the addition of fresh milk to cold milk stored in cooling tank had bad impact on the properties of the resultant cheese. So, the aim of this study was to determine the effect of mixing of different lactations milk and cold storage of buffalo's milk for 24 or 48 hours on the quality of Domiati cheese.

MATERIALS AND METHODS

Materials:

Fresh buffalo's milk was obtained from Mahlt Moussa Animal Production Research Station, Animal Production Research Institute, Agriculture Research Center. Egypt. Liquid calf rennet obtained from local market (Domiat city) was added to the milk at a rate of 1.5 mL kg-1 milk. Dry coarse commercial food grad salt was obtained from El-Nasr Salines Company, Egypt. Analytical grade calcium chloride was obtained from El-Gomhouria Company, Egypt.

Methods

Cheese manufacture

Domiati cheese was made from raw or pasteurized milk as described by Abd El–kader (2003). Ten treatments of cheese were carried out as fallows:

Treatment A: Cheese made from fresh raw morning milk.

Treatment B: Cheese made from raw mixed milk (morning, evening and next morning day milkings- mixing between 3 milkings within 24 hours with 12 hours intervals) and stored at 4±1°C.

Treatment C: Cheese made from raw mixed different lactations milk (mixing of morning and evening 5 milkings within 48 hours with 12 hours intervals) and stored at 4±1°C.

Treatment D: Cheese made from raw milk stored at 4±1°C for 24 hours (without mixing).

Treatment E: Cheese made from raw milk stored at 4±1°C for 48 hours (without mixing).

Treatment F: Cheese made from pasteurized (63°C/30min.) morning milk.

Treatment G: Cheese made from pasteurized mixed different lactations milk (morning, evening and next morning day milkings- mixing between 3 milkings within 24 hours with 12 hours intervals) and stored at 4±1°C.

Treatment H: Cheese made from pasteurized mixed milk (mixing of morning and evening 5 milkings within 48 hours with 12 hours intervals) and stored at 4±1°C.

Treatment I: Cheese made from pasteurized milk stored at 4±1°C for 24 hours (without mixing).

Treatment J: Cheese made from pasteurized milk stored at 4±1°C for 48 hours (without mixing).

Buffalo's milk of treatments F to J was pasteurized (65°C/30 min.) before storing at 4±1°C. Raw or pasteurized milks of different treatments were heated to 40°C then 0.02% CaCl was added only to pasteurized milk. Salt was added at 8% before renneting. The resultant cheese from all treatments were weighed and pickled into their own whey, and stored in plastic jars at 4±1°C for 3 months. Samples of cheese were analyzed when fresh and after 15, 30, 60 and 90 days of ripening period. Three replicates of each treatment were conducted.

Methods of analysis

Milk samples were analyzed for titratable acidity (TA), total solids (TS), fat and total protein contents according to Ling (1963). The pH values were estimated using a pH meter type CG 710. Actual cheese yield was determined by dividing the weight of cheese by the weight of milk used, multiplied by 100. Adjusted cheese yield was calculated using the formula given by Metzger et al. (2000):

Adjusted yield = (actual yield × (100 − actual moisture + actual salt)) / (100 − (55 + 1.5)).

Cheese samples were analyzed for total solids (TS), titratable acidity (TA), pH, fat, total nitrogen (TN), water soluble nitrogen (WSN) and non-protein-nitrogen (NPN) according to Ling (1963). Salt content was estimated using Volhard's method according to American Public Health Association (1992). Total volatile fatty acids (TVFA) were determined as described by Kosikowski (1978) and expressed as ml of 0.1 N NaOH 100 g^{-1} cheese. Amino acids analysis was carried out according to Marino *et al.,*(2010). Cheese samples were also analyzed for total viable bacterial count (TVBC), lactic acid bacteria (LAB), proteolytic, lipolytic, coliform, sporeformers, psychrophilic bacteria, moulds and yeast counts according to the methods described by the American Public Health Association (1992).

The cheese samples were sensorialy scored by the trained staff of the El-Serw Animal Production Research Station according to Ismail and Osman (2004). The obtained results were statistically analyzed 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).

RESULTS AND DISCUSSION

Chemical composition of milk used in Domiati cheese manufacture:

Table (1) deals with the physico-chemical properties of buffalo's milk used in making Domiati cheese. Storage of milk at 4±1°C increased its acidity and decreased pH values. Acidity percentages of fresh raw milk (Treatment A) and stored milk for 48 hours (Treatment E) were 0.17 and 0.19% respectively. Very slight increase in TS, fat and protein contents of milk was found at the end of cold storage time. Adding fresh raw milk from evening and morning milkings to refrigerated stored milk slightly increased its TS, fat and protein contents. TS contents of fresh raw milk (Treatment A) and mixing of three lactations milk (Treatment B) were 15.61 and 15.84% respectively.

On the other hand, pasteurization of milk before adding to cooling tank decreased the acidity and increased the pH, TS, fat and protein contents. As expected, the rate of increasing of acidity during cold storage was lower in pasteurized milk than that of raw milk. Also, adding pasteurized evening or morning milk to refrigerated stored milk slightly increased TS, fat and protein contents.

Table (1): Chemical composition of buffalo's milk used in Domiati cheese manufacture

Treatments*	Acidity (%)	pH	TS (%)	Fat (%)	Protein (%)
A	0.17	6.63	15.61	6.2	4.21
B	0.18	6.60	15.84	6.3	4.28
C	0.18	6.60	15.86	6.3	4.35
D	0.19	6.56	15.70	6.2	4.25
E	0.19	6.55	15.73	6.4	4.26
F	0.15	6.68	16.03	6.4	4.38
G	0.16	6.65	16.19	6.6	4.41
H	0.16	6.65	16.25	6.6	4.46
I	0.16	6.64	16.11	6.5	4.40
J	0.16	6.64	16.15	6.5	4.41

***A: fresh raw morning milk.**
B: raw mixed milk (morning, evening and next morning day milkings- mixing between 3 milkings within 24 hours with 12 hours intervals) and stored at 4±1°C.
C: raw mixed different lactations milk (mixing between morning and evening 5 milkings within 48 hours with 12 hours intervals) and stored at 4±1°C.
D: raw milk stored at 4±1°C for 24 hours (without mixing).
E: raw milk stored at 4±1°C for 48 hours (without mixing).
F: pasteurized (63°C/30min.) morning milk.
G: pasteurized mixed different lactations milk (morning, evening and next morning day milkings- mixing between 3 milkings within 24 hours with 12 hours intervals) and stored at 4±1°C.
H: pasteurized mixed milk (mixing between morning and evening 5 milkings within 48 hours with 12 hours intervals) and stored at 4±1°C.
I: pasteurized milk stored at 4±1°C for 24 hours (without mixing).
J: pasteurized milk stored at 4±1°C for 48 hours (without mixing).

Yield of Domiati cheese:

Actual yield of fresh cheese and moisture and salt adjusted yield are shown in Table (2). The differences in the yield between treatments were highly significant ($P<0.001$). Mixing evening and morning milk with raw or pasteurized cold stored milk slightly increased the actual yield of cheese but it remained lower than the control cheese made from raw fresh or pasteurized milk. Cold storage of raw or pasteurized milk slightly decreased the actual yield of the resultant fresh cheese and an increase in storage time of milk caused a proportional decrease in the actual yield values of the cheese. These results agree with those of Johnston et al., (1987) who reported that cold storage decreased Cheddar cheese yield. On contrast, the adjusted yield values of cheese made from pasteurized and cold stored milk were higher than those of control cheese made from pasteurized milk only. Crudden et al., (2005) stated 4% reduction in curd yield made from 0 to 48 h storage of milk indicating that casein continues to undergo proteolysis during storage, probably due to the activity of plasmin under cold storage.

Table (2): Effect of cold storage and mixing various lactations of buffalo's milk on yield and chemical composition of Domiati cheese

Treatments*	Storage period (days)	Actual Yield (%)	Adjusted Yield (%)	Acidity (%)	pH values	TS (%)	Fat (%)	Fat/DM (%)	Salt (%)	Salt in Moisture (%)
A	0	29.01	28.29	0.29	6.55	37.45	22.8	60.88	4.97	7.36
	15	-	-	0.95	5.47	40.10	24.1	60.10	5.27	8.08
	30	-	-	1.80	4.54	43.48	25.8	58.85	5.43	8.76
	60	-	-	2.00	4.37	44.83	26.4	58.88	5.57	9.17
	90	-	-	2.10	4.24	46.05	26.9	58.41	5.69	9.54
B	0	28.82	28.87	0.27	6.60	38.33	23.7	61.83	5.25	7.84
	15	-	-	0.88	5.53	41.04	25.1	61.15	5.52	8.56
	30	-	-	1.70	4.60	44.21	26.4	59.71	5.76	10.32
	60	-	-	1.84	4.45	45.70	26.9	58.86	5.95	9.87
	90	-	-	2.00	4.35	47.77	27.4	57.35	6.12	10.48
C	0	28.75	29.97	0.26	6.63	40.09	24.3	60.61	5.26	8.07
	15	-	-	0.85	5.59	42.98	25.5	59.33	5.56	8.88
	30	-	-	1.70	4.63	44.69	26.8	59.97	5.80	9.49
	60	-	-	1.82	4.48	46.28	27.3	58.99	6.01	10.06
	90	-	-	1.94	4.40	48.52	27.9	57.50	6.16	10.68
D	0	28.10	27.31	0.31	6.51	36.99	22.5	60.82	5.30	7.75
	15	-	-	1.05	5.39	39.10	23.9	61.12	5.55	8.35
	30	-	-	1.95	4.45	43.50	25.2	57.93	5.84	9.36
	60	-	-	2.11	4.24	44.77	26.0	58.07	6.05	9.87
	90	-	-	2.20	4.11	45.58	26.7	58.57	6.20	10.22
E	0	27.86	26.70	0.34	6.43	36.39	22.2	61.00	5.31	7.70
	15	-	-	1.17	5.29	38.36	23.5	61.26	5.53	8.23
	30	-	-	2.06	4.19	43.11	25.0	57.99	5.85	9.32
	60	-	-	2.20	4.09	44.27	26.0	58.73	6.02	9.74
	90	-	-	2.29	4.01	45.32	26.5	58.47	6.19	10.16
F	0	31.83	30.07	0.29	6.56	35.54	21.3	59.93	5.56	7.94
	15	-	-	0.47	6.18	38.67	23.3	60.25	5.97	8.87
	30	-	-	0.61	5.98	41.91	25.0	59.65	6.23	9.22
	60	-	-	0.72	5.89	43.56	25.5	58.53	6.49	10.31
	90	-	-	0.81	5.82	45.87	26.0	56.68	6.56	10.80
G	0	31.70	31.20	0.27	6.62	36.41	21.7	59.59	6.41	9.15
	15	-	-	0.43	6.25	39.25	24.1	61.40	6.73	9.97
	30	-	-	0.60	5.97	43.10	25.6	59.39	6.97	10.91
	60	-	-	0.70	5.90	45.12	26.0	61.72	7.12	12.23
	90	-	-	0.79	5.85	46.59	26.4	56.66	7.31	12.03
H	0	31.66	32.16	0.27	6.63	37.76	22.0	58.26	6.44	9.36
	15	-	-	0.40	6.30	39.95	24.3	60.82	6.78	10.14
	30	-	-	0.58	6.03	44.75	25.7	57.43	6.95	11.17
	60	-	-	0.68	5.94	46.48	26.2	56.36	7.14	11.74
	90	-	-	0.78	5.85	47.73	26.8	56.15	7.35	12.32
I	0	31.42	31.86	0.31	6.50	37.61	20.9	55.50	6.50	9.43
	15	-	-	0.48	6.16	40.58	23.3	57.42	6.84	10.32
	30	-	-	0.68	5.93	44.73	24.8	55.44	7.03	11.28
	60	-	-	0.79	5.85	46.26	25.3	54.69	7.21	12.14
	90	-	-	0.88	5.71	47.82	26.7	55.83	7.40	12.42
J	0	31.11	32.27	0.32	6.47	38.62	20.5	53.08	6.51	9.58
	15	-	-	0.47	6.11	41.04	23.1	56.28	6.82	10.36
	30	-	-	0.71	5.90	44.86	24.4	54.39	7.07	11.36
	60	-	-	0.82	5.80	47.10	25.1	53.29	7.22	12.00
	90	-	-	0.92	5.60	48.24	26.2	54.31	7.41	12.52

*** see legend to Table (1) for details.**

Both the actual and adjusted yield values of Domiati cheese manufactured from pasteurized milk were higher than those of cheese produced from raw milk. The adjusted yield values of treatments A and F were 28.29 and 30.07% respectively. Similar results were fund by Awad et al., (2001). Aly and Galal (2002) noticed that the highest Domiati cheese yield was obtained with pasteurized milk (72°C/15sec.) comparing with that of raw and heated milk (65°C/15sec.) cheese. This may be attributed to the effect of pasteurization on forming complex between k-casein and β lactoglobulin which affects clotting time and subsequent cheese yield (Kanka et al., 1989 and Girgis et al., 1999).

Chemical composition of Domiati cheese:

Data in Tables (2 and 3) illustrate the changes in chemical composition of Domiati cheese during ripening period for 90 days at 4±1°C. Blinding fresh or pasteurized milk from various evening or morning lactations to milk stored in cooling tank in 4 equal lots at 0.5-day intervals decreased the acidity values while increased the TS, fat, salt, salt in moisture, TN and TN/DM contents of Domiati cheese produced from such milk comparing with control cheese manufactured from fresh raw or pasteurized milk. On the contrary, adding various lactations milk to raw or pasteurized refrigerated stored milk lowered the WSN, WSN/TN, NPN, NPN/TN and TVFA contents of cheese.

As a result of increasing acidity of raw or pasteurized milk during refrigerated storage, the resultant Domiati cheese had higher acidity than that of the control cheese made from fresh milk. Similar trend was observed by Ammar (1999).

Cooling of the raw milk had slight effect on the TS and fat contents of cheese compared with the uncooled during ripening period. These results had nearly the same trend of changes in the yield probably to more hydration casein particles in cooled stored milk (Youssef et al., 1975). Oppositely, cooling of pasteurized milk increased the TS and fat contents of the resultant cheese. Nevertheless refrigerated storage of raw fresh or pasteurized milk for 24 or 48 hours caused a slight decrease in TN and TN/DM contents but it raised the salt, salt in moisture, WSN, WSN/TN, NPN, and NPN/TN values of resultant cheese during ripening period compared with the control one. These findings agree with those of Youssef et al., (1975) and Zalazor et al., (1991) who showed that refrigerated storage can affect milk quality by either promoting the growth of psychrotrophs or affecting the plasmin system. The authors also observed significant dissociation of beta casein into the serum fraction during storage at 5 °C, supporting previous observation by Ali et al (1980).

Also, cold storage of milk remarkably increased the TVFA. Aly et al., (1990) mentioned that the excessive lipolysis occurred in the refrigerated milk cheese than that in control cheese probably owing to heat resistant lipases produced from the raw milk psychrotrophs.

Acidity values of pasteurized milk cheese were lower than those of raw milk cheese. Also, the rates of acidity development during storage period were lower in former cheese than the later one

Table (3): Effect of cold storage and mixing various lactations of buffalo's milk on TN and some ripening indices of Domiati cheese

Treatments*	Storage period (days)	TN (%)	TN/DM (%)	WSN (%)	WSN/TN (%)	NPN (%)	NPN/TN (%)	TVFA**
A	0	1.50	4.22	0.287	19.13	0.088	5.86	6.0
	15	1.97	5.09	0.396	20.10	0.120	6.09	9.1
	30	2.30	5.48	0.515	22.39	0.153	6.65	11.0
	60	2.40	5.50	0.586	24.41	0.176	7.33	12.4
	90	2.55	5.54	0.671	26.31	0.193	7.57	13.6
B	0	1.55	4.26	0.280	18.06	0.080	5.67	5.6
	15	2.10	5.35	0.385	18.33	0.114	5.42	8.8
	30	2.38	5.52	0.515	21.63	0.148	6.21	10.8
	60	2.50	5.54	0.582	23.28	0.165	6.60	12.0
	90	2.60	5.58	0.666	25.61	0.184	7.07	13.2
C	0	1.60	4.23	0.277	17.31	0.078	4.87	5.6
	15	2.14	5.35	0.380	17.75	0.110	5.14	9.0
	30	2.42	5.40	0.508	20.99	0.146	6.03	10.8
	60	2.53	5.44	0.583	23.04	0.156	6.17	11.7
	90	2.65	5.55	0.661	24.94	0.185	6.98	13.0
D	0	1.46	3.88	0.295	20.20	0.093	6.36	6.4
	15	1.90	4.68	0.402	21.15	0.132	6.94	9.4
	30	2.21	4.94	0.520	23.52	0.160	7.23	11.4
	60	2.32	5.01	0.593	25.56	0.184	7.93	12.4
	90	2.52	5.26	0.677	26.86	0.196	7.77	14.0
E	0	1.43	3.70	0.301	21.04	0.098	6.85	6.6
	15	1.84	4.48	0.408	22.17	0.135	7.33	10.0
	30	2.18	4.85	0.533	24.44	0.166	7.61	11.8
	60	2.25	4.77	0.597	26.53	0.194	8.62	12.6
	90	2.49	5.16	0.684	27.46	0.202	8.11	14.7
F	0	1.47	3.93	0.266	18.09	0.081	5.51	5.6
	15	1.95	4.86	0.371	19.02	0.116	5.94	8.7
	30	2.26	5.19	0.491	21.72	0.149	6.59	10.8
	60	2.41	5.37	0.574	23.82	0.170	7.05	11.8
	90	2.52	5.47	0.660	26.19	0.189	7.50	13.0
G	0	1.54	4.02	0.259	16.82	0.075	4.87	5.2
	15	2.08	5.07	0.360	17.30	0.110	5.28	8.3
	30	2.35	5.32	0.485	20.63	0.140	5.95	10.2
	60	2.47	5.40	0.565	22.87	0.159	6.43	11.0
	90	2.60	5.44	0.652	25.07	0.181	6.96	12.7
H	0	1.64	4.09	0.255	15.54	0.074	4.51	5.2
	15	2.15	5.00	0.362	16.84	0.107	4.97	8.1
	30	2.41	5.39	0.480	19.92	0.141	5.85	10.0
	60	2.50	5.40	0.561	22.44	0.154	6.16	11.0
	90	2.64	5.44	0.651	24.66	0.180	6.81	12.5
I	0	1.43	3.86	0.270	18.88	0.088	6.15	6.0
	15	1.90	4.85	0.384	20.21	0.125	6.57	9.0
	30	2.22	5.10	0.501	22.56	0.154	6.94	11.1
	60	2.37	5.29	0.583	24.59	0.181	7.63	11.7
	90	2.47	5.42	0.675	27.32	0.194	7.85	13.4
J	0	1.35	3.70	0.278	20.59	0.095	7.03	6.4
	15	1.82	4.74	0.388	21.31	0.131	7.19	9.7
	30	2.15	4.98	0.513	23.86	0.159	7.39	11.1
	60	2.31	5.22	0.596	25.80	0.190	8.22	11.9
	90	2.42	5.34	0.686	28.34	0.198	8.18	14.0

*** see legend to Table (1) for details.**

**** expressed as ml 0.1 NaOH 100 g^{-1} cheese**

Domiati cheese made from fresh raw milk (Treatment A) possessed higher TS, fat, TN, TN/DM, WSN, WSN/TN, NPN, and NPN/TN contents and lower salt and salt in moisture percentages than those of cheese made from pasteurized milk (Treatment F). The lower rate of ripening in heat treated milk cheese may be due to the destructive effect of heat treatment on the natural milk flora and enzymes which in turn affect fat and protein degradation (Ghosh et al., 1996 and Girgis et al., 1999). It is clear from Table (3) that pasteurization of milk decreased values of TVFA which could be attributed to destroying some of lipolytic bacteria spices and their enzymes by heat treatment. Also, numbers of spore forming bacteria were higher in raw milk cheese than those of pasteurized milk cheese (Table 5).

On the other hand, the titratable acidity of Domiati cheese from different treatments were increased significantly ($P<0.001$) while pH values were decreased significantly ($P<0.001$) during ripening period. This might be due to the continuous fermentation of lactose to lactic acid, as well as the gradual increase of degradation products in the resultant cheese. Similar to acidity values, TS and fat contents of all cheese treatments significantly increased ($P<0.001$) as the maturation period advanced. This may be attributed to curd contraction and expulsion of whey as the result of acid production. These results are in accordance to those reported by El-Shafei (1994) and Abou Zeid et al., (2007).

On the contrary, the Fat/DM values of different treatments especially those made from raw milk gradually decreased as ripening progressed. These results agree with those of Ammar (1999), who attributed that to contentious degradation of cheese fat. Also, as ripening period progressed, salt and salt in moisture contents of cheese in all treatments increased gradually. The gradual increase in the above contents of the cheese is due to the progressive loss in the moisture occurring during storage.

During ripening period, the TN, TN/DM, WSN, WSN/TN, NPN, and NPN/TN values increased significantly ($p< 0.001$) in all cheese samples. Furthermore, there was a significant interaction of nitrogen level and age, indicating that the differences in the rates of increase in WSN and NPN were significantly different between cheeses of differing nitrogen percentages. Similar trends were obtained by Abou-Zeid and Zaki (1988) and Kebary et al., (1991), who reported that as ripening period advanced the protein contents of cheese increased.

Free amino acid (FAA):

Free amino acids contents of ripened Domiati cheese from various treatments are presented in Table (4). In general, concentrations of aspartic and glycine acids were the lowest while proline acid was the predominant one of free amino acids contents in all cheese samples. Adding evening and morning milk to cold stored milk lowered concentrations of various amino acids of cheese except aspartic acid. Levels of serine acid for treatments A, B and C were 28.72, 16.48 and 7.50ug/ml respectively. On the other hand, preservation of raw or pasteurized milk for 24 or 48 hours in cooling tank decreased the majority of amino acids concentrations of cheese. Pasteurization of milk decreased concentrations of aspartic, serine, glutamic, alanine, tyrosine, histidine, lysine, arginine and proline acide while increased

levels of threonine, valine, methionine, isoleucine, leucine and phenylalanine acids of resultant cheese. No pronounced differences in contents of glycine acid were observed between cheese treatments made from raw or pasteurized milk.

Table (4): Amino acid concentrations (ug/ml) of Domiati cheese at the end of storage period

Amino acids	Treatments*									
	A	B	C	D	E	F	G	H	I	J
Aspartic	5.24	9.17	6.18	6.24	3.18	4.38	5.51	6.87	4.50	3.62
Threonine	14.08	12.29	3.71	18.31	12.73	15.38	2.19	14.49	1.97	3.34
Serine	28.72	16.48	7.50	22.33	13.68	17.88	5.96	27.93	6.21	6.51
Glutamic acid	58.24	33.57	15.63	49.32	22.42	35.98	25.09	65.57	21.03	20.14
Glycine	5.08	3.32	3.32	3.95	3.38	5.48	3.82	4.48	2.01	4.48
Alanine	11.29	8.82	5.27	10.84	8.86	8.70	6.52	13.01	2.56	6.35
Valine	16.33	14.19	6.10	24.18	20.68	30.55	7.84	17.05	8.86	19.12
Methionine	138.73	83.32	56.18	134.18	102.78	156.89	134.96	134.47	61.83	95.73
Isoleucine	20.44	18.64	15.20	19.15	20.84	33.33	13.84	19.69	17.15	21.15
Leucine	52.72	45.00	33.06	45.36	46.56	56.76	36.57	50.97	40.81	48.02
Tyrosine	129.40	100.08	76.14	105.08	88.93	116.64	49.49	122.15	119.59	111.51
Phenylalanine	53.70	41.55	52.29	38.27	41.15	72.12	41.65	45.30	43.00	55.74
Histidine	55.40	45.02	11.41	40.89	36.16	45.55	40.34	52.22	31.97	43.42
Lysine	153.28	116.33	74.39	122.59	108.11	130.10	110.70	145.80	86.46	101.42
NH4+	110.25	87.94	66.15	103.75	69.21	97.52	88.03	120.70	76.30	84.24
Arginine	40.22	30.97	16.26	31.79	22.45	34.39	27.23	35.87	16.61	27.27
Proline	1083.80	988.94	484.13	955.41	811.40	939.66	702.74	1011.29	640.83	691.22

*** see legend to Table (1) for details.**

Microbial profile of cheese:

There were significant ($p < 0.001$) differences in counts of total viable bacteria (TVB), lactic acid bacteria (LAB), psychrophilic bacteria, proteolytic bacteria, lipolytic bacteria, coliform, sporeformers bacteria, moulds and yeast between cheese treatments (Table 5). During ripening period, the numbers of different microbial groups were significantly ($p < 0.001$) decreased reaching their minimum at the end of ripening period. This decrease could be evidently attributed to the increase in titratable acidity (Table 2) which controlled the rate of bacterial growth or acted as bactericidal agent (El-Abd et al., 2003). On contrast, Hamed et al., (1992) stated that total colony count, aerobic spore former, total proteolytic and total mold and yeast counts gradually increased until 60 days of refrigerated storage of Domiati cheese. This increase can be explained by the sufficient change in the environmental conditions which happen during cheese storage and allow the growth and multiplication of microorganisms.

Table (5): Effect of cold storage and mixing various lactations of buffalo's milk on some microorganisms of Domiati cheese

Treatments*	Storage period (days)	Microbial groups cfu g-1							
		TVBC ($x10^6$)	LAB ($x10^4$)	Psychrophilic bacteria ($x10^4$)	Proteolytic bacteria ($x10^3$)	Lipolytic bacteria ($x10^3$)	Coliform bacteria ($x10^2$)	Spore-forming bacteria ($x10^3$)	Moulds &Yeast ($x10^3$)
A	0	400	380	3	35	13	71	125	35
	15	120	170	0	12	10	35	45	24
	30	55	65	0	4	8	21	18	17
	60	10	15	0	2	5	8	12	11
	90	2	3	0	1	2	0	2	5
B	0	420	389	7	41	16	79	132	39
	15	130	184	1	17	13	43	53	28
	30	63	70	0	7	10	30	20	20
	60	13	15	0	3	6	11	12	13
	90	4	4	0	1	3	2	3	6
C	0	469	396	15	44	20	90	138	45
	15	141	195	6	21	16	52	60	32
	30	69	78	1	11	12	34	26	24
	60	16	19	0	5	7	14	15	16
	90	5	6	0	2	5	5	5	8
D	0	431	394	9	43	18	82	135	41
	15	133	187	4	20	14	50	56	31
	30	68	72	0	9	12	35	22	22
	60	16	15	0	4	7	14	13	13
	90	5	5	0	1	4	4	3	7
E	0	481	399	19	48	21	92	145	49
	15	152	194	9	25	17	55	68	36
	30	70	78	2	13	14	35	30	26
	60	20	19	0	8	9	17	17	19
	90	6	7	0	3	5	7	6	8
F	0	78	120	1	8	4	1	29	17
	15	31	61	0	2	1	0	14	10
	30	16	22	0	0	0	0	9	5
	60	5	6	0	0	0	0	3	0
	90	1	-	0	0	0	0	0	0
G	0	85	131	3	10	4	2	33	18
	15	43	69	0	3	1	0	18	12
	30	20	29	0	1	0	0	11	5
	60	7	10	0	0	0	0	6	1
	90	3	1	0	0	0	0	1	0
H	0	97	139	4	11	6	2	35	20
	15	56	76	0	4	2	0	19	14
	30	28	36	0	1	0	0	12	7
	60	10	15	0	0	0	0	6	3
	90	5	3	0	0	0	0	1	0
I	0	90	136	7	10	5	3	33	20
	15	51	74	0	4	1	0	19	13
	30	27	33	0	1	0	0	12	6
	60	11	15	0	0	0	0	7	1
	90	5	2	0	0	0	0	1	0
J	0	104	145	9	13	6	3	38	23
	15	66	81	1	5	2	0	20	16
	30	30	42	0	2	0	0	14	9
	60	15	16	0	0	0	0	8	4
	90	7	4	0	0	0	0	2	0

Mixing equal quantities of raw or pasteurized milk from different lactations with cold stored milk (raw or pasteurized) slightly increased the counts of previous microorganisms groups in Domiati cheese. With regarding to the effect of cold storage of milk on microbial groups of Domiati cheese, it noticed from Table (5) that cold stored milk cheese had higher counts of TVB, LAB, psychrophilic bacteria, proteolytic bacteria, lipolytic bacteria, coliform, sporeformers bacteria, moulds and yeast than those of cheese made from fresh milk. This may be duo to raising microbial counts of milk within cooling preservation. Nearly similar finding were reported by Bockelmann (1974) who stated that bacterial counts of milk increased during cold storage. As expected, pasteurization of milk before cold storage significantly ($p< 0.001$) decreased the counts of mentioned microbial groups in Domiati cheese.

Organoleptic properties:

Data illustrated in Table (6) showed the organoleptic total score of fresh and refrigerated stored Domiati cheese. The organoleptic properties of cheese of all treatments were significantly ($p< 0.001$) improved during ripening period. Appearance and colour scores of cheese were not significantly affected by adding various lactations milk, cold storage or pasteurization of milk.

Blinding evening and morning milk with cold stored milk slightly increased scores of body, texture and flavour of Domiati cheese. Cold storage of milk had no pronounced effects on body, texture and flavour of Domiati cheese at zero storage time and through ripening period. In spit of pasteurized milk cheese gained the higher scores for body and texture at the beginning of ripening and after 90 days as compared with raw milk cheese, the flavor of raw milk cheese had the highest total score compared to pasteurized cheese. This may be due to the natural flora initially present in raw milk which participates in flavor production.

In conclusion, results implied that mixed lactations milk and lower storage temperatures yield Domiati cheese with acceptable quality. Also, it could be recommended that for obtained the high quality of buffalo's milk, it could be pasteurized before cold storage.

Table (6): Effect of cold storage and mixing various lactations of buffalo's milk on organoleptic properties of Domiati cheese

Treatments*	Storage period (days)	Color& Appearance (15)	Body& Texture (35)	Flavor (50)	Total (100)
A	0	12	28	40	80
	15	12	30	42	84
	30	13	31	43	87
	60	13	33	45	91
	90	13	33	47	93
B	0	12	30	41	83
	15	13	32	42	87
	30	13	33	44	90
	60	13	33	46	92
	90	14	34	47	95
C	0	12	28	41	81
	15	12	31	43	86
	30	13	32	44	89
	60	13	32	45	90
	90	13	33	48	94
D	0	12	29	41	81
	15	13	32	43	88
	30	13	31	43	87
	60	13	32	45	90
	90	13	33	47	93
E	0	12	30	41	83
	15	13	31	42	86
	30	13	32	44	89
	60	13	32	45	90
	90	14	33	47	94
F	0	12	30	39	81
	15	13	32	41	86
	30	13	33	42	88
	60	13	33	44	90
	90	13	34	45	92
G	0	12	31	41	84
	15	13	33	43	89
	30	13	33	43	89
	60	13	34	44	91
	90	13	34	46	93
H	0	13	31	41	85
	15	13	32	43	88
	30	13	33	45	91
	60	13	33	45	91
	90	13	34	46	93
I	0	12	31	41	84
	15	12	32	42	86
	30	12	32	43	87
	60	13	33	44	90
	90	13	34	44	91
J	0	13	30	41	84
	15	13	33	43	89
	30	13	33	44	90
	60	13	33	45	91
	90	13	33	45	91

*** see legend to Table (1) for details**

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تـأثير خلـط لـبن مـن حلبـات مختلفـة و حفـظ اللـبن الجامـوسـي بالتبريـد علـى صـفات الجبن الدمياطي

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تم دراسة تأثير خلط لبن جاموسي من حلبات مختلفة و حفظ هذا اللبن بالتبريد على درجة ٤±١°م لمدة ٢٤ أو ٤٨ ساعة على خواص الجبن الدمياطي. تشير النتائج إلي أن إضافة لبن المساء و الصباح للبن الجاموسي الخام أو المبستر المحفوظ بالتبريد يؤدي لزيادة قيم التصافي و المادة الصلبة و الدهن و الملح و النيتروجين الكلى في حين تؤدي لخفض قيم الحموضة و النيتروجين الذائب فى الماء والنيتروجين غير البروتينى و الأحماض الدهنيه الكلية الطيارة بالجبن الدمياطي الناتج. و من ناحية أخرى فأن حفظ اللبن الجاموسي الخام أو المبستر بالتبريد قد أدى إلي خفض طفيف في قيم التصافي و المادة الصلبة و الدهن و النيتروجين الكلى و إلي زيادة في محتوى الجبن من الملح و النيتروجين الذائب فى الماء والنيتروجين غير البروتينى و الأحماض الدهنيه الكلية الطيارة. لوحظ أيضاً أن خلط لبن من حلبات مختلفة أو حفظه بالتبريد قد أدى إلي خفض في تركيز غالبية الأحماض الأمينية الحرة بالجبن بعد ٩٠ يوم من التخزين و على العكس أدى ذلك إلي زيادة طفيفة في العد الكلى للبكتيريا وأعداد بكتيريا حمض اللاكتيك والمقاومة للبرودة والمحللة للبروتين والمحللة للدهن وبكتيريا الكلوروفورم والبكتيريا المكونة للجراثيم والفطريات والخمائر. هذا و لم يلاحظ تأثير لحفظ اللبن الجاموسي بالتبريد على قوام و تركيب و نكهة الجبن الدمياطي.

قام بتحكيم البحث

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