

**TRIALS TO IMPROVE THE QUALITY OF SOFT CHEESE  
MANUFACTURED FROM GOAT'S MILK**

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**ABSTRACT**

The present study aimed to improve the production of Domiati cheese from goat's milk. Goat's milk manufactured to Domiati cheese as control. Also goat's milk retentate was divided to 4 portions, the first one manufactured to Domiati cheese (T1), the second portion was manufactured to Domiati cheese using direct acidification (DA) to pH 5.9 prior to renneting (T2), the third portion was heated by 1% freeze-shocked (f.sh) culture *L. helveticus* (T3), the rest portion was treated with combination of 1% (f-sh) of *L. helveticus* addition and DA to pH 5.9. The obtained cheeses were pickled in whey 15% salt at 15°C for 90 days. Samples of cheeses were analyzed chemically, microbiology and organoleptically. The maximum yield and fat obtained from T2. On the other hand, the addition of (f-sh) culture of *L. helveticus* did not affected T3 or gross chemical composition while increased the value of SN/TN , TVFA, microbiological groups, flavour intensity and improved the body characteristic at the first month. But after 60 days of ripening, it became apparently defected in flavour and texture and were not acceptable. It could be concluded that the quality of Domiati goat's milk cheese was improved by using UF technique followed by DA with lactic acid and addition of (f-sh) culture of *L. helveticus*.

**INTRODUCTION**

Domiati cheese is the most popular soft cheese in Egypt which can be consumed fresh or after pickling in salted whey for several months. It made mainly from buffaloe's or cow's milk or from mixture of varying preparation of whole and separated milks and also few amounts is made from sheep or goat's milk (**Abo-Donia 2007**).

Recently goat's milk processing take place in many desert zones. This is mainly because of the fact that goat's can survive under extreme and rough climatic conditions.. The gross chemical compositions of cow's and goat's milk are similar, so many researchers have used goat's milk for cheese production as cow's milk (**Emara 1990, Saker 1998 and El-Zawahry, 2003**).

With the utilization of ultrafiltration (UF) technique in Domiati cheese making rapid expansion in the production of UF Domiati cheese can be seen in Egypt.

This process opened new avenue for significant advances and increase in cheese yield (El-Shibiny *et al.*, 1982).

Applications of UF have expanded by cheese makers where many research efforts has been implemented to develop, improve and solve technical problems, however, some unfavorable characteristic in UF cheese quality can develop during pickling as cheese texture became softer during storage, solubilization of cheese in pickling solutions, cheese texture is crumbly and has spread ability Hofi *et al.* (2001).

Direct acidification (DA) with continuous agitation process can shorten the production time and may be avoiding the above problems. Furthermore, DA procedure has also been described for manufacture of some varieties of cheese (Emara, 1990). On the other hand, El-Baz (2001) suggested that improving the quality and ripening of Edam-like cheese made from cow's milk retentate could be achieved by adding 2% freeze- shocked culture (F-sh) of *L. helveticus* to pre cheese.

The aim of this study was to improve the quality of Domiati cheese made from goat's milk by using UF technique, treating the resultant retentate by DA, fortifying it with freeze-shocked culture of *L. helveticus* or treating it by ( DA + F-sh). Yet, recognizing effect of these additives on yield, chemical, microbiological and organoleptic properties of Domiati cheese during pickling period.

## MATERIALS AND METHODS

### Goat's milk:

Goat's milk used in this study was obtained from the herd of Sakha Station, Animal Production Research Institute, Ministry of Agriculture.

### Starters:

*Lactobacillus helveticus* was obtained from Chr. Hansen's Laboratory Copenhagen, Denmark. Culture of *L. helveticus* was freeze-shocked at 25°C for 24h. before use according to Salama *et al.* (2002).

**Acidulates:** Food grade lactic acid was used according to Ismael (1995).

**Rennet:** A commercial rennet powder ( HA-LA Chr. Hansen's Denmark) was used at rate of 3g/100kg milk .

### Traditional Domiati cheese making:

The milk was divided into two parts; the first part was sent to manufacture of Domiati cheese (Control) as essentially described by Fahmi and Sharara (1950).

### Ultrafiltration of cheese milk:

The second part of goat's milk was pasteurized at 72°C for 15sec. It was achieved concentration factor = 2x UF at 50°C. The resultant retentate was then mixed

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with the cream which was previously separated from the same milk and pasteurized at 72°C for 15sec., then divided into 4 portions.

- 1- The first portion was renneted without additives (T1)
- 2- The second portion was cooled at 4°C and acidified to pH 5.9 with lactic acid, warmed to 40°C and then renneted (T2)
- 3- The third portion was treated by 1% (F-sh) of *L. helveticus* then renneted (T3)
- 4- The fourth portion was treated with 1% (F-sh) of *L. helveticus* and acidified as (T4)

All portions were manufactured to Domiati cheese as described by **Fahmy & Sharara (1950)**.

### **Cheese pickling**

After two days of cheese making, the control and UF cheese were rinsed on whey after increased the whey salt content to 15% and stored at 12°C ±2°C

### **Cheese sampling:**

Samples of fresh cheese were taken after two days of manufacturing and then periodically after 30, 45, 60 and 90 days.

### **Method of analysis:**

The yield of cheese was recorded as kg of cheese/kg milk x 100. Titratable acidity, total nitrogen (TN) and soluble nitrogen (SN) were determined according to **Ling (1963)**, fat and moisture as described by **British Standard Institutions Methods (1976)**, total volatile fatty acids (TVFA) were determined according to **Kosikowski (1978)**.

### **Microbiological analysis of cheese**

The total bacterial count (TC) was determined according to **Marth (1978)**. The proteolytic bacterial count (PBC) was determined as described by **Chalmer (1962)** and Lipolytic bacterial count (LBC) was determined as given by **Sharif (1970)**.

### **Organoleptic properties:**

Cheese organoleptic properties were evaluated by a trained test panel (10 members) according to **Harper and Hall (1976)**.

## RESULTS AND DISCUSSION

### **Cheese yield and moisture content:**

Table 1 showed that goat's milk cheese made from UF milk had higher yield than those made by traditional method. These results could be due to the retention of whey protein during UF process. Cheese made from acidified retentate (T2) had highest yield and moisture, that may be due to the direct acidification of retentate prior renneting

which increased the water holding capacity of the curd as previously described by **Ismael (1995)**.

#### **Fat content and cheese acidity**

Table 2 showed that fat content of both the control and experimental cheese increased gradually during pickling, otherwise the fat of Domiati cheese made by (DA) was higher than control and other treatments. However, the (DA) of milk prior to renneting may increase the recovery of fat in the resultant cheese. These results were in agreements with **Salama (2004)**. The treated UF goat's milk cheese with (F-sh) *L. helveticus* showed no remarkable changes in fat/DM compared with control while being fresh and throughout pickling period. The general trend of these results are in agreement with those reported by **Salama *et al.* and Soda *et al.* (1999)**.

The acidity of cheese was progressively increased during pickling either in the control cheese or in the UF cheese. The use of DA alone did not affect titratable acidity, while the addition of F-sh of *L. helveticus* to cheese curd enhanced the development of acidity. However the level of acidity in control cheese was slightly higher than that made by UF-technique except T3. These results could be explained on the base that permeate of UF cheese contained lower level of lactose than the control cheese. Therefore, the increased transform of lactose is in agreement with that found by **El-Gazzar and March (1991)**.

#### **Total and soluble nitrogen content**

Table 3 showed the changes in the total nitrogen content of the cheeses made from different treatments. It is clear that the TN content of all cheeses gradually increased as pickling progressed depending on the loss of moisture content. Also, the obtained result showed that values of TN in UF cheese was slightly higher than that of control cheese. These results could be attributed to the retention of whey protein during UF process (**Sakr, 1998**). On the other hand, the addition of F-sh culture of *L. helveticus* to retentate did not remarkably affected the TN of the cheese (**El-Baz, 2001** and **El-Zawahry, 2003**).

The same table showed that the SN of fresh control cheese was less than the corresponding values of fresh UF cheese. These increases mainly due to the retention of whey proteins. As pickling advanced, SN/TN contents were increased and that might be attributed to the action of rennet and proteolytic enzymes. In addition the high acidic condition might accelerate the protein hydrolysis (**Taleb, 1994**). Meanwhile, the results show that addition of F-sh of *L. helveticus* to cheese curd increased SN/TN compared with other treatments and control (**Salama, 2004**).

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### Total volatile fatty acids (TVFA)

Table 4 showed the changes in TVFA of control and UF milk cheeses during pickling. The TVFA increased in control cheese and UF cheese with extending pickling (El-Abd et al., 2003). This increase could be attributed to the action of lipase produced by lipolytic microorganisms on milk fat and liberation of TVFA. This increase in TVFA of UF cheese is a result of the reduction in fat globule membranes (Madsen, 1985). The UF cheese made by (DA) had lower TVFA content (Sakr 1998). Cheese made by treatment of adding F-sh *L.helveticus* had higher TVFA that might be due to the higher rate of protein degradation associated with more accumulation of free amino acid which serve as precursors for TVFA (Salama, 2004).

Table (5) show the changes in total, proteolytic and lipolytic bacterial counts in Domiati cheeses either made from goat's milk or UF goat's milk of all treatments during pickling. Results showed that the total proteolytic and lipolytic bacterial count in all cheeses gradually decreased along the pickling period reaching the minimum count at the end of pickling. However cheeses with added freeze-shocked *L.helveticus* was higher in the total count than untreated and control cheese when being fresh or throughout pickling. The obtained results could be explained on the basis that the incorporation of freeze-shocked into pre-cheese stimulates the development of bacterial growth during cheese making and pickling. This stimulatory effect might attributed to simple nitrogenous compound produced by the cell lysis the freeze-shocked *L. helveticus*. Furthermore, during ripening process the liberated intracellular enzymes from these freeze-shocked cultures enhanced the proteolysis which in turn stimulates the growth and activity of cheese flora in the experimental cheese (El-Soda et al. (1999), El-Baz (2001) and El-Zawahry (2003)).

The organoleptic properties of Domiati cheese made from goat's milk (control) and goat's milk retentate from different treatments and the corresponding score are presented in Table (6). The obtained results showed that organoleptic evaluation for Domiati cheese that treated with DA, followed by fortified with 1% (f-sh) *L. helveticus* gained higher score compared with the control and other treatments after 30 days of pickling. This may be explained on the basis that cheese made by (f-sh) *L. helveticus* treatment, accelerated the hydrolysis and breakdown of cheese fat and protein. Consequently, this accelerated the flavour development and improved the characteristic of cheese body and texture. These results are in agreement with that found by El-Baz (2001) and Salama (2004). As pickling advanced, the flavour and textures were not acceptable and a rancid flavours was observed at the end of cheese pickling. Similar results were obtained by Skar (1998).

Table 1.

The changes in yield and moisture contents (%) of Domiati cheese made from goat's milk retentate as affected by certain additives.

Pickling period days	Cheese made from retentate goat's milk									
	control		T1		T2		T3		T4	
	yield	Mois.	yield	Mois.	yield	Mois.	yield	Mois.	yield	Mois.
0	18.00	62.50	33.00	64.00	35.00	65.00	32.90	63.90	34.50	64.90
30	14.60	56.00	19.50	57.00	20.50	58.00	19.00	57.20	21.00	58.80
45	13.75	54.73	18.15	56.00	19.00	57.00	18.25	56.10	19.20	57.20
60	13.00	54.10	17.35	55.00	18.00	56.00	17.20	55.00	18.32	56.00
90	12.60	53.80	16.50	55.00	17.20	56.00	16.40	55.20	17.10	56.20

C: Control

T1 : Goat's milk cheese retentate

T2 : Goat's milk cheese retentate and using DA

T3: Goat's milk cheese retentate and treated with 1% (f-sh)

T4 : Goat's milk cheese retentate by using DA and treated with 1% (f-sh)

Table 2. The changes in titratable acidity (TA) and fat percent of Domiati cheese made from goat's milk retentate as affected by certain additives.

Pickling period days	Cheese made from retentate goat's milk									
	Control		T1		T2		T3		T4	
	TA	Fat	TA	Fat	TA	Fat	TA	Fat	TA	Fat
0	0.19	34.50	0.21	35.59	0.22	36.00	0.24	35.50	0.23	35.65
30	0.44	36.39	0.40	36.25	0.45	37.65	0.52	36.30	0.48	37.00
45	0.50	36.65	0.52	37.85	0.53	38.00	0.67	37.00	0.54	37.65
60	0.62	36.00	0.61	36.00	0.64	37.50	0.71	36.50	0.66	36.33
90	0.68	35.00	0.66	37.30	0.69	37.00	0.74	35.9	0.71	36.00

Table 3. The changes in total and soluble nitrogen content of Domiati cheese made from goat's milk retentate as affected by certain additives.

Pickling period days	Cheese made from retentate goat's milk									
	control		T1		T2		T3		T4	
	TN	SN/TN	TN	SN/TN	TN	SN/TN	TN	SN/TN	TN	SN/TN
0	1.52	2.52	1.73	3.91	1.78	4.02	1.70	4.08	1.73	4.05
30	2.2	6.10	2.56	5.92	2.62	5.91	2.55	6.98	2.60	6.70
45	2.60	6.22	2.62	10.20	2.69	10.31	2.59	13.70	2.62	13.45
60	2.87	8.52	2.60	12.35	2.61	12.21	2.50	15.90	2.53	16.25
90	2.82	14.74	2.55	14.53	2.59	14.00	2.42	19.42	2.45	18.52

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**Table 4. The changes in total volatile fatty acids of Domiati cheese made from goat's milk retentate as affected by certain additives.**

Pickling period days	Cheese made from retentate goat's milk				
	control	T1	T2	T3	T4
0	7.6	8.40	8.60	9.00	8.60
30	10.80	11.80	13.00	14.30	14.65
45	15.35	15.00	16.30	17.56	18.00
60	16.65	15.65	17.00	20.80	19.65
90	17.00	16.60	17.35	23.00	22.35

**Table 5. The changes in total, proteolytic and lipolytic bacterial count of Domiati cheese made from goat's milk retentate as affected by certain additives.**

Pickly period days	Cheese made from retentate goat's milk														
	control			T1			T2			T3			T4		
	TC	PBC	LBC	TC	PBC	LBC	TC	PBC	LBC	TC	PBC	LBC	TC	PBC	LBC
0	220	131	107	200	121	98	186	115	92	220	133	102	210	117	97
30	170	97	81	166	71	70	172	62	65	192	102	91	181	82	80
45	80	75	67	78	58	49	103	45	42	125	85	72	116	60	65
60	75	52	36	62	32	35	80	35	30	105	66	64	92	42	59
90	60	37	24	54	19	22	69	22	20	92	52	49	81	36	42

TC : total bacterial count (  $\times 10^6$  cfu/ml)

PBC : proteolytic bacterial count ( $\times 10^4$  cfu/ml)

LBC : lypolytic bacterial count ( $\times 10^3$  cfu/ml)

## محاولة تحسين جودة الجبن الطرى المصنع من لبن الماعز

محمد الدمرداش و أحمد إسماعيل و سونيا و متولى

### الملخص العربي

يهدف هذا البحث الى تحسين جودة الجبن اللميماطى الناتج من لبن الماعز كمقارنة وتم عمل ترشيح فانق للبن الماعز وتم تقسيم المحتجز الى اربع اقسام الاول تم تصنيعة الى جبن لميماطى والثانى تم معاملةته بالتحميض المباشر حتى 5.9pH بواسطة حمض اللاكتيك والثالث تم معاملةته بـ 1% من بكتيريا *L. helveticus* المعامل بصدمة التجميد والرابع تم معاملةته بكل من التحميض المباشر والصدمة التجميدية وتم تخزين الجبن الناتج من المعاملات السابقة فى الشرش الناتج من التصنيع بعد تملحه الى 15% وتم التخزين لمدة 90 يوم على 15° م .

واوضحت النتائج مايلي:

- ان اكبر تصافى ونسبة دهن كانت فى الجبن الناتج من المحتجز المعامل بالتحميض المباشر بينما اقل محصول كان جبن المقارنة
- لم يؤثر تدعيم المحتجز سواء بحمض اللاكتيك او غير المحمض او المضاف اليه البادىء المعامل بالصدمة التجميدية على التركيب الكيماوى للجبن الناتج وكذلك لم يكن لها تاثير على تصافى الجبن بينما ادى التدعيم بالبادىء المعامل الى زيادة قيمة SN/TN والاحماض الدهنية الطيارة واعداد المجاميع البكتيرية علاوة على تحسين خواص القوام والنكهة
- وبذلك يمكن تحسين الجبن الناتج من لبن الماعز بمعاملة محتجز الترشيح الفائق للبن الماعز بالتحميض المباشر ثم تدعيم خثرة الجبن بـ 1% من بكتيريا *L.helveticus* المعامل بصدمة التجميد.