ELSEVIER

Food Chemistry 79 (2002) 445–452

Food Chemistry

www.elsevier.com/locate/foodchem

Manufacture of fresh soft white cheese (Domiati-type) from ultrafiltered goats' milk

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Received 18 December 2001; received in revised form 18 March 2002; accepted 18 March 2002

Abstract

Manufacturing procedures and compositional characteristics were studied for fresh soft white cheese (Domiati-type) made from goats' milk, using ultrafiltration (UF) and conventional processes. Yields, recovery of protein, fat, total solids and sensory characteristics of this type of cheese were also evaluated. The cheeses made by UF process was higher in pH, moisture content and ash, whereas protein and fat contents were lower compared to those cheeses made by the conventional process. An increase of 21% in cheese yields, 21–26% in protein recovery, 15–19% in fat recovery and 17–22% in total solids recovery was achieved by the UF process. Moreover, the UF process showed 83–85, 83.3, 75, 82.5 and 75% reduction in the total process time, salt, starter culture, rennet and calcium chloride used, respectively. The mean score for texture of cheeses made by UF was significantly higher than that of cheeses made by the traditional process. However, a difference in flavour and overall acceptability between UF cheeses and traditional process cheeses was not verified. The most acceptable cheeses were these made with yogurt or lactic ferment starter culture.

Keywords: Goat milk; Cheese; Ultrafiltration; Ultrafiltered milk; Domiati cheese

1. Introduction

Goats' milk plays an important role in certain parts of the world. In Saudi Arabia, however, the goat population of 6.2 million (Anonymous, 1997) ranks even third in the indigenous total animals population and comes behind sheep and cattle. However, interest in applications for goats' milk has been increased internationally in recent years. Goats' milk has been used since ancient times for the manufacture of different types of cheeses, throughout the world. A great number of these are made from goats' milk or from combinations of goats' milk with milk from the cow, ewe or buffalo (Loewenstein, Speck, Barnhart, & Frank, 1980; Mallatou, Pappas, & Voutsinas, 1994; USDA, 1978).

Domiati cheese is basically a pickled cheese, although it may be sold fresh, and is considered to be the most popular soft white cheese in Egypt and in other Middle Eastern countries. Domiati cheese is made mainly from buffalos' milk, cows' milk, or a mixture of both, but it is also made from sheep or goat milk (Abou-Donia, 1986; Ibrahim, Fahimi, Amer, & Mehriz, 1974). This soft white cheese has been made from pasteurized milks containing different percentages of fat (1–6%) and by addition of different percentages of salt (2–15%). It also has been made with or without the addition of starter cultures to cheese milk (Abou-Donia, 1986; El-Koussy, 1966; Fahmi & Sharara, 1950; Ibrahim, Fahmi, Amer, & Mehriz, 1975). Single or mixed cultures of streptococci and lactobacilli in different combinations have been used by several investigators (Abou-Donia, 1986). Generally, starter cultures govern the flavour, body and texture of the cheese, and help to suppress the growth of pathogenic and spoilage bacteria.

During the past 30 years, the use of ultrafiltered milk for cheesemaking has attracted considerable attention throughout the world (Cheryan, 1998; Cheryan & Alvarez, 1995; El-Gazzar & Marth, 1991; Glover, 1985; Kosikowski, 1986a & 1986b; Kosikowski & Mistry, 1997a; Lelievre & Lawrence, 1988; Mohr, Engelgau, Leeper, & Charboneau, 1989; Pal & Cheryan, 1987; Renner & Abd El-Salam, 1991). The ''precheese'' technology known as the Maubois, Mocquot, and Vassal (MMV) process (Maubois & Mocquot, 1975; Maubois, Mocquot, & Vassal, 1969) is used in many dairies in the world to produce different cheese varieties (Cheryan &

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0308-8146/02/$ - see front matter
PII: S0308-8146(02)00195-4

Alvarez, 1995; Cheryan, 1998; Kosikowski, 1986a & 1986b; Maubois, 1980; Olson, 1983).

Cheeses being successfully made from cows' milk by the UF process, on an industrial scale, include Camembert cheese (DeBoer & Hiddink, 1980; Eriksen, 1986; Hansen, 1981; Kosikowski, 1986a), Feta and Mozzarella cheeses (Eriksen, 1985; Hansen, 1980, 1984; King, 1986; Kosikowski, 1986a; Kyle & Hickey, 1993; Novakovic & Alexander, 1988; Maubois, 1980), and Ricotta cheese (Eriksen, 1985; Ernstrom, 1986; Maubois & Kosikowski, 1978). Although several reports have described the manufacture of many varieties of soft cheeses, from cows' milk, using the MMV process, e.g. Cottage cheese (Kealy & Kosikowski, 1986; Versteeg & Hickey, 1993), Quarq cheese (Friis, 1981; Patel, Rueter, & Prokopek, 1986; Puhan & Gallmann, 1981; Sachdeva, Reuter, Prokopek, & Klobes, 1993), Cream cheese (Covacevich & Kosikowski, 1977), Chhana cheese (Sachdeva & Reuter, 1991; Sharma & Reuter, 1991), Kareish cheeese (El-Zayat & Omar, 1987; Hagrass, Renner, & Fayed, 1986), direct acidified soft cheese (Hydamaka, Wilbey, & Lewis, 2000), Teleme cheese (Antoniou, Kioulafi, & Sakellaroulos, 1995) and Domiati cheese (Abd El-Salam & El-Shibiny, 1982, 1983; Abd El-Salam, El-Shibiny, Ahmed, & Ismail, 1981, Abd El-Salam, El-Shibiny, El-Koussry, & Haggag, 1982; Ashour, Abdel Baky, & Neshawy, 1986; El-Hofi, 1984; El-Shibiny, Haggag, Ahmed, & Abd El-Salam, 1982; Ernstrom & Anis, 1985; Mahmoud, 1980; Omar, 1987), only one report was found in the literature on low-fat fresh cheeses made with a mixture of ultrafiltered cow, sheep and goats' milk (Rodriguez, Requena, & Juarez, 1998).

The objectives of this work were (1) to characterize the process for making fresh soft cheese (Domiati-type) from goats' milk, using liquid pre-cheese obtained by ultrafiltration, (2) to determine compositional characteristics and yield for cheese manufactured by conventional and UF processes, and (3) to evaluate sensory properties of cheese produced from goats' milk by the two processes.

2. Materials and methods

2.1. Materials

Fresh whole goats' (Jamunapri) milk was obtained from King Saud University Farm, Buriedah, Saudi Arabia. The milk was immediately cooled to 5 ± 1 ° C, transported to the laboratory and maintained cold until used. Rennet powder, calcium chloride (food quality grade), yogurt (B-6) starter (a mixed strain of *Streptococcus salivarius* ssp.*thermophilus* and*Lactobacillus delbrueckii* ssp.*bulgaricus*) and lactic ferment (CH-normal 01) starter (a mixed strain of *Lactococcus lactis* ssp. *cremoris, Lactococcus lactis* ssp.*lactis* and *Lactococcus lactis subsp. diacetylactis*) were obtained from Chr. Hansen's Laboratories A/S (Copenhagen, Denmark). Salt (sodium chloride) was obtained from a local market.

2.2. Ultrafiltration process

Thirty kilogrammes of raw whole goats' milk were pasteurized at 65 °C for 30 min. The pasteurized milk was cooled to 50 °C before ultrafiltration. Two bench-scale UF systems were used. Each system consisted of a feed tank for holding the milk, a Masterflex peristaltic pump (Cole-Parmer Instrument Co., Chicago, IL, USA) for recycling milk, two pressure gauges to monitor inlet and outlet pressures, a hollow fibre UF module with a polysulphone membrane of 30,000 molecular weight cut-off (MWCO) (Model UFP-30-C-4) obtained from A/G Technology, Needham, MA, USA, and a container to collect and measure the permeate. The UF process was started by pumping the milk at 50 ° C through the membrane module while maintaining inlet and outlet pressures of 137 and 35 k Pa, respectively. Permeate volume was monitored continuously to determine reduction in milk volume to a volume concentration ratio (VCR of 4). VCR was calculated as an initial volume of milk divided by concentrate (retentate) volume. When the VCR reached 4, the UF system was stopped and the retentate collected for manufacture of cheese. After each run, the membrane module was cleaned and disinfected according to the manufacturer's instructions and stored in a 5 °C cooler.

2.3. Cheese manufacturing

Three cheesemaking trials were conducted at our dairy technology laboratory. Two methods, conventional and ultrafiltration (UF) processes, were used to manufacture fresh soft white cheese (Domiati-type) from goats' milk. In the conventional process, 30 kg of whole goats' milk were equally divided into three portions for producing cheese with or without starter cultures as shown in Fig. 1. In the UF process, 7.5 kg of milk retentate, obtained from the UF process, were also equally divided into three portions for producing cheese with or without starter cultures (Fig. 2). Table 1 indicates the manufacturing parameters for fresh soft white cheese from goats' milk. Cheese samples were taken for analyses after one day.

2.4. Compositional analyses

Whole milk, milk retentate and cheese samples were analyzed for moisture and fat as described by Ling (1963). Nitrogen was determined by the micro-Kjeldahl method and salt (sodium chloride) by the modified Volhard test, according to Kosikowski and Mistry (1997b). A nitrogen conversion factor of 6.38 was used to calculate protein content. Ash was determined by

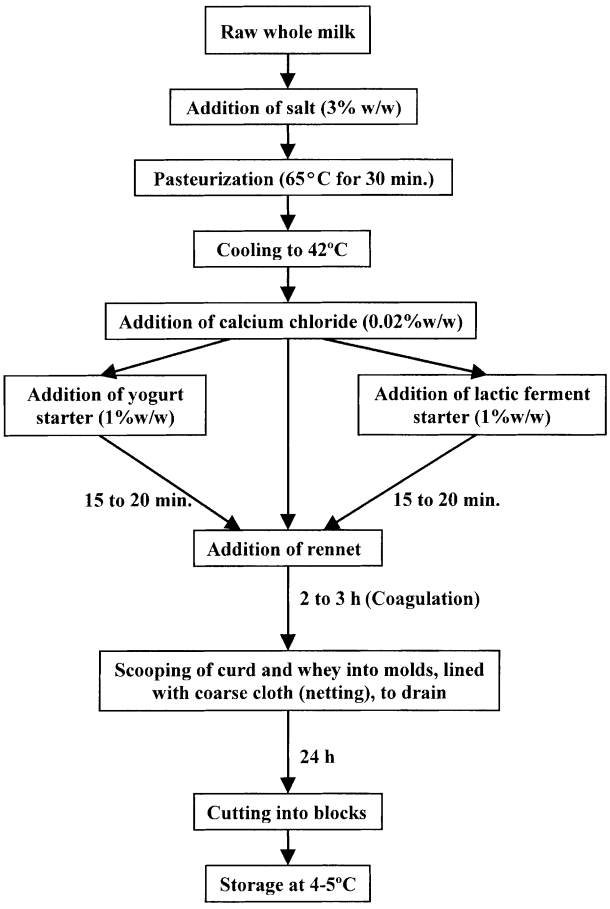

Fig. 1. Manufacturing procedure for fresh soft white (Domiati-type) cheese from goats' milk using conventional process with or without yogurt or lactic fermentation starter culture.

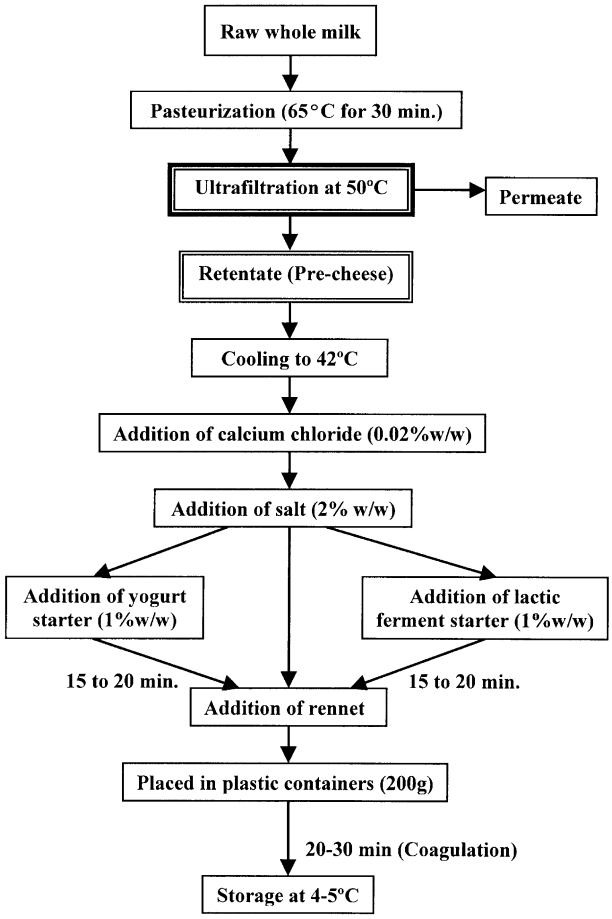

Fig. 2. Manufacturing procedure for fresh soft white (Domiati-type) cheese from goats' milk using ultrafiltration process with or without yogurt or lactic fermentation starter culture.

using a muffle furnace at 550 °C (AOAC, 1980). Titratable acidity was determined by titrating 10 g of sample with 0.1 N NaOH to a pink endpoint using phenolphthalein indicator (AOAC, 1980), and pH was measured with an Orion pH meter (Orion Research Inc., Cambridge, MA). All analyses of milk, milk retentate and cheese samples were done in duplicate. All reagents were of analytical grade.

2.5. Cheese yields and component recovery

Actual cheese yields were calculated as a weight of cheese divided by weight of milk expressed as kg 100 kg^{-1}. However, adjusted cheese yields were calculated according to the Lau and colleagues' equation (Kosikowski & Mistry, 1997a):

$$\text{Adjusted yield} = \text{Actual yield} \times \frac{[100 - (\text{actual\% water} + \text{actual\% salt})]}{[100 - (\text{desired\% water} + \text{desired\% salt})]}$$

Table 1
Manufacturing parameters for fresh soft white cheese (Domiati-type) from goats' milk

Process	Conventional	Ultrafiltration	% Reduction
Raw milk (kg)	10	10	–
Retentate (kg)	–	2.5	75
Salt used (g)	300 (3% w/w)	50 (2% w/w)	83.3
Starter used (g)	100 (1% w/w)	25 (1% w/w)	75
Rennet used (g)	2.0	0.35	82.5
Calcium chloride (mg)	2.0 (0.02%)	0.5 (0.0 2%)	75
Total process time (h)	28–30	4–5	83–85

Cheese yield efficiency was calculated by dividing the total cheese yield (kg 100 kg^{-1}) by percent total of fat, protein or total solids in milk. Component (protein, fat and milk total solids) recovery was calculated as the weight of the component in the cheese divided by the original weight of the component in the milk expressed as kg 100 kg^{-1}.

Table 2
Compositional characteristics (mean ± S.D.) of whole goats' milk used for manufacture of fresh soft white cheese (Domiati-type) (g 100 g^{-1})[a]

pH	Titratable acidity	Moisture	Fat	Protein[b]	Lactose	Ash
6.61 ± 0.05	0.17 ± 0.4	87.25 ± 0.16	3.3 ± 0.1	4.10 ± 0.13	4.49 ± 0.06	0.86 ± 0.02

[a] Means of duplicate analyses on each of three trials.
[b] Protein: total nitrogen × 6.38.

2.6. Sensory evaluation

Sensory evaluation of cheeses was performed after one day of storage at 5 ± 1 ° C. A panel of 12 university faculty and staff members who were familiar with soft white cheese (Domiati-Type) evaluated the cheeses. Sensory attributes of appearance, texture, flavour, and overall acceptability was considered by the panellists. A nine-point hedonic scale (Stone & Sidel, 1985) was utilized in this study (9 = like extremely; 5 = neither like nor dislike; and 1 = dislike extremely). Panellists were also asked to list defects, if any were detected. The cheeses were randomly coded with three-digit numbers. Cheeses manufactured on the same day were evaluated together. Each attribute was separately scaled and analyzed. Sensory attributes were analyzed for significance along with the other measurements, as described in Section 2.7.

2.7. Statistical analysis

Data from the cheesemaking trials was statistically analyzed using analysis of variance of the SAS package (SAS, 1985). Standard error (SE) of the means was derived from the error mean square term of the ANOVA. If the F test for the treatments within each trial was significant ($P < 0.05$), a protected least significant difference test (LSD) was used to compare treatment means.

3. Results and discussion

3.1. Cheesemaking processes

The manufacturing procedures, processing parameters, and composition of milk used for goats' milk cheese are summarized in Fig. 1 and 2 and Tables 1 and 2. Conventional and ultrafiltration (UF) processes were used to manufacture fresh soft white cheese from goats' milk with two different lactic cultures. Lactic cultures (mixed-strain cultures) are primarily responsible for the production of lactic acid and improve curd firmness; they suppress the growth of undesirable bacteria in the curd, and improve the flavour compounds which contribute to the aroma of fresh cheese (Chapman & Sharpe, 1983).

Manufacturing parameters for fresh soft white cheese from goats' milk using UF and conventional process are presented in Table 1. The UF process showed 83–85, 83.3, 75, 82.5 and 75% reduction in the total process time, salt, starter culture, rennet and calcium chloride used, respectively. A similar observation was reported by Hagrass et al. (1986) in fresh soft cheese (Kariesh) manufactured from cow's milk. Renner and Abd El-Salam (1991) reported that the amount of rennet needed for Domiati cheese made from ultrafiltered cow milk to a concentration factor of 4 (34% dry matter) could be reduced by 90%. Maubois and Mocquot (1975) reported that UF process saved 80% of the quantity of rennet usually needed for the preparation of a given weight of cheese. However, production of Domiati cheese by the UF process also eliminates the disposal problem associated with the highly salted whey of the conventional process. The benefits of using the UF process in cheesemaking have been summarized and reported by several authors (Cheryan, 1998; Cheryan & Alvarez, 1995; Kosikowski, 1986a; Lawrence, 1989; Renner & Abd El-Salam, 1991).

3.2. Compositional characteristics

Compositional characteristics of fresh soft white cheeses made from goats' milk are shown in Table 3. Cheeses made from goats' milk, using the conventional process or UF process, within the same treatment, were similar in moisture, fat, protein, salt and ash contents but significantly different in acidity and pH. However, cheeses made by the UF process had higher moisture and ash contents and lower fat and protein contents than did cheeses produced by the conventional process. The percentage of titratable acidity was significantly higher, and the pH was significantly lower, in cheeses made with yogurt or lactic fermentation cultures, using the conventional or UF processes, than in other cheese samples. The pH and acidity of UF cheeses were significantly ($P > 0.5$) higher than those of cheeses produced by conventional process. This difference appears to be due to the high buffering capacity occurring in cheeses made by the UF process (Brule, Moubois, & Fauquant, 1974; Covacevich & Kosikowski, 1979; Glover, 1985; Mistry & Kosikowski, 1984; Omar, 1987; Patel et al., 1986; Srilaorkul, Ozimek, Wolfe, & Dziube,

Table 3
Compositional characteristics of fresh soft white cheese (Domiati-type) made from goats' milk (g 100 g^{-1})[a]

Cheese samples[b]	pH	Titratable acidity	Moisture	Fat	Protein	Salt	Ash
CC	6.55a	0.22d	63.95b	14.2a	16.1a	2.20a	3.15b
CC-Y	5.81c	0.48b	64.10b	14.1a	16.2a	2.25a	3.21b
CC-LF	6.01c	0.43b	64.05b	14.2a	16.2a	2.28a	3.24b
UFC	6.57a	0.34c	66.20a	13.2b	15.7b	2.01b	3.85a
UFC-Y	6.46b	0.58a	66.29a	13.1b	15.6b	2.09b	3.89a
UFC-LF	6.45b	0.55a	66.27a	13.1b	15.7b	2.08b	3.92a

[a] Means of duplicate analyses on each of three trials. Means with same letter in the same column are not significantly different ($P < 0.05$).
[b] CC: conventional cheese; CC-Y: conventional cheese with yogurt starter; CC-LF: conventional cheese with lactic ferment starter; UFC: ultrafiltration cheese; UFC-Y: ultrafiltration cheese with yogurt starter; UFC-LF: ultrafiltration cheese with lactic ferment starter.

1989). Mehaia and El-Khadragy (1998) reported that the acidity of ultrafiltered goat skim milk increased during the UF process, whereas pH slightly decreased, indicating that UF milk has a high buffering capacity. In general the compositional characteristics of fresh soft white cheeses, made by conventional or UF processes, were within the normal composition range for fresh soft white Domiati cheese (Abd El-Salam et al., 1981, 1982; Abou-Donia, 1986; El-Hofi, 1984; El-Shibiny et al., 1982; Mahmoud, 1980; Omar, 1987).

3.3. Cheese yields and components recovery

Cheese yield is one of the most economically important aspects of cheese manufacturing. Abou-Donia (1986) reported that factors such as milk composition, addition of salt, pasteurization of milk, milk concentration, and addition of starter, affect the yield of Domiati cheese. A major advantage of the UF process is the inclusion of whey proteins and all the fat in the cheese, as whey drainage, is reduced or eliminated, thereby increasing cheese yield. However, incorporation of whey proteins raises cheese yield, due to the higher moisture level in UF cheeses, resulting from the greater water holding capacity of whey proteins (Lawrence, 1989).

Yield and recovery of protein, fat, and milk total solids of cheeses made from goats' milk are shown in Table 4, which clearly indicates that UF cheese yields are higher than those produced by the conventional process. For comparison of cheese yield between different vats, adjusted cheese yield at 60% moisture was calculated. Given the original amount of milk and the amount of retentate from the UF process, and considering that there was practically no whey loss from packaged cheese, the adjusted cheese yield of UF cheeses was 21.1%, whereas the adjusted cheese yield of conventional cheeses was 17.5%. An increase of 21% in adjusted cheese yields was achieved by the UF process, because of increased recovery of proteins, fat and milk total solids. El-Hofi (1984) reported that the cheese yield

Table 4
Mean[a] yields and recovery of fat, protein and milk total solids of fresh soft white cheeses (Domiati-type) made from goats' (kg 100 kg^{-1})[b]

Cheese sample[c]	Actual yield	Adjusted yield	Recovery		
			Fat	Protein	Total solids
CC	19.5b	17.4b	84c	77c	55c
CC-Y	19.8b	17.5b	85bc	78bc	56bc
CC-LF	20.1b	17.5b	87b	80b	57b
UFC	25.2a	21.1a	100a	97a	67a
UFC-Y	25.3a	21.1a	100a	97a	67a
UFC-LF	25.3a	21.1a	100a	97a	67a

[a] Means of duplicate analyses on each of three trials. Means with same letter in the same column are not significantly different ($P < 0.05$).
[b] Cheese corrected to 60% moisture.
[c] CC: conventional cheese; CC-Y: conventional cheese with yogurt starter; CC-LF: conventional cheese with lactic ferment starter; UFC: ultrafiltration cheese; UFC-Y: ultrafiltration cheese with yogurt starter; UFC-LF: ultrafiltration cheese with lactic ferment starter.

of Domiati cheese produced from ultrafiltered cow milk could be increased by about 31%. Moreover, Renner and Abd El-Salam (1991) reported that the yield of UF Domiati cheese was increased by about 20% and the UF cheese had normal properties compared with the traditional product. However, greater cheese yields are accompanied by higher milk solids recovery. Rodriguez et al. (1998) reported that the average cheese yield was high for fresh low-fat cheese made from a mixture of cow, sheep and goat milks using the UF process. Higher cheese yields, using the UF process, have been reported for other types of cheese (Cheryan, 1998; Eriksen, 1986; Ernstrom, Sutherland, & Jameson, 1980; Hydamaka, Wilbey, & Lewis, 2001; King, 1986; Kosikowski, 1986a, 1986b; Kyle & Hickey, 1993; Lelievre & Lawrence, 1988; Maubois & Mocquot, 1975; Veinoglou & Boyazoglu, 1982). However, the average actual cheese yield obtained from goats' milk (19.5–25.3%), using conventional or UF process, was in agreement with that reported from cow's milk, 20.6–24.6% (Ashour et al.,

Table 5
Mean[a] yields efficiencies of fresh soft white cheeses (Domiati-type) made from goats' milk[b]

Cheese sample[c]	Cheese (kg^{-1})		
	Fat	Protein	Total solids
CC	5.27b	4.24b	1.36b
CC-Y	5.30b	4.27b	1.37b
CC-LF	5.30b	4.27b	1.37b
UFC	6.34a	5.15a	1.65a
UFC-Y	6.34a	5.15a	1.65a
UFC-LF	6.34a	5.15a	1.65a

[a] Means of duplicate analyses on each of three trials. Means with same letter in the same column are not significantly different ($P<0.05$).

[b] Cheese corrected to 60% moisture.

[c] C: conventional cheese; CC-Y: conventional cheese with yogurt starter; CC-LF: conventional cheese with lactic ferment starter; UFC: ultrafiltration cheese; UFC-Y: ultrafiltration cheese with yogurt starter; UFC-LF: ultrafiltration cheese with lactic ferment starter.

Table 6
Mean[a] taste panel scores for fresh soft white cheeses (Domiati-type) made from goats' milk[b]

Cheese sample[c]	Appearance	Texture	Flavour	Overall acceptability
CC	7.05d	5.20d	6.68b	5.92b
CC-Y	7.50c	6.86c	7.90a	7.58a
CC-LF	7.55c	6.91c	7.95a	7.62a
UFC	8.01b	7.84b	6.65b	6.01b
UFC-Y	8.27a	8.02a	8.01a	7.69a
UFC-LF	8.25a	8.01a	7.98a	7.61a

[a] Means of duplicate analyses on each of three trials. Means with same letter in the same column are not significantly different ($P<0.05$).

[b] Nine-point scale (9 = like extremely, 5 = neither like nor dislike, and 1 = dislike extremely).

[c] C: conventional cheese; CC-Y: conventional cheese with yogurt starter; CC-LF: conventional cheese with lactic ferment starter; UFC: ultrafiltration cheese; UFC-Y: ultrafiltration cheese with yogurt starter; UFC-LF: ultrafiltration cheese with lactic ferment starter.

1986; Ibrahim et al., 1974), but was lower than that reported from buffalo's milk, 32.9–35.3% (Asker, Gaafar, Magdoub, & Sheta, 1982; Ibrahim et al., 1974). Cheese yield efficiencies (Table 5), expressed as kilogrammes of cheese (60% moisture) obtained per kilogramme fat, protein, or total solids, were significantly ($P<0.05$) higher for UF cheeses, confirming the advantage of the UF process.

Cheese recovery values for fat, protein, and milk total solids are also shown in Table 4. In all cheeses, fat recovery (84–100%) was higher than protein recovery (77–97%), whereas total solids recovery (55–67%) was low. An increase of 21–6% in protein recovery, 15–19% in fat recovery and 17–22% in total solids recovery was achieved by the UF-process. However, the recoveries of fat, protein and total solids were significantly ($P<0.05$) higher for UF cheeses. This was consistent with the reported findings on milk concentrated with an UF membrane (Bastian, Collinge, & Ernstrom, 1991; Glover, 1971; Green, Scott, Anderson, Griffin, & Glover, 1984; Mehaia, 1996; Mehaia & El-Khadragy, 1998; Pompei, Resmini, & Peri, 1973). Similar observations were reported by Hydamaka et al. (2001) for acid coagulated cheese made from ultrafiltered milk retentates.

3.4. Sensory evaluation

Mean scores of the sensory panels for cheeses made from goats' milk, using conventional and UF processes, are listed in Table 6. These data show that appearance, texture, flavour, and overall acceptability of cheeses were affected by manufacturing process and by the addition of yogurt or lactic ferment starter culture to cheese milk. Cheeses made by the conventional process scored lower for appearance and texture than those made by the UF process. However, Omar and Buchheim (1986) reported that UF Domiati cheese had a uniform and closed texture, good appearance and better organoleptic properties than the cheese made by the conventional process. Mahmoud (1980) reported that the texture of UF cheeses were smoother than those obtained by the conventional method. Hagrass et al. (1986) reported that Kariesh cheese made by conventional process was characterized by an opened texture, while UF cheese had a homogeneous closed texture as shown by the electron microscopical study.

The mean scores for appearance, texture, flavour, and overall acceptability of cheeses made with yogurt or lactic ferment starter culture, using UF or conventional process, were significantly higher ($P<0.05$) than mean scores for other cheeses, indicating that cheeses made with cultures were the most acceptable cheeses. The least acceptable cheese was that made by conventional process without the addition of lactic culture. No differences ($P<0.05$) were found in flavour and overall acceptability between cheeses made using UF or conventional process.

Mamoud (1980), Omar (1987) and Omar and Buchheim (1986) reported that a good quality Domiati cheese was produced from cow's milk using the UF process compared with that made by the conventional method. Kyle and Hickey (1993) reported that Feta cheese manufacture, using the UF process, appears to improve product acceptability. Rodriguez et al. (1998) reported that, using ultrafiltered semi-skim milk, fresh cheeses with acceptable quality and reduced fat content were produced. Hydamaka et al. (2001) reported that acid-coagulated cheese made from ultrafiltered milk scored significantly ($P<0.05$) higher than cheese from whole milk in terms of sensory data, which included the attributes of flavour, texture, and appearance. Hagrass et al. (1986) reported that UF Kariesh cheeses had higher sensory quality than conventional cheeses.

4. Conclusions

By using goats' milk concentrated by ultrafiltration to the volume concentration ratio of four (total protein of 15.2%), it was possible to make fresh soft white cheese (Domiati-type) with acceptable characteristics.

Compositional characteristics of cheeses obtained from this study compared favourably with Domiati cheese characteristics reported from cow (Abou-Donia, 1986). The cheese made by the UF process was higher in pH, moisture content and ash, whereas protein and fat contents were lower compared to those cheeses made by the conventional process. An increase of 21% in cheese yields, 21–26% in protein recovery, 15–19% in fat recovery and 17–22% in total solids was achieved by the UF process. Moreover, the UF process showed 83–85, 83.3, 75, 82.5 and 75% reduction in the total process time, salt, starter culture, rennet and calcium chloride used, respectively.

The mean score for appearance and texture of cheeses made by UF was significantly ($P<0.05$) higher than that of cheeses made by the traditional process. However, no differences ($P<0.05$) were found in flavour or overall acceptability between cheeses made using UF or the traditional process. Moreover, fresh soft white cheeses made with yogurt or lactic ferment starter culture were the most acceptable cheeses, whereas the least acceptable cheese was that made by the conventional process without lactic cultures.

Acknowledgements

The Agricultural and Veterinary Research Centre, College of Agriculture and Veterinary Medicine, King Saud University-Qassim, Buriedah, Saudi Arabia supported this research. The author is very grateful to Mr. Saad M. El-Khadragy for his technical assistance in chemical analysis.

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