Ripening Changes in Cephalotyre "RAS" Cheese Manufactured from Raw and Pasteurized Milk with Special Reference to Flavor

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Abstract

Ripening changes in Cephalotyre cheese, the most popular hard type produced in the United Arab Republic under the name of Ras Cheese, were investigated for flavor. Experimental Ras cheeses were manufactured from raw and pasteurized milk. The chemical changes during ripening for six months were examined for composition and chemical changes that affect flavor intensity; namely, acidity, pH, soluble protein, lactose, and total volatile fatty acids. Cheeses of the two treatments were evaluated for flavor, body, and texture after 3 months, the time commonly held before this cheese can be marketed with consumer acceptability.

Raw milk cheese scored much higher for flavor. There was a close relationship between good flavor and high total volatile acidity. Milder flavor was associated with moderate soluble protein and low volatile acidity. On the other hand, pasteurized milk cheese had a more compact body and smoother texture, and fewer holes and cracks. Nevertheless, pasteurized milk Ras cheese may not withstand technological and economic competition from raw milk cheese until the inferior flavor problem can be solved.

Introduction

Cephalotyre cheese, known in the United Arab Republic as Ras Cheese, is one of the popular hard cheeses in the Mediterranean countries, particularly in the Middle and Near East. According to Sanders (16) Cephalotyre cheese is similar to Caskawal, both originally being made from goat's or cow's milk. When fully ripened it has a pungent flavor popular with Egyptians. Owing to the similarity of Ras and Caskawal cheeses in body, texture, and flavor they are sometimes marketed under the name Roumy Cheese. However, Ras cheese is characterized by its simpler manufacturing technique, for which market supplies of locally produced hard cheeses are mostly from the Ras cheese.

Although some experiments were performed on locally produced Caskawal cheese by Safwat (15) as well as Hofi and Tawab (8), no available information could be found for the Ras cheese. The uncontrolled traditional methods adopted by private producers, dependent on raw milk for manufacturing the Ras cheese, were responsible for its wide variations in compositional and ripening qualities (21).

According to the recent trend, to ensure uniform production all dairy products are supposed to be produced from heat-treated milk. Therefore, our work was planned to investigate some chemical characteristics of Ras cheese manufactured from raw and pasteurized milk with special reference to flavor intensity.

Experimental Procedures

Cheesemaking. Two treatments of cheese, with 3 replicates, were conducted. The first was manufactured from raw milk, and pasteurization (82.2 C for 1 min) was applied to the second one. The buffalo and cow milk mixtures recommended by Safwat (15) were used. For each replicate 45 kg of equal parts of mixed buffalo and cow milk (5% fat) were used, resulting in a cheese weighing about 6 kg. The manufacturing technique of Tawab (19) was used. It is comparable to that for Dutch Gouda cheese, with the following differences: Heating temperature is higher, to about 44 C in 15 minutes and then held for about 30 minutes, acidity being about 0.14%. Salting is done in two stages, the first when curd is still in the whey and the second by sprinkling ground salt on the two sides daily for about 12 days.

Sampling. Cheeses were sampled on the first day of production, after 2 weeks, and then

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at 1, 2, 3, and at the end of 6 months of ripening. A clean cheese trier was used to obtain 4 to 6 plugs extending from one flat surface to near the other, and taken equal distances on a straight line passing through the center of the cheese. The lines of subsequent samplings of the same cheese were so made that they finally divided the surface of the cheese into equal wedges. The holes were immediately filled with sterile melted paraffin (7).

About 1 cm at both ends of each plug was discarded. The plugs were passed through a small mincing machine before being placed in a tightly sealed jar and labeled. They were kept at about −22 C.

Methods of cheese analysis. Moisture, total and soluble protein, salt, and acidity were determined according to Ling (11). The Gerber method (2) was used for estimating the fat. A Radelkls pH meter with a glass electrode was used. Barnett and Tawab's (1) technique was adopted for determining lactose colorimetrically. Total volatile fatty acids (milliliters of N/10 acid per 100 g of cheese) were assessed as given by Smiley et al. (17). Cheeses were also scored for flavor (60 points) and also for body and texture (40 points) when they were 3 months old, the usual age for satisfactory ripening.

Results and Discussion

Analytical data for raw and pasteurized milk cheese are in Tables 1 and 2.

Moisture. Pasteurized milk cheese retained more moisture than raw milk cheese due to higher pH and softer curd (4, 6, 20). The average moisture of pasteurized cheese was 34.95 compared to 31.92% for raw milk cheese after 3 months of ripening. Most of the loss occurred during the first 2 weeks after manufacture, being about 5% in both cheeses. The reason for this loss may be attributed to the second stage of salting, done during this period. Market Ras cheese examined by Youssef (21) had a mean moisture of 34.82%.

Fat content. The average fat contents on dry basis were 56.34% for raw milk cheese and 51.87% for pasteurized milk cheese after 3 months of ripening. Market Ras cheese had a lower average of 48.56%.

pH value. There was a gradual decrease in pH of all cheese (raw and pasteurized) during the early stages, followed by a gradual increase later (Tables 1 and 2). Brown and Price (3) and Phillips (13) reported similar results for Cheddar cheese. Price (14) also reported a correlation between high acidity and the in-

TABLE 1. Analytical data of raw-milk Cephalotyre "Ras" cheese (average of 3 replicates).

Age	Moisture	Fat	Dry[a] matter	pH	Salt	Dry matter	Protein			Soluble protein coef[b]	Lactose	Volatile fatty acids[c]
							Total	Dry matter	Soluble			
	(%)						(%)					
Day 1	39.03	34.00	57.07	4.97	0.74	1.21	21.35	35.02	0.90	4.36	0.4	58.68
Week 2	34.70	36.70	56.20	4.90	1.18	1.81	22.62	34.62	2.30	10.17	0.2	66.13
Month 1	33.77	37.88	57.20	4.90	1.76	2.66	23.87	36.04	3.10	12.99	0.2	75.58
Month 2	32.84	38.08	56.70	4.83	2.25	3.35	24.66	36.72	3.60	14.00	0.15	167.08
Month 3	31.92	38.36	56.34	5.05	2.28	3.35	26.25	38.56	4.50	17.14	0.1	190.36
Month 6	30.03	39.26	56.11	5.03	2.03	2.90	27.18	38.85	5.30	19.50	0.1	222.44

[a] Dry matter basis.

[b] Soluble protein coefficient $= \frac{\text{Soluble protein}}{\text{Total protein}} \times 100.$

[c] Milliliters of N/10 acid per 100 g cheese.

TABLE 2. Analytical data of pasteurized-milk Cephalotyre "Ras" cheese (average of 3 replicates).

Age	Moisture	Fat	Dry[a] matter	pH	Salt	Dry matter	Protein Total	Protein Dry matter	Protein Soluble	Protein Soluble protein coef[b]	Lactose	Volatile fatty acids[c]
	(%)				(%)							
Day 1	45.46	29.75	53.13	5.50	1.06	1.94	22.36	41.00	0.67	3.09	0.5	47.74
Week 2	40.78	31.25	52.14	5.32	1.73	2.92	24.66	41.64	1.50	6.08	0.3	48.73
Month 1	38.17	32.93	52.19	5.25	2.51	4.06	26.49	42.84	2.80	10.57	0.2	51.71
Month 2	37.15	33.83	52.30	5.23	2.80	4.58	26.97	42.91	3.00	11.12	0.2	54.20
Month 3	34.95	34.57	51.87	5.25	2.61	4.01	28.16	43.29	3.60	12.78	0.2	55.69
Month 6	34.20	34.90	52.37	5.53	2.89	4.39	28.95	44.00	4.50	15.54	0.15	62.65

[a] Dry matter basis.

[b] $\text{Soluble protein coefficient} = \frac{\text{Soluble protein}}{\text{total protein}} \times 100.$

[c] Milliliters of N/10 acid per 100 g cheese.

cidence of bitter flavor in Cheddar cheese. Phillips (13) stated that high-acid cheese ripens less rapidly than that with lower acidity.

Salt content. Ras cheese is salted at two stages, before and after pressing. In the first stage, the heated curd is lightly salted in brine. The second stage, continuing for almost 2 weeks after manufacture, is the most effective. Average salt contents of ripened cheese from pasteurized milk were 2.61 versus 2.28% for that made from raw milk after 3 months. Market samples ranged from 2.81 to 4.90%, averaging 3.88%. There is a gradual increase in salt content to the second month, then it remains almost constant until the end of the ripening period. Dry salting of Ras cheese is a slow process. Besides their unsuitability for large-scale production, resultant cheeses would definitely lack uniformity in salt content. Salting by brine solution or any other method should be considered.

Protein content. The higher total protein in cheese made from pasteurized milk may be due to lower fat as well as partial denaturation of soluble proteins by heat and their retention in the resulting paracasein curd (9,10).

Results indicate that raw milk cheese had a higher initial soluble protein coefficient of 4.36 versus 3.09% for pasteurized milk cheese. Rate of increase in soluble protein was less for pasteurized milk cheese, due to the effect of heat on the natural flora and enzymes of milk known to affect protein degradation. Besides these two ripening agents, the amount of decomposed protein and the degree of decomposition would also depend on age, moisture, acidity, and type of cheese (9). After 3 months of ripening, usual time for marketing Ras cheese, the soluble protein coefficient was 17.14 for raw cheese and 12.78% for pasteurized cheese. The corresponding values at the end of 6 months were 19.50 and 15.54%.

Lactose content. Decrease in lactose was most apparent during the first 2 weeks, amounting to 50% in raw milk cheese and 60 % in pasteurized milk cheese. In this connection, Swartling and Mattison (18) reported that lactose disappeared in Herrgard cheese from 2 to 24 days after manufacture. However, lactose did not disappear entirely until the end of the sixth month. Mention should be made that Dolby et al. (5) reported that lactose could be detected in Cheddar cheese four months after manufacture.

Total volatile fatty acids. Results in Tables 1 and 2 show that raw milk cheese contained 58.68 ml of volatile fatty acids per 100 g on

the first day of production, compared to 47.74 ml in the pasteurized milk cheese. The corresponding values after three months of ripening were 190.36 versus 55.69 ml and after 6 months 222.44 and 62.65 ml. These fatty acids increased continuously at all stages of ripening but much faster in the raw milk cheese.

Higher volatile fatty acids in raw milk cheese than in the one pasteurized could be attributed to differences in their bacterial types as well as the precursors of these acids in cheese. Similar results have been reported by Peterson et al. (12) for Cheddar cheese made from raw and pasteurized milk. They attributed the differences to a large reduction by pasteurization of bacterial species capable of liberating intracellular lipases. However, bacterial lipases have been considered responsible by the same investigators for splitting milk fat, with the production of more volatile fatty acids.

Comparing the information obtained for volatile fatty acids with that of similar types, Hofi and Tawab (8) reported a range of 28.5 to 103.0 ml, with an average of 62.8 ml for a market sample of locally produced Caskawal cheese. Cheeses containing from 83.5 to 103.0 ml had a sharp flavor, whereas those containing from 51.0 to 66.0 ml per 100 g of cheese had a strong flavor, and those below were graded as "poor."

Scoring. Ras cheeses were scored for flavor and body and texture by a panel of the Dairy Research Control, Ministry of Agriculture, Cairo, after 3 months. Results in Table 3 indicate that raw cheese replicates were much higher in flavor and slightly lower for body and texture scores. However, these results were expected for flavor, because of the effect of pasteurization. When scores were compared with the analytical data in Tables 1 and 2, a close relationship between strong flavor and higher volatile fatty acidities was evident. Less flavor in pasteurized cheese could be attributed to less soluble protein and lower volatile acidity. Similar observations have been reported by Hofi and Tawab (8) for Caskawal cheese. Safwat (15) stated that Caskawal cheese flavor is directly related to the extent of protein degradation and is greatly affected by the hydrolysis of fat.

TABLE 3. Scores for Cephalotyre "Ras" cheese made from raw and pasteurized milk.

Milk source	Cheese experiment	Flavor 60	Body and texture 40	Total 100
		—(scores)—		
Raw	1	55	30	85
	2	50	25	75
	3	50	30	80
Average		52	28	80
Pasteurized	1	35	35	70
	2	35	30	65
	3	30	35	65
Average		33	33	67

Cheeses made from pasteurized milk had superior body and texture, smoother texture and fewer holes and cracks. Smoothness may be attributed to higher pH and moisture. The effect of heat caused a softer curd. Raw cheeses had a slight harshness in texture and some gassiness.

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