



Influence of different level of casein/fat ratio on textural characteristics of buffalo feta type cheese

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ABSTRACT

The effect of different level of casein/fat (C/F) ratio on textural characteristics of buffalo feta type cheese were investigated up to 2 months of ripening. The rate and extent of textural development during ripening can be monitor by measuring some of the quantifiable rheological characteristics of cheese in terms of hardness, cohesiveness, springiness, gumminess and chewiness were determined by employing textural profile analyzer (TPA) during ripening period at 15 days interval. The maximum hardness was found with cheese prepared using C/F ratio of 0.80, while the minimum hardness was found with C/F ratio of 0.60 throughout the ripening period. The maximum cohesiveness and springiness was found in cheese made with C/F ratio of 0.80 and minimum cohesiveness and, springiness was found in cheese made with C/F ratio of 0.60. However, cohesiveness and springiness of all experimental cheeses decreased throughout the ripening period.

Key words: Casein/fat, Feta cheese, Ripening, Textural characteristics

Feta, a soft white-brined cheese, is made from sheep's milk alone or from mixture with goat's milk. Presently, there is a great scope for manufacture of feta cheese from buffalo milk and its export to middle-east countries. Mild acidic flavour of this cheese may be even popular in India. The texture of cheese depends upon the cheese composition and the extent of biochemical changes during ripening (De Jong 1976, Lawrence *et al.* 1987).

The selection of proper level C/F ratio in preparation of buffalo feta type cheese is very important not only with respect to sensory characteristics but also to textural attributes of buffalo feta type cheese. The desirable texture of feta cheese is also depends upon the level of C/F ratio. The effect of different level of C/F ratio on textural attributes of feta type cheese has not been studied earlier from buffalo milk using microbial rennet. The objective of this study was to determine the best desirable textural characteristics among the buffalo feta type cheese made using C/F ratio of 0.60, 0.70 and 0.80.

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MATERIALS AND METHODS

Preparation of feta cheese from buffalo milk: Buffalo milk was standardized to different C/F ratio of 0.60, 0.70 and 0.80 in different cheese vat. The standardized buffalo milk was subjected to heat treatment 63°–65°C with a holding time of 30 min and cooled in a cheese vat to 30–35°C. Thereafter, mesophilic cheese culture (NCDC-149), @ 1.5 by weight of cheese milk were added to the different cheese vat. Subsequently, after 40–50 min, cheese milk was renneted at 31–32°C and coagulation took place in 40–50 min. The curds were cut into approximately 1–2 cm cubes with vertical and horizontal knives and left undisturbed for 10–20 min for removal of whey and the curds were transferred into perforated moulds lined with muslin cloth for further removal of whey and texturization of cheese curd without pressure. Whey was collected and stored at 5°C for making brine. Moulds were turned every 2–4 h to form a firm curd. After 4–5 turns, the moulds were left undisturbed for about overnight. Subsequently, cheese blocks were cut into uniform size and transferred to the whey brine solution for about 22–24 h. Cheese blocks were then transferred into plastic packages for vacuum packaging. Subsequently, vacuum packaged cheeses were stored for maturation at 10 ± 1°C and relative humidity of 80%.

Packaging of feta cheese: Feta cheese samples were packaged under vacuum by using a vacuum chamber machine

after establishing a vacuum of 20 mm of Hg (< 0.70 kpa).

Cheese analysis: Cheese samples from each lot were taken for analysis at 1, 15, 30, 45 and 60 days after manufacture. All the analysis was made five replicates.

Textural analysis: Various textural characteristics such as hardness, cohesiveness, springiness, gumminess and chewiness were measured for feta type cheese using a commercial analyzer.

A cylindrical shape of feta type cheese sample with 1 cm diameter and 1 cm height was used for determining the textural characteristics. A data acquisition rate 200 pps with probe P75 were used and samples were compressed twice to 80% of its height. The probe speed of 2.5 mm/sec during test and 2.5 mm/sec for pre and 5.0 mm/sec post- test were used throughout the study. All measurements of samples were carried out at $25 \pm 1^\circ\text{C}$.

Data analysis: The data were statistically analyzed using the SYSTAT Software (version 6.01). In all experiments, 1-way/2-way analysis of variance (ANOVA) with subsequent least significant difference (LSD) test was applied for multiple sample comparison. This was done to test for any significant differences ($P < 0.05$ and 0.01) in the mean value of all the groups as described by Snedecor and Cochran (1989).

RESULTS AND DISCUSSION

Hardness of feta cheese: Hardness is the forces necessary to the material to produce a given deformation. The effect of C/F ratio on hardness during ripening period is illustrated in Fig. 1. The maximum hardness (40.60N) was found in cheese with C/F ratio of 0.80, followed by C/F ratio of 0.70 (28.42 N) and C/F ratio of 0.60 (23.04 N), respectively. Our findings were in close agreement with the result of Das (1996) who reported that the higher values of hardness observed for gouda cheese made with higher C/F ratio cheese milk. This may be due to higher protein content in high C/F ratio cheese and protein content has positive correlation with hardness. De Jong (1976), reported a linear relationship between the protein content of cheese and firmness.

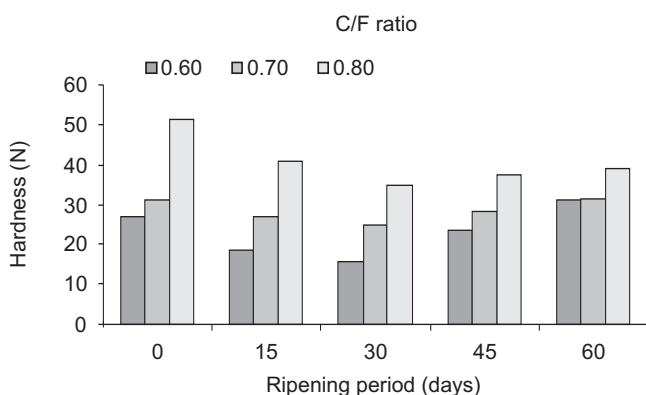


Fig. 1. Effect of levels of C/F ratio on hardness (N) of Feta cheese.

The hardness of all experimental cheese were decreased up to 30 days, thereafter, increased upto 60 days in all C/F ratio cheeses. The minimum hardness (15.47 N) was found with C/F ratio of 0.60 at 30 days of ripening. The early decrease in hardness (before 30 days) may be due to hydrolysis of α_{s1} -casein to α_{s1} -1-casein. Creamer and Olson (1982) suggested that the hydrolysis of α_{s1} -casein to α_{s1} -1-casein is responsible for early softening of high moisture cheeses. Pappas *et al.* (1996) also suggested that increased degradation of α_{s1} -casein during ripening softens the cheese. However, after 30 days onwards, the hardness of all experimental C/F ratios of feta cheese increased could be due to the fact the extent of proteolysis, probably is not sufficient enough to compensate to the loss of moisture in cheese towards the end of ripening period. The change in the state of water could also be the reason for this development. As such peptide bond is cleaved, two new ionic groups are generated and each of these will compete for the available water in the system.

Thus, the water previously available for solvation of the protein chain will become tied up with the new ionic group, leading to the increase in the hardness of cheese (Creamer and Olson 1982). Kavas *et al.* (2004) also supplemented our result that low-fat cheese was harder than the full-fat cheese for white pickled cheese. Ustunol *et al.* (1995) also reported similar result for Cheddar cheese.

Cohesiveness of feta cheese

Cohesiveness is defined as the extent to which a material can be deformed before its rupture. The effect of C/F ratios on cohesiveness of feta cheese during ripening period is illustrated in Fig. 2. The maximum cohesiveness as 0.26 was found in C/F of 0.80, while the minimum cohesiveness as 0.22 was found in cheese with C/F ratio of 0.60. This finding was found to be similar with the finding of Das (1996), reported that initial cohesiveness value of gouda cheese increased with the increase in C/F ratio content of the cheese. The cohesiveness value was decreased as the ripening period progressed irrespective of all C/F ratios cheeses.

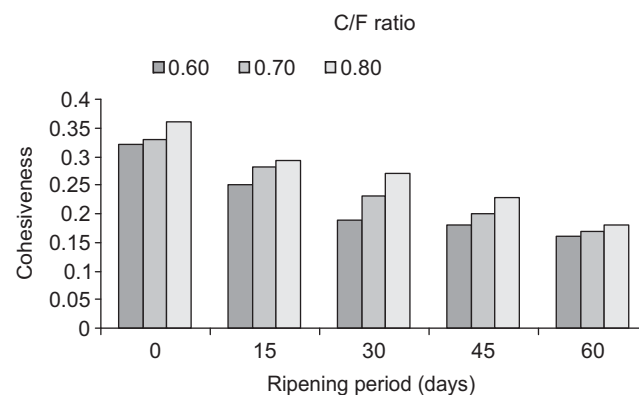


Fig. 2. Effect of levels of C/F ratio on cohesiveness of feta cheese.

The highest cohesiveness value was found with high C/F ratio cheese and vice-versa. It may be due to higher protein and lesser fat in high C/F ratio cheese milk. Fat content was found to have little or no effect on the cohesiveness which is supported by Yang and Taranto (1982). Ghosh (1987) also observed that cohesiveness of Mozzarella cheese decreased with the increase in ripening period irrespective of different fat level as found in our study. Erdem (2005) also reported that cohesiveness of white brined cheeses decreased as the ripening period progressed. This can probably be higher level of proteolysis in these cheeses with the increase in ripening period.

Springiness of feta cheese: Springiness is the rate at which the sample returns to its original shape when the deforming force is removed. The effect of C/F ratio on springiness of feta cheese during ripening period is illustrated in Fig. 3. It reveals that the springiness value of 0.26 mm was found maximum in C/F ratio 0.80, while the minimum springiness of 0.42 mm was found with C/F ratio of 0.60. This was in agreement with the result of Das (1996) who reported that springiness of fresh low-fat gouda cheese increased with increase in C/F ratio. The springiness value in all experimental C/F ratio cheeses were decreased as the ripening period progressed.

Our finding was in accordance with the Erdem (2005) who reported that springiness index of white brined cheeses decreased as the ripening period increased up to 3 months. Ghosh (1987), also reported that springiness value of Mozzarella cheese decreased during ripening irrespective of different level of fat. It could be attributed to the release of calcium ions from monocalcium and calcium para- ϵ -caseinate molecules and to the hydrolysis of these molecules during ripening. These molecules are reported to be responsible for the springiness of cheese curd (Van Slyke and Price 1952). In addition to this, the increase in proteolysis was responsible for decrease in springiness. Thus, the proteolysis in cheese is significantly negatively correlated with springiness (Lawrence *et al.* 1987).

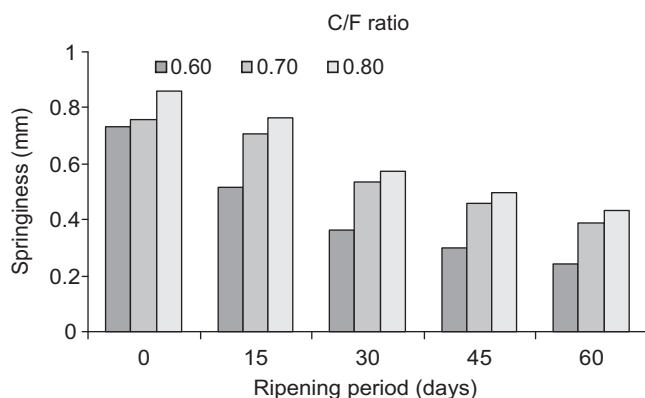


Fig. 3. Effect of levels of C/F ratio on springiness (mm) of feta cheese.

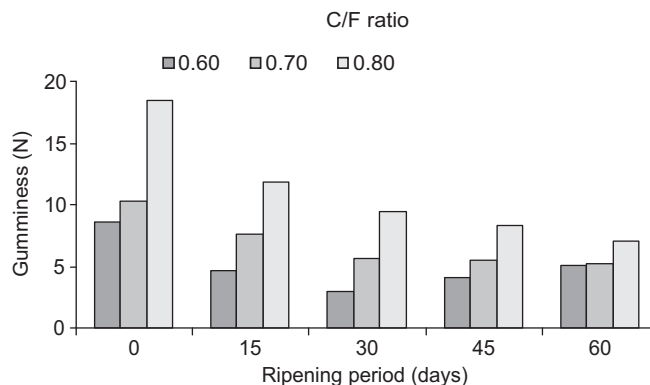


Fig. 4. Effect of levels of C/F ratio on gumminess of feta cheese.

Gumminess of feta cheese: Gumminess is the energy required to macerate or disintegrate semisolid food to a state ready to swallowing. The effect of different level of C/F ratio on gumminess of feta cheese during ripening period illustrated in Fig. 4.

The gumminess value as 10.89 N was found maximum in cheese manufactured from C/F ratio of 0.80. However, the minimum gumminess value (5.06 N) was found with C/F ratio of 0.60. Our findings were in accordance with the results of Das (1996) who reported that gumminess value increased with the increase in C/F ratios for the gouda cheese. This was also in agreement with the result of (Sundar and Upadhyay 1991) who reported that lower gumminess value for lower C/F ratio and higher gumminess value for higher C/F ratio for Mozzarella cheese made from buffalo milk. Kavas *et al.* (2004) also supplemented that the low-fat (higher C/F ratio) cheese were gummier than the full-fat cheese in case of white pickled cheese.

Chewiness of feta cheese: Chewiness is the work needed to masticate a semisolid food to a state ready for swallowing. The effect of different C/F ratio on chewiness during ripening period is illustrated in Fig. 5. The maximum chewiness value (7.49 N.mm) was found with cheese of C/F ratio 0.80 and the minimum chewiness value (2.43 N.mm) was found with cheese using C/F ratio of 0.60. Our finding was in accordance

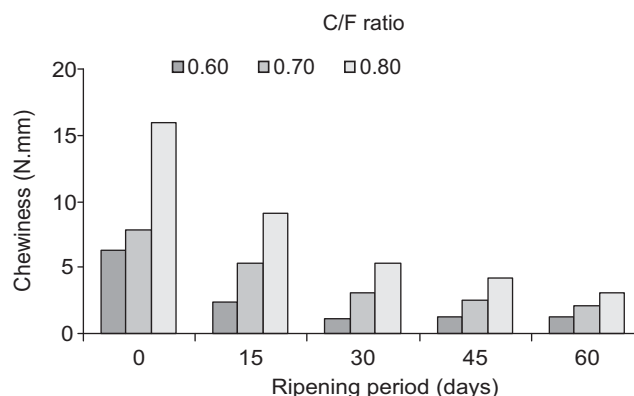


Fig. 5. Effect of levels of C/F ratio on chewiness of feta cheese.

with the finding of Das (1996), who reported that chewiness value increased with the increase in C/F ratio and the highest value observed with high C/F ratio cheese and vice-versa for gouda cheese. Our results further supported by the finding of Sundar and Upadhyay (1991), who also reported that lower chewiness value is with the low C/F ratio cheese and vice-versa for the Mozzarella cheese made from buffalo milk. Kavas *et al.* (2004) also reported that low fat cheese were more chewy than the full fat cheese in white pickled cheese. Ustunol *et al.* (1995), also reported similar finding in case of Cheddar cheese.

The overall result of this study indicated that the hardness of buffalo feta type cheese increased with the increase in C/F ratio and vice-versa. The hardness of all experimental cheeses decreased up to 30 days of ripening, thereafter, increased up to 60 days of ripening. In addition to this, the springiness and cohesiveness of cheese also increased with the increase in C/F ratio, but their value decreased throughout the ripening period in all experimental cheeses. A C/F ratio of 0.70 was found with close desirable characteristics of feta cheese.

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