CHAPTER - 5

Summary and Conclusions
5.0 SUMMARY AND CONCLUSION

Chhana serves as a base material and filler for a large variety of Indian sweetmeats like cham-cham, sandesh, rasogolla, chhana murki, chhana podo, rasomalai etc. A compact close-knit smooth texture and a soft body of chhana are desirable for manufacture of good quality cham-cham. Buffalo milk as such is not suitable for chhana and cham-cham making due to high calcium and casein contents, which results in production of hard chhana, rendering it unfit for making cham-cham. In view of the above problems, it was planned to develop a suitable technology for the production of chhana from buffalo milk so that a good quality cham-cham could be produced. The results obtained during the course of the research are summarized and concluded in this chapter.

5.1 Modifications in the technology for production of chhana from Buffalo milk

5.1.1 Different temperature of coagulation such as 85, 80, 75 and 70°C were investigated for getting good quality chhana suitable for preparation of cham-cham. Among all, 70°C was found suitable as cham-cham produced was soft, succulent and spongy and got sensory scores as 8.5 and 8.27 on 9-point Hedonic scale for flavour and body & texture, respectively.

5.1.2 The effect of different pH value such as 5.5, 5.2 and 5.1 for coagulation on quality of chhana and cham-cham were studied, and pH 5.2 was observed to be the best as the sensory comments for cham-cham prepared form chhana obtained at pH 5.2 were favorable as soft, spongy and succulent. The maximum average sensory scores of 8.2, for both body and texture and overall acceptability of sweet, were recorded at pH 5.2.

5.1.3 Amongst different coagulants such as citric acid, calcium lactate, lactic acid and sour whey studied, chhana prepared from 4.0 percent calcium
lactate at 70°C was softer and smoother than the chhana produced with either citric acid or sour whey. However, calcium lactate failed to produce a good quality cham-cham. The samples of sweet (cham-cham) prepared from sour whey and citric acid scored maximum ratings for body and texture, and hence, sour whey was selected.

5.1.4 Addition of different salts such as trisodium citrate, sodium dihydrogen phosphate and disodium phosphate increase the water absorption ability of casein micelles, causing swelling of micelles which in turn increased the voluminosity. This led to formation of swollen and greasy textured chhana, unfit for chhana sweet preparation.

5.2 Modification of buffalo milk prior to coagulation

5.2.1 Effect of different fat levels, such as 3, 4, 5 and 6%, of buffalo milk on quality of chhana and cham-cham were studied. Cham-cham sample prepared from buffalo milk with 5.0 percent fat got maximum sensory scores and also retain the cylindrical shape of cham-cham during cooking.

5.2.2 Buffalo milk homogenized at 100, 125 and 150 kg/cm² pressure did not show any beneficial effect on the quality of cham-cham in terms of softness and smoothness rather it produced adverse effects on the quality of sweet.

5.2.3 Not much improvement in the sensory characteristics of cham-cham, especially in the body and texture, and overall acceptability, were observed beyond 30 percent dilution of milk with water. Higher dilution caused slight reduction in flavour scores and balls developed slight surface cracks with a tendency to flatten during cooking in sugar syrup.

5.2.4 Additive like sodium citrate, at 0.10 percent level, produced most soft chhana with maximum yield, desired characteristics of spongy cham-cham. The samples of sweet prepared from milk treated with 0.05 percent sodium alginate were preferred most (maximum average overall
acceptability scores of 8.47 against 8.01 for the control). It is inferred that the treatment of buffalo milk with 0.05 percent of sodium alginate will improve the textural properties of cham-cham.

5.3 Optimization of processing parameters for production of cham-cham from buffalo milk

5.3.1 Among the two kneading temperature (7°C and 30°C) studied in the present investigation, cham-cham samples prepared at 30°C were judged to be superior in terms of sponginess and other textural properties.

5.3.2 The samples of cham-cham prepared with addition of 6.0 percent arrowroot were soft, spongy and had smooth surface, and the cham-cham samples preferred most among 5, 6, 7 and 8% level of addition.

5.3.3 The addition of semolina at 2.0 percent produced soft, spongy and most acceptable cham-cham samples from appearance stand point.

5.3.4 Addition of baking powder, in general, improved the voluminosity characteristic of cham-cham leading to improved body and texture and overall acceptability. The most acceptable product was obtained when 0.60 percent baking powder was added to chhana. The product at this level secured on overall acceptability score upto 9.0. Above 0.60 percent of baking powder, the sweet was criticized for medicinal flavour and having tendency to disintegrate during cooking.

5.3.5 Among three concentration of sugar syrup i.e. 50, 60 and 70 %, cham-cham samples cooked in 60 percent sugar syrup were preferred most because of their white colour, round shape, pleasant flavour and free from any surface crakes.

5.3.6 A minimum cooking time of 10 min was recommended for manufacturing good quality cham-cham as samples obtained on cooking for 10 min secured maximum scores for each sensory attribute except for flavour.
5.3.7 Cham-cham samples were prepared by adjusting the moisture content of chhana to four different levels viz., 54, 56, 58 and 60 percent. On the basis of maximum score for all the sensory attributes, a moisture level of 58 percent in chhana was found to be the optimum for manufacturing good quality cham-cham from buffalo milk.

5.4 Recommended technology for the production of cham-cham from buffalo milk are as follows: standardization of milk to 5.0 percent fat and its heating to temperature 90°C, addition of 0.05 percent sodium alginate with slow and continuous agitation at temperature around 80°C followed by filtering and cooling to 70°C, coagulation with 2.0 percent citric acid (pasteurized sour whey optional), draining, pressing for 15 min, grinding of chhana to a smooth paste, addition of arrowroot @ 6 percent by weight of chhana, mixing of semolina (2.0% by weight of chhana) and baking powder @ 0.60 percent of the weight of ground chhana, kneading to smooth paste, forming into cylindrical balls of 8.0 gram each and cooking in 60 percent sugar syrup for 10 min followed by soaking in 33.0 percent sugar syrup and packaging.

5.5 Rheological quality of cham-cham

5.5.1 Not much decrease in springiness of cham-cham due to increase in moisture content in chhana was noticed.

5.5.2 Hardness of cham-cham samples from buffalo milk ($5.691 \times 10^{-3}$ N), was lesser than that of cow milk ($7.839 \times 10^{-3}$ N). Cham-cham samples from buffalo milk were observed to be less cohesive (0.661 Vs 0.662), less gummy ($3.763 \times 10^{-3}$ N Vs $5.189 \times 10^{-3}$ N), less springy (9.0 Vs 11.5 mm) and less chewy ($0.034$ Vs $0.059$ N mm$^2$) in comparison with those from cow’s milk. The standard method of production of cham-cham from buffalo milk developed in the present investigation is recommended for industrial production of cham-cham.
5.6 Among the three packaging materials such as polystyrene cups, metabolized polyester laminate and tin containers; the samples packaged in tin cans, on the basis of acidity and pH developed and microbiological quality, kept in good state for period above 20 days at 30°C.