Original Research

Effect of Coagulants on Quality of Cow Milk Chhana and Chhana Podo Supplemented with Non-Dairy Ingredients

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Abstract

The study was undertaken to investigate the effect of two different coagulants (citric acid and lactic acid, used in 1and 2 % solution) on sensory quality, yield and total solids recovery of chhana. *Chhana podo supplemented with non-dairy ingredients (suji 5 %, maida 5 % and combination of suji 2.5 % and maida 2.5 %) on sensory and physico-chemical attributes. The study revealed that, colour and appearance and overall acceptability of chhana made with 1 % citric acid and 2 % lactic acid solution recorded significantly (P≤0.05) higher scores. The sensory scores for body and texture of chhana recorded significantly (P≤0.05) highest for 1 and 2 % lactic acid solution as compared to 1 and 2 % citric acid solution. However, 1% citric acid solution as coagulant recorded significantly (P≤0.05) highest yield observed for chhana followed by 2 % lactic acid. Further, chhana made with citric acid and lactic acid recorded significantly highest fat and total solids recovery. The chhana made by 1 % citric acid and 2 % lactic acid solution recorded highest fat and total solids recovery. Chhana podo prepared by 2 % citric acid solution with incorporation of 2.5 % suji and 2.5 % maida in combination recorded significantly higher scores for all the sensory attributes as compare to other non-dairy ingredients. On the basis of observations it is concluded that, among different coagulants 2 % lactic acid was found suitable for chhana as well as incorporation of 2.5 % suji and 2.5 % maida in combination of chhana podo was found appropriate.*

Key words: Coagulants, Chhana Podo, Sensory Quality

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Introduction

Chhana refers to the milk solids obtained by the acid coagulation of boiled hot whole milk and subsequent drainage of whey. It is an indigenous milk product of Indian origin which is being produced throughout the year in the country on large scale and serves as base material for a large variety of Indian sweetmeats

like rasogolla, sandesh, chum-chum, chhana murki, chhana podo, rasomalai, chhana balushahi, khorma/belgrami, pantowa etc. Pattern of milk consumption in India indicates that about 6 per cent milk is converted into chhana (Sahu and Das, 2009).

The type of coagulant used for coagulation of milk has prominent role in maintaining quality of chhana as it regulates the moisture content in chhana and thereby affects the quality of chhana. Generally organic acids like citric acid or lactic acid, calcium lactate, lemon juice and sour whey are used as coagulant. De and Ray (1954) reported that lactic acid produces chhana with granular texture, suitable for rasogolla preparation, while citric acid resulted in pasty texture. Pandey *et al.* (2004) prepared chhana from cow milk coagulated by lactic acid and citric acid and found that yield of chhana was higher with lactic acid coagulant.

Chhana podo is a dairy product, which has potential for wider marketing. It is a chhana based Indian delicacy much popular in eastern region of India. It is the only baked type traditional dairy product, prepared in India. Popularly known as 'Podo' which means 'burnt' products, Sushma *et al.* (2010). It is made from chhana, sugar and semolina (suji) / refined wheat flour (maida). It is often garnished with nuts, cloves and cardamoms. Chhana podo closely resembles the north Indian traditional dairy products like "milk cake" in appearance, which is prepared from whole milk by heat desiccation in contrast to heat/acid coagulation employed for chhana podo (Karwasra *et al.*, 2001). Such products contain high or intermediate moisture content hence requires refrigerated storage for the extension of their limited shelf life (Aneja *et al.*, 2002). Chhana podo have been served to Lord Jagannath in Puri as offering prasad for hundreds of years. Since the product is presently confined to Orissa, its characteristic taste and appeal may find wider acceptance in other parts of India. Traditionally, it is made by smouldering chhana sugar mix wrapped in sal leaves or any other large leaves baked on slow fire. It is also possible that the name has come from Podomari village in Ganjam district of Odisha (Ghosh *et al.*, 2002).

The most preferred varieties of chhana podo available in the market have a pleasant, rich, caramel, smoky flavour, moderate sweetness, spongy texture and a soft body with light brown crust and creamy white to light brown interior.

Material and Method

Fresh cow milk was procured from the livestock unit of College of Veterinary and Animal Sciences, Parbhani. Citric acid and lactic acid were used in different concentrations for preparation of chhana.

Chhana Making

Chhana was prepared from cow milk (standardized 4 % fat) as per the method described by De (1980) with slight modifications. Milk was divided into different lots as per the treatment. Each lot of milk was heated

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to boiling and subsequently cooled to 80° C. Different coagulants viz. citric acid and lactic acid were used @ 1 and 2 %, respectively. Before addition, the coagulants were heated at 80° C and were slowly added with continuous stirring till complete coagulation occurred and the clear whey was observed. The coagulated mass was kept undisturbed for 2 min. and then transferred to muslin cloth for drainage of whey. After 20 min., chhana obtained from each lot was collected and weighed.

Preparation of Chhana Podo

Chhana podo was prepared from chhana made from standardized cow milk using selected levels of coagulants (1 % citric acid and 2 % lactic acid).

Preparation of Dough

Standardization of dairy ingredients to be incorporated in chhana for making chhana podo was done as under. Chhana dough was made by mixing the weighed quantity of chhana with non-dairy ingredients viz. 5 % suji, 5 % maida and combination of 2.5 % suji and 2.5 % maida using 25 % sugar. The mixture was kneaded manually till whole sugar was completely dissolved.

Baking of Dough

The kneaded mixture was spread on a flat, dry and clean pan smeared with ghee to a thickness of about 2 cm. The pan was kept in hot air oven maintained at 180° C for 60 min. to obtain a puffed, brown, spongy textured product which was subsequently cooled to room temperature.

Chemical Analysis

Total solid and moisture content of chhana was determined by standard gravimetric method (De, 1980) for milk. Fat content in cow milk and chhana were determined by Gerber method (IS: SP: 18, 1981). Total protein and ash content of chhana were determined according to methods of AOAC (1995).

Percent Yield of Chhana

Chhana obtained from each lot of cow milk using different coagulants was recorded to calculate the per cent recovery of the product.

Sensory Quality

The samples of chhana were evaluated for colour and appearance, flavour, body and texture and overall acceptability on 9 point hedonic scale as suggested by Amerine *et al*. (1965).

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Statistical Analysis

Each treatment was replicated for three times and the data was subjected to analysis of variance using Completely Randomized Design and standard deviation was computed as described Snedecor and Cochran (1989).

Result and Discussion

Effect of Different Coagulants on the Sensory Quality of Chhana

The effect of two different coagulants citric acid and lactic acid on sensory quality are presented in Table 1.

Table 1: Effect of different coagulants on sensory quality of cow milk chhana

Coagulant	Concentration	Colour & Appearance	Body & Texture	Flavour	Overall Acceptability
Citric acid	1%	8.24^{a}	7.78^{b}	8.14^{a}	8.02^{a}
	2%	8.04^{ab}	7.72^{c}	7.56^{b}	7.60^{b}
Lactic acid	1%	8.02^{b}	8.24^{a}	7.84^{ab}	7.76^{ab}
	2%	8.28^{a}	8.32^{a}	8.00^{ab}	8.06^{a}

Common superscripts indicate treatments are not significant at 5 per cent and 1 per cent level of probability.

The sensory quality scores for all the attributes of chhana made by using two different coagulants in different concentrations differed significantly ($P \leq 0.05$), higher scores was recorded for colour and overall acceptability of chhana prepared by using 1 % citric acid and 2 % lactic acid solutions as compared to 2 % citric acid and 1 % lactic acid solutions. Scores for body and texture were found significantly highest ($P \leq 0.05$) for the product made with 1 and 2 % lactic acid followed by 1 % citric acid solution. The results are in close agreement with Singh and Ray (1977) and Joshi *et al.* (1991). No significant difference was observed in flavour of chhana coagulated with 1 % citric acid and 2 % lactic acid solution. The flavour score for chhana made with different coagulants was recorded non-significant. Acceptability of chhana decreased with increasing strength of citric acid as a coagulant Ahmed *et al.* (1982).

Effect of Different Coagulants on Yield, Fat and Total Solids Recovery of Chhana

Per cent yield, fat and total solids recovery of chhana as influenced by various coagulants are depicted in Table 2.

Table 2: Effect of coagulants on per cent yield, fat and total solids recovery of cow milk chhana

Coagulant	Concentration	Per cent yield	Per cent fat recovery	Per cent total solids recovery
Citric acid	1%	16.45^{a}	91.46^{a}	60.66^{a}
	2%	16.26^{a}	90.20^{a}	59.97^{ab}
Lactic acid	1%	16.33^{a}	90.79^{a}	60.36^{a}
	2%	16.41^{a}	91.36^{a}	60.69^{a}

Common superscripts indicate treatments are not significant at 5 per cent and 1 per cent level of probability.

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Chhana prepared form different concentration of coagulants recorded significantly highest scores (P≤0.05) for yield. The chhana prepared by using 1 % citric acid solution as coagulant recorded significantly maximum yield (16.45 per cent) followed by 2 % lactic acid solution (16.41 per cent). Further, the yield of chhana declined as the concentration of citric acid was increased from 1 to 2 per cent and the same effect was observed when lactic acid concentration was increased from 1 to 2 per cent as coagulant. De (1952) reported that with the increase in strength of coagulant there was steady decline in the yield of chhana, it may be due to the more losses in whey.

Chhana made by using different coagulants recorded highly significant (P≤0.05) differences among all the treatments for fat and total solids recovery. Significantly highest (P≤0.05) values were observed for fat and total solids recovery in chhana made with 2 % lactic acid (91.36 per cent and 60.69 per cent) and 1 % citric acid (91.46 per cent and 60.66 per cent) solution. It showed that fat and total solids recovery declined steadily with increase in concentration of citric acid from 1 to 2 per cent solution whereas fat and total solids recovery in chhana made with 2 % lactic acid recorded highest (60.69%). Highest fat and total solids recovery in the chhana made by using 1 % citric acid and 2 % lactic acid solution is probably due to minimum fat losses in chhana whey. Moorty and Rao (1982) also observed that similar result for 1 % citric acid and 2 % lactic acid level in chhana podo processing. It is observed that chhana made with 1 % citric acid and 2 % lactic acid solution level is more suitable for chhana podo processing.

Effect of Non-Dairy Ingredients (Suji and Maida) on Sensory Quality of Chhana Podo

Effect of non-dairy ingredients (suji and maida) on sensory quality of chhana podo depicted in Table 3.

Table 3: Effect of different additives on sensory quality of chhana podo

Type of chhana	Additives	Colour & Appearance	Body & Texture	Flavour	Overall Acceptability
1% Citric acid	5 % Suji	8.60^{b}	8.52^{b}	8.24^{b}	8.24^{bc}
	5 % Maida	8.40^{c}	8.04^{c}	7.84^{c}	8.08^{c}
	2.5% Suji + 2.5% Maida	8.64^{b}	8.76^{a}	8.44^{ab}	8.44^{ab}
2% Lactic acid	5% Suji	8.60^{b}	8.64^{ab}	8.32^{b}	8.28^{bc}
	5% Maida	8.56^{bc}	8.20^{c}	8.20^{b}	8.28^{bc}
	2.5% Suji + 2.5% Maida	8.84^{a}	8.84^{a}	8.64^{a}	8.76^{a}

Common superscripts indicate treatments are not significant at 5 per cent and 1 per cent level of probability.

On the basis of sensory parameters the quality of chhana podo made with incorporation of 5 % suji, 5 % maida and combination of 2.5 % suji and 2.5 % maida in chhana differed significantly (P≤0.05). Chhana podo made from both, 1 % citric acid and 2 % lactic acid chhana incorporated with combination of 2.5 % suji and 2.5 % maida recorded significantly higher scores (P≤0.05) for all the sensory attributes as compare

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to 5 % suji or 5 % maida. Significantly lower scores were observed for chhana podo incorporated with 5 % maida for all the sensory attributes. However, chhana podo made after incorporation of 5 % suji exhibited significantly higher sensory score ($P \leq 0.05$) as compare to 5 % maida. Suggesting that maida used as additives is not suitable for getting desired quality attributes of chhana podo. Further, irrespective of additives used, chhana podo made from 2 % lactic acid solution exhibited significantly higher sensory scores ($P \leq 0.05$) for all the attributes of 5 % suji, 5 % maida and combination of 2.5 % suji and 2.5 % maida as compare to 1 % citric acid solution. Among the treatments 2% lactic acid coagulated chhana podo incorporated with combination of 2.5 % suji and 2.5 % maida represents significantly higher scores ($P \leq 0.05$) for all the sensory attributes as compared to other coagulants as well as additives. Ghosh *et al.* (2002) also reported that suji helps in improving body and textural attributes of chhana podo. Dash *et al.* (1999) documented that the cake like texture of chhana podo was due to the addition of maida or suji during manufacture.

Effect on Chemical Composition of Chhana Podo Made from Combination of 2.5 % Suji and 2.5 % Maida

Chemical composition of chhana podo made from 1 % citric acid and 2 % lactic acid solution incorporated with 2.5 % suji and 2.5 % maida as additives along with 25 % sugar are depicted in Table 4.

Table 4: Chemical composition of chhana podo made from combination of 2.5 % suji and 2.5 % maida

Type of Chhana	Moisture %	Total solids %	Fat %	Protein %	Ash %
1% Citric acid	26.26	73.74	22.96	18.83	1.99
2% Lactic acid	25.46	74.54	22.98	18.86	2.05

It is observed that the moisture content was more in chhana podo made from 1% citric acid as compared to the product made from 2 % lactic acid. This may be attributed to higher moisture content in citric acid chhana. Higher fat and protein content observed in chhana podo prepared by 2 % lactic acid chhana as compared to 1 citric acid solution. This might be due to higher content of these constituents in 2% lactic acid chhana. The ash content in chhana podo made from combination of 2.5 % suji and 2.5 % maida with different coagulants were marginally different. Similar observations were observed by Dash *et al.* (1999) who reported that the composition of chhana podo made by using maida or suji as additive with 25 % sugar in the similar range.

The acceptable quality chhana with optimum yield, fat and total solids recovery can be obtained from cow milk using 1 % citric acid and 2 % lactic acid solution as coagulants which could be successfully utilized for getting desirable quality chhana podo. Chhana dough prepared from 2 % lactic acid chhana admixture with combination of 2.5 % suji and 2.5 % maida with 25 % sugar and baked at 180 ºC for 60 min. resulted in acceptable quality chhana podo.

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Conclusion

The acceptable quality chhana with optimum yield, fat and total solids recovery can be obtained from cow milk using 1 % citric acid and 2 % lactic acid solution as coagulants which could be successfully utilized for getting desirable quality chhana podo. Chhana dough prepared from 2 % lactic acid chhana admixture with combination of 2.5 % suji and 2.5 % maida with 25 % sugar and baked at 180 ºC for 60 min. resulted in acceptable quality chhana podo.

References

1. AOAC. 1995. Methods of Analysis. 13th edn. Association of Official Analytical Chemists, Washington, D.C.
2. Ahmed AR, Vyas SH, Upadhyay KG and Thaka PN. 1982. Study on manufacture of chhana from buffalo milk. Gujarat Agriculture University Research Journal 7:32–38.
3. Amerine MA, Pangborn EB and Roessler EB. 1965. Principles of sensory evaluation of food. Academic Press, New York.
4. Aneja RP, Mathur BN, Chandan RC and Banerjee AK. 2002. Technology of Indian milk Products. A Dairy India Publication, Delhi, India.
5. Dash DK, Ghatak PK and Das A. 1999. Laboratory made chhana podo. Journal of Dairying, Food and Home Science 18(2): 127-129.
6. De S. 1952. Study on desiccation and coagulation of milk in the manufacture and storage of indigenous milk products. M.Sc. Thesis, Bombay University, Bombay.
7. De S and Ray SC. 1954. Studies on the indigenous method of *chhana* making. Indian Journal of Dairy Science 3:113–125.
8. De S. 1980. Outlines of Dairy Technology, Oxford University Press, New Delhi, pp.517.
9. Ghosh BC, Rao JK, Balasubramanyam BV, and Kulkarni S. 2002. Market Survey of of Chhana Podo sold in Orissa, its Characterisation and Utilization. *Indian Dairyman*, 54 (6) 37-41.
10. IS: SP-18 Part XI. 1981. ISI Handbook for food analysis. Bureau of Indian Standards, Manak Bhavan, New Delhi.
11. Joshi SV, Majgaonkar SV and Toro VA. 1991. Effect of different coagulants on yield and sensory quality of chhana prepared from cow, buffalo and goat milk. Indian Journal of Dairy Science 44 (6): 380-383.
12. Karwasr RK, Srivastava DK, and Hooda S. 2001. Standardization of the process for manufacture of Milk–cake. Indian Dairyman, 54 (10), 61-65.
13. Moort PRS and Rao BVR. 1982. Studies on production and qualities of chhana from goat milk. Journal of Food Science & Technology 19 (2):69-71.
14. Pandey RK, Singh M and Govindam. 2004. Effect of chemical and herbal extracts on yield and quality of *chhana* from cow's milk. Souvenir, XXXIII Dairy Industry conference, Sept. 26–28, New Delhi.
15. Sahu JK and Das H. 2009. A continuous heat-acid coagulation unit for continuous production of chhana. Assam University Journal of Science & Technol: Physical Science and Technology 4:40–45.
16. Singh GP and Ray TK. 1977. Effect of milk coagulants on the quality of chhana whey. Journal of Food Science and Technology 14:205-207.
17. Snedecor GW and Cochran WG. 1989. Statistical Methods, 8th Edition, IOWA State University Press, Amer Ioxa.
18. Sushma TS, Pisal JU, Desale RJ and Kadam DG. 2010. Studies on sensory qualities of chhana podo from cow milk. Journal of Dairying Foods and Home Science 29 (3/4): 193-196.

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