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THE IMPACT OF VARIOUS COAGULATION TEMPERATURES AND LEVELS OF SALT ON CHEMICAL PROPERTIES OF CHHANA SPREAD PREPARED FROM BUFFALO MILK

Yadav Nishu [3], Paul Virginia[1] Roli [3], Rathore Alka [3], Chandra Ramesh [2], Khandelwal M.S [4] and Paul Ajit [5]
[1]Advisor, Associate Prof, [3]Ph.D Scholar, Dept of Foods & Nutrition, Ethelind School of Home Science
[2]Co-advisor, Prof & Dean, Warner School of Food & Dairy Technology
[5]Associate Prof, Head, Dept of Mathematics & statistics, College of Basic Sciences Institution,
Sam Higginbottom Institute of Agriculture, Technology & Sciences, Allahabad, India
[4]Senior Research Associate, Indian Agriculture Statistics Research Institute, New Delhi
yadav.nishu1984@gmail.com

Abstract

Among milk products Chhana is gaining momentum in its production and consumption. Chhana is heated and acid coagulated indigenous milk product which forms the base of several popular Indian sweets like Rasogulla, Sandesh, Rasamalai and Chumchum etc Chhana or paneer, means the product obtained from cow or buffalo milk or a combination of them by precipitation with sour milk, lactic acid or citric acid. It shall not contain more than 70% of the moisture, and the milk fat not be less than 50% of the dry matter (PFA, 1976).The study was conducted in the Student's Training Dairy and Research Laboratory of Warner School of Food and Dairy Technology, SHIATS Allahabad. The buffalo milk as (M_2) were used for making chhana spread and three different coagulant temperature 60^0C, 65^0C, 70^0C as T_1 T_2 T_3 and three salt levels 1%,1.5%, 2% S_1, S_2, S_3 were used in the present experimental work. 9 treatment combinations used in the experiment namely $M_2T_1S_1$, $M_2T_1S_2$, $M_2T_1S_3$, $M_2T_2S_1$, $M_2T_2S_2$, $M_2T_2S_3$, $M_2T_3S_1$, $M_2T_3S_2$, $M_2T_3S_3$ and replicated three times. The experiment treatment combination ($M_2T_1S_3$) chhana spread contained highest percentage of moisture(54.66). The experiment treatment combination ($M_2T_3S_1$) contained highest percentage of fat (25.98).The highest percentage of protein (15.29) was found in the treatment combination ($M_2T_2S_1$).The highest percentage of lactose (3.06) was found in the treatment combination ($M_2T_2S_1$). The treatment combination ($M_2T_3S_1$) contained highest percentage of ash (3.07).The highest percentage of calcium (479.63) was found in the treatment combination ($M_2T_1S_3$). The highest energy value of (253.26) was found in the treatment combinations ($M_2T_2S_1$). Chhana spread is still in its infancy and needs various parameters to be fixed and tested before its commercial use and large scale productions by organized sector

Key words: Chhana Spread, Coagulation Temperature, Salt Levels, Storage Periods

1. INTRODUCTION

Among milk products Chhana is gaining momentum in its production and consumption. Chhana is heated and acid coagulated indigenous milk product which forms the base of several popular Indian sweets like Rasogulla, Sandesh, Rasamalai and Chumchum etc. It is also used as base material for the preparation of large number of culinary dishes. It originated in eastern part of the country particularly in West Bengal, but is now popular in north and north western regions of India. Its preparation is mainly confined to the cottage sector, largely in the eastern parts of India, and more recently, in Bikaner district of Rajasthan. India's total production of chhana is estimated at 200,000 tones, and the value of chhana- based sweets, around Rs. 70,000 million. However, chhana based sweets are gaining popularity in other parts of country. Chhana or paneer, means the product obtained from cow or buffalo milk or a combination of them by precipitation with sour milk, lactic acid or citric acid. It shall not contain more than 70% of the moisture, and the milk fat not be less than 50% of the dry matter (**PFA, 1976).**Shelf life of milk products is also one of the most important factors for its production on commercial scale. Shelflife of chhana has been reported to be about 12 days and 3 day at 7^0 C and 24^0 C respectively **(De and Ray 1954).** It was also reported that 10 minutes steaming and sterilization of chhana at 1.05 kg/15 minutes in the presence of 1%lactic solution improved its shelflife up to 6 &8 days respectively $30^0 \pm 1^0$C. Chhana could be preserved for 4 days at the same temperature by treating it with 2% lactic acid solution **(kulkarni et al. 1984)**.The chemical composition of the products (chhana spread) was depends on types of milk (buffalo, cow and admixed milk)used to preparation of chhana.Buffalo milk contains all the nutrients in higher proportions than cow milk. The compositional differences between buffalo and cow milk are reflected on their physic chemical properties. Buffalo milk is the more preferred for preparing milk and dairy of western and indigenous. The inherent properties of buffalo milk like high total solids content, superior whiteness and viscosity render it eminently suitable for the manufacture of traditional milk products. On the other hand cow milk yields soft coagulum making it suitable for preparing chhana and chhana based sweets. Higher total solids in buffalo milk also provide more calories (100calories/100gm) than cow milk (70calories/100gm). Higher proportion of Beta casein in buffalo milk makes it easier to prepare humanized. and buffalo milk high in calcium a better

calcium: phosphorous ratio and less sodium and potassium than in cow milk which makes it a better nutritional supplement for infants. But buffalo milk contains less cholesterol compare to cow milk. The buffalo milk contains more fat, solids not fat and total solids and hence yield of products will be always higher than cow milk. The higher fat content in buffalo milk helps in increasing the quantity of toned milk. Production of chhana involves precipitation of casein along with entrapped fat and water-soluble components of milk (Lactose, whey, proteins, minerals, vitamins) by addition of acidulate to milk at near- boiling temperatures, followed by removal by whey from the curd. Acidification of boiled/ hot cow milk yields chhana as an off-white, mildly acidic, spongy coagulum. Chhana retains about 90 per-cent of fat & protein, 50 per-cent ash &10 per-cent lactose of the original milk. The energy value of cow chhana ranges from 2866 to 3748 calories per kg and chhana also retains appreciable proportion of fat soluble vitamins like A & D **(Ray and De 1954)**. On an average calcium, Phosphorus, Vitamins, A, B, B_2, and C contents per 100g of chhana samples were reported to be 208 mg, 138 mg, 3.66 IU, 73µg, 15µg and 2.8 mg respectively. Chhana was reported to contain practically no nicotinic acid. The loss of ascorbic acid during chhana making was reported to be about 57 % as compared with the figure of boiled milk **(Mani *et al*.1955).** The average biological value and digestibility coeffcient of chhana were found to be 67 and 97 respectively **(Balasubramaniam 1955).**

2. MATERIAL AND METHODS

The present investigation was conducted in the Student's Training Dairy and Research Laboratory of Warner School of Food and Dairy Technology and Nutrition Research Laboratory of Ethelind school of Home science, Sam Higginbottom Institute of Agriculture, Technology and Sciences (Deemed - to – be – University), Allahabad, U.P.

a. Preparation of chhana spread:

Chhana was prepared from buffalo milk standardized to 6 % fat & 9% SNF as per method suggested by ***Ray and De (1953)***. buffalo milk was heated at 90^{o}C for 15 minutes and cooled down to 60^{o}C and therefore, added warm coagulant solution (1%) at 60^{o}C to effect proper coagulation. Traditional method was used to drain the free whey from the coagulated mass. The curd along with whey was transferred on a muslin cloth and whey was allowed to drain by hanging technique till trickling of free whey was stopped. The curd sample obtained by this method was subjected for chhana spread making. The curd from traditional method was converted into chhana spread by using method suggested by ***Tiwari and Sachdeva (1991)***. In this case chhana was broken into pieces and blended in domestic blender along with 10 percent whey and specified salt level**.**

S.No.	Treatments	Combinations
1	$M_2T_1S_1$	Chhana spread prepared from buffalo milk containing 6 % milk fat and 9 %SNF and coagulation of milk at 60^{0}C and using 1 % salt level
2	$M_2T_1S_2$	Chhana spread prepared from buffalo milk containing 6 % milk fat and 9 %SNF and coagulation of milk at 60^{0}C and using 1.5 %salt levels
3	$M_2T_1S_3$	Chhana spread prepared from buffalo milk containing 6 % milk fat and 9 %SNF and coagulation of milk at 60^{0}C and using 2 % salt levels
4	$M_2T_2S_1$	Chhana spread prepared from buffalo milk containing 6 % milk fat and 9 %SNF and coagulation of milk at 65^{0}C and using 1 % salt levels
5	$M_2T_2S_2$	Chhana spread prepared from buffalo milk containing 6% milk fat and 9 %SNF and coagulation of milk at 65^{0}C and using 1.5 % salt levels
6	$M_2T_2S_3$	Chhana spread prepared from buffalo milk containing 6 % milk fat and 9 %SNF and coagulation of milk at 65^{0}C and using 2 % salt levels

7	$M_2T_3S_1$	Chhana spread prepared from buffalo milk containing 6% milk fat and 9 %SNF and coagulation of milk at 70^0C and using 1 % salt levels
8	$M_2T_3S_2$	Chhana spread prepared from buffalo milk containing 6% milk fat and 9%SNF and coagulation of milk at 70^0C and using 1.5 % salt levels
9	$M_2T_3S_3$	Chhana spread prepared from buffalo milk containing 6 % milk fat and 9%SNF and coagulation of milk at 70^0C and using 2 % salt levels

b. Treatment Combinations: The buffalo milk as (M_2) chhana spread and three different coagulant temperature 60^0C,65^0C,70^0C as T_1, T_2, T_3 and three salt levels 1%,1.5%, 2% as S_1, S_2, S_3, respectively, were used in the present experimental work. Channa prepared from different treatment combinations were compared with each other.The different combinations used in the experiment were represented as follow

c. Chemical testing of chhana spread: The procedure given in Manual in Dairy Chemistry, ICAR(1972), for sampling was followed.

d. Analytical technique - Chhana spread was analyzed for moisture content using AOAC (1980) method. Total nitrogen was determined by micro-kjedahl method. For fat content in milk, Gerber's method of BIS(1981) was used. The fat, ash and content was determined using AOAC (1980) procedures. Lactose, calcium content was estimated by AOAC (1980.

e. Determination of total energy: Kcal/100gm = (4 X protein %) + (4 X CHO %) + (9 X fat %)

f. Statistical Analysis: The order to study the effects of milk, various coagulation temperatures and levels of salt of chhana spread, a laboratory experiment was conducted and required data were collected. Analysis of variance of these data was worked out on the basis of factorial completely randomized design (Federer, 1963).

3. RESULTS AND DISCUSSION:

Table:1.1 Average moisture content of chhana spread in percent on account of milk various coagulation temperatures and different levels of salt

Buffalo milk (M_2)					
Nutrient	**Coagulation Temperatures**	**Different levels of Salt (S)**			**Mean**
		S_1 (1%)	S_2 (1.5%)	S_3 (2%)	
Moisture	**T_1 (60^0C)**	54.24	54.45	54.66	54.45
	T_2 (65^0C)	53.23	53.52	53.71	53.48
	T_3 (70^0C)	54.04	54.24	54.45	53.24
	Mean	**53.83**	**54.07**	**54.27**	**53.72**
Factors	M	T	S	MxTxS	
SE(m) ±	0.012	0.012	0.012	0.038	
C.D. at 5%	0.036	0.036	0.036	0.180	

In above table 1.1buffalo milk on an average moisture content of chhana spread with respect of different coagulation temperatures were recorded as 54.45, 53.48 and 53.24 % at 60^0C, 65^0C and 70^0C, respectively. Likewise levels of salt were 53.83, 54.07 and 54.27% at 1%, 1.5 and 2% , respectively. The milk, coagulation temperature and levels of salt changes in the experiment of moisture content of chhana spread was also changed in prepared product i.e. variation of milk, temperatures and levels of salts was found significant at 5% level of significance. The interaction effect between milk, coagulation temperatures and levels of salts (MxTxS) was found significant.

Table:1.2 Average fat content of chhana spread in percent on account of milk various coagulation temperatures and different levels of salt

Buffalo milk (M_2)					
Nutrient	**Coagulation Temperatures**	**Different levels of Salt (S)**			**Mean**
		S_1 (1%)	S_2 (1.5%)	S_3 (2%)	
Fat	T_1 (60^{0}C)	25.46	25.35	25.23	25.34
	T_2 (65^{0}C)	25.55	25.48	25.37	25.46
	T_3 (70^{0}C)	25.98	25.86	25.75	25.86
	Mean	25.66	25.56	25.45	25.55
Factors	M	T	S	MxTxS	
SE(m) ±	0.002	0.002	0.002	0.006	
C.D. at 5%	0.006	0.006	0.006	N.S	

The effect of milk different coagulation temperatures and salt levels on fat content of chhana spread in buffalo milk presented Table 1.2 the effect of temperature was found 70^{0}C, which contained the highest content of fat which was highest 25.86 % as compared to low temperatures 60^{0}C and 65^{0}C as 25.34 and 25.46 %, respectively. In salt levels 1 % showed the maximum fat content was 25.66%, while minimum as 25.45% at highest salt level i.e. 2%.

Table: 1.3 Average protein content of chhana spread in percent on account of milk various coagulation temperatures and different levels of salt

Buffalo milk (M_2)					
Nutrient	**Coagulation Temperatures**	**Different levels of Salt (S)**			**Mean**
		S_1 (1%)	S_2 (1.5%)	S_3 (2%)	
Protein	**T_1 (60^{0}C)**	14.50	14.43	14.37	14.43
	T_2 (65^{0}C)	15.29	15.22	15.66	15.39
	T_3 (70^{0}C)	14.79	14.73	14.66	14.72
	Mean	14.86	14.79	14.89	14.84
Factors	M	T	S	MxTxS	
SE(m) ±	0.006	0.006	0.006	0.019	
C.D. at 5%	0.002	0.002	0.002	0.006	

Table 1.3 shows the effect of milk different coagulation temperatures and salt levels on protein content of chhana spread. In buffalo milk the maximum content of protein was noticed 14.72% at 70^{0}C, while 60^{0}C and 65^{0}C showed minimum as 14.43 and 15.39 %, respectively. Likewise in salt level 2% showed the maximum protein content i.e. 14.89% and minimum as 14.79 percent at 1.5% salt level. The effect between milk, coagulation temperatures and levels of salts (MxTxS) was found dependent as interaction was recorded significant.

Table:1.4 Average lactose content of chhana spread in percent on account of milk various coagulation temperatures and different levels of salt

Buffalo milk (M_2)					
Nutrient	**Coagulation Temperatures**	**Different levels of Salt (S)**			**Mean**
		S_1 (1%)	S_2 (1.5%)	S_3 (2%)	
Lactose	**T_1 (60^{0}C)**	3.05	3.04	3.02	3.03
	T_2 (65^{0}C)	3.02	3.06	3.04	3.04
	T_3 (70^{0}C)	2.41	2.40	2.38	2.39
	Mean	2.82	2.83	2.81	2.82

Factors	M	T	S	MxTxS
SE(m) ±	0.005	0.005	0.005	0.016
C.D. at 5%	0.015	0.015	0.015	0.045

Average lactose content of various samples of chhana spread has been given in Tables 1.4 which shows the effect of different milk, coagulation temperatures and salt levels on lactose contents of chhana spread. In buffalo milk on an average lactose content of chhana spread with respect of different coagulation temperatures were recorded 3.03, 3.04 and 2.39 per cent at 60^0C, 65^0C and 70^0C. Likewise in salt level 2 % showed the minimum lactose content was 2.81 percent and maximum was noticed 2.83 percent at 1.5% salt level. The effect between milk, coagulation temperatures and levels of salts was found dependent as interaction (MxTxS) was recorded significant.

Table:1.5 Average ash content of chhana spread in percent on account of milk various coagulation temperatures and different levels of salt

Buffalo milk (M_2)				
Nutrient	**Coagulation Temperatures**	**Different levels of Salt (S)**		**Mean**
		S_1 (1%)	S_2 (1.5%)	S_3 (2%)	
Ash	**T_1 (60^0C)**	2.75	2.72	2.73	2.73
	T_2 (65^0C)	2.76	2.74	2.75	2.75
	T_3 (70^0C)	2.78	2.77	2.76	2.77
	Mean	2.76	2.74	2.73	2.74

Factors	M	T	S	MxTxS
SE(m) ±	0.006	0.006	0.006	0.018
C.D. at 5%	0.017	0.017	0.017	0.052

The results of chhana spread in respect to ash content have given in Table 1.5 which exhibited the effect of different types of milk, coagulation temperatures and salt levels and on ash content of chhana spread. In buffalo milk, the maximum content of ash was noticed as 2.77% at 70^0C and minimum as 2.73 at 60^0C. Likewise in salt level 1% showed the maximum ash content 2.76% and minimum 2.73 at 2% salt level and the value was significant at par. The effect between types of milk, coagulation temperatures and levels of salts was found dependent as interaction (MxTxS) was recorded significant.

Table: 1.6 Average calcium content of chhana spread in percent on account of milk various coagulation temperatures and different levels of salt

Buffalo milk (M_2)				
Nutrient	**Coagulation Temperatures**	**Different levels of Salt (S)**		**Mean**
		S_1 (1%)	S_2 (1.5%)	S_3 (2%)	
Calcium	**T_1 (60^0C)**	619.11	619.07	619.62	619.27
	T_2 (65^0C)	619.12	619.50	619.43	619.35
	T_3 (70^0C)	619.47	619.55	619.54	619.52
	Mean	619.23	619.37	619.53	619.38

Factors	M	T	S	MxTxS
SE(m) ±	0.004	0.004	0.004	0.012
C.D. at 5%	0.012	0.012	0.012	0.036

The results of chhana spread in respect to calcium content have given in Table 1.6 this showed the effect of different milk, coagulation temperatures and salt levels on calcium content of chhana spread. In buffalo milk on an average calcium means of chhana spread with respect of different coagulation temperatures were recorded 619.27, 619.35 and 619.52 at 60^0C, 65^0C and 70^0C, respectively. The values recorded at variation of coagulation temperatures were showed significantly at par value. The calcium content was of chhana spread with respect of levels of salt were 619.23, 619.37and 619.53 recorded at 1%, 1.5% and 2%, respectively. There were no significant differences observed at levels of salt, values recorded at par.

Table:1.7 Average energy content of chhana spread in percent on account of milk various coagulation temperatures

Buffalo milk (M_2)					
Nutrient	**Coagulation Temperatures**	**Different levels of Salt (S)**			**Mean**
		S_1 (1%)	S_2 (1.5%)	S_3 (2%)	
Energy	**T_1 (60^{0}C)**	299.34	298.03	296.63	298.00
	T_2 (65^{0}C)	303.41	302.36	301.09	302.28
	T_3 (70^{0}C)	302.62	301.26	299.91	301.26
	Mean	301.79	300.55	299.21	300.51
Factors	M	T	S	MxTxS	
SE(m) ±	0.006	0.006	0.006	0.018	
C.D. at 5%	0.017	0.017	0.017	0.052	

Table1.7 shows the effect of milk different types of coagulation temperatures and salt levels on energy content of chhana spread. In buffalo milk the maximum content of energy was noticed as 302.28at 65^{0}C. Coagulation temperature 60^{0}C and 70^{0}C recorded low values i.e. as 298.00 and 301.26, respectively. Likewise in salt level 1% showed the maximum energy content i.e. 301.79 and minimum as 299.21 at 2% salt level. The milk, coagulation temperatures and levels of salt changes in the experiment of an average energy content of chhana spread was also changed in prepared product i.e. variation of milk, temperatures and levels of salts was found significant.The effect between types of milk , coagulation temperatures and levels of salts was found dependent as interaction (MxTxS) was recorded significant.

4. CONCULSION

It was concluded that chhana spread can be successfully prepared by the buffalo milk different kind's coagulation temperature and levels of salt the recipe is standardized for chhana spread. Chhana spread prepared from cow milk having 6% fat and 9%SNF, respectively. The experimental treatment ($M_2T_1S_3$) chhana spread contained highest percentage of moisture and ($M_2T_3S_1$) contained percentage of fat and ash. The experimental treatment ($M_2T_2S_1$) was contained highest percentage of protein, lactose and energy. The experimental treatment ($M_2T_1S_3$) was contained highest percentage of calcium.

REFERENCES

1. Ahmed, M.(1981). "Study on manufacture of chhana from buffalo milk". Gujarat Agriculture University Res. Vol.7 : p.p.32.
2. Aneja, V.P.; Rajorhia, G.S. and Makker, S.K. (1977). *J. Institute Engineers* (India), 58, 1.
3. Balasubramaniam, S.C.(1955). Composition and nutritive value of some indigenous milk products. *Indian J. Med. Res*. 43,237
4. De, S. and Ray, S.C. (1954). Studies on the indigenous method of chhana making Indian J. Dairy Sci., 7, 113.
5. De, S. and Ray, S.C. (1954). Studies on the indigenous method of chhana making. *Indian J. Dairy sci., 3*:113.
6. Dharam, P. (2007) "International conference Traditional dairy foods" Nov. 14-17 NDRI, Karnal. p.p. 1
7. Indian Dairy Scenario(2009). J. Indian Dairyman march 2009: 1-2
8. Kulkarni,S.; Rajohria, G.S. and Chakraborty, B.K.(1984). Studies on shelflife of chhana. *Indian J.Dairy Sci*.37 (4): 392-95
9. Mathur, B.N. (1991) "Indigenous milk product of India." India Dairyman. Vol.(2) p.p.61-74.
10. Mani, G.S.; Lily, G. Balasubramaniam, S.C. and Basu, K.P.(1955). Composition and nutritive value of some indigenous milk products. *Indian J. Med. Res*. 43,237
11. Pal, D. and Garg, F.C, (1990) "Utilization of sour butter milk in the manufacture of paneer." Indian J. of dairy Sci.Vol.42 p.p.589-594.
12. PFA (1976) commentaries on the prevention of food adulteration act 1954. 4th Ed Asian law house Hyderabad.
13. Sachdeva and Kanoujia (1985) "Recent development in paneeer technology" Indian.Dairyman Vol. (11)p.p. 801.
14. Singh and Kanauja, (1988) "Development of manufacturing technique for paneer from cow milk". Indian J. of dairy sci. Vol. (3) : p.p.322.
15. Singh, S. and Roy, (1994)." Paneer like product from conversional solids." Indain J. of dairy sci. Vol. (4): p.p.245-256.