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Efficacy of Natural and Chemical Coagulants on Quality Characteristics of *Maush kraer* - A Traditional Milk Product

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Abstract: *Maush kraer* is a traditional dairy product of state of Jammu and Kashmir. However, there is lack of literature regarding processing and quality of *Maush kraer*, therefore the present study was undertaken with the objective to study the effect of different coagulants (natural and chemical) on quality characteristics of *Maush kraer*. In T1, the buttermilk was used as a natural coagulant, while as in other treatments citric acid (chemical coagulant) was used at 2 (T2), 3 (T3) and 5% (T4) in order to bring about the coagulation of milk. The results revealed that use of citric acid resulted in decrease of moisture content in the *Maush krear* with increase in concentration from 2 to 5%. Further, the use of citric acid resulted in significant ($p>0.05$) increase of fat content in *Maush krear* with highest value of 37.08±0.49% in the group wherein 5% (T4) citric acid was used compared to 34.15±1.13% in control. The increase in the citric acid level resulted in proportional increase in fat percent. The yield of *Maush krear* did not differ among all the treatments groups. There was no difference ($p>0.05$) in the values of total solids and yield of whey among various treatment groups. The values of various sensory attributes viz. appearance, flavor, body and texture and overall acceptability were highly desirable for buttermilk group (T1) when compared with other groups. In conclusion, highly desirable scores in terms of sensory attributes were achieved for buttermilk group than the citric acid groups, hence buttermilk, a natural coagulant, is recommended for quality preparation of *Maush krear*.

Key words: Buttermilk, citric acid, coagulant, *Maush kraer*, sensory quality

INTRODUCTION

India is the highest milk producer in the entire globe, accounting for more than 15% of world's total milk production (Sukumar *et al*., 2010). The state of Jammu and Kashmir has made a significant stride in terms of milk production with an overall current figure of 1.51 million tones growing steadily at around 3% annually (Wani *et al*., 2012). In India, about 50-55% milk produced is converted into a number of traditional products by means of various processes viz. coagulation, desiccation and fermentation (Aneja *et al*., 2002). *Paneer* and *Maush kraer* are rather the only culinary preparations of dairy origin in Kashmir (Pal and Kapoor, 2007).

Maush Kraer is a traditional dairy product of state of Jammu and Kashmir (Fig. 1a-b), prepared by coagulating milk, working out the coagulum into a pat and finally making small balls out of it which are manually spread out to a circular shape of varying diameter and thickness and then sun dried to a slightly firm texture (Pal *et al*., 2003). Ahmad *et al*. (2014) defined *Maush kraer* as an acid coagulated product that is prepared directly by acidifying milk with some coagulating agents like organic acids. The tribal communities in hilly regions of Jammu and Kashmir call this product as *Kaladhi*. This product is believed to possess anti-diarrheal, anti-cold and anti-tussive properties besides being a salubrious food, thus has tremendous market potential (Pal *et al*., 2003). It offers a range of advantages viz. the surplus milk gets utilized, increase in shelf life, engagement to the family and source of cash income. The preparation of this product, if properly channelized to the market can prove a supportive livelihood option for this class of society. Since there is lack of literature regarding processing and quality of *Maush kraer*, the technological interventions on scientific lines regarding the raw material use, processing techniques, end product characteristics, preservation and value addition are highly warranted (Pal *et al*., 2003). Thus the present study was undertaken with the objective to study the effect of different coagulants (natural and chemical) on quality characteristics of *Maush kraer*.

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MATERIALS AND METHODS

Survey of the selected areas: On the basis of background knowledge and perception, areas of Kashmir valley (Pahalgam, Bandipore, Kangan and Shopian) and adjoining parts of Jammu viz. Rajouri and Poonch, were selected for the survey programme based on the rationale that in these regions *Maush kraer* is being produced traditionally. The traditional manufacturing practices adopted by these nomadic people were studied in detail.

Source of milk: In all experiments fresh cow milk from the local market was procured. The milk procured was immediately taken to the laboratory and pasteurized by heating the milk at 90°C without holding. The milk was kept in thoroughly cleaned suitable sized pans for further experimentation and also analyzed for various physic-chemical parameters (Table 1).

Chemical coagulant: Citric acid used for the coagulation of milk was procured from standard source (Thomas Baker Chemicals Ltd.).

Experimental preparation of *Maush kraer*: The *Maush kraer* was prepared following the traditional practice studied during the survey programme. The cow milk was used to prepare curd from which buttermilk was prepared. Curdling was done spontaneously without any control over the time of maturation just like traditional method. The buttermilk (natural coagulant) was then mixed with the fresh milk in the proportion of 1:1 (T1), while as in other treatments citric acid (chemical coagulant) was used at 2 (T2), 3 (T3) and 5% (T4) in order to bring about the coagulation of milk. The mixture was heated to 70°C and coagulum so formed was cooked for around a minute's time and then the separated whey was simultaneously removed from the pan. Cooking was continued till whey was completely withdrawn and pan was taken away from the heating source. The coagulum was then filled into wooden hoops (7.5 x 7.5 x 7.5 cm) with holes on all sides and bottom to facilitate quick and efficient expulsion of whey. The hoops were lined with strong and clean muslin cloth from inside and the whole mass was then pressed in hoops by applying 1.3 kg of weight on the lid of the hoop for 15 min (230 kg/m^2). The pressed block of curd was weighed to obtain green product yield. After removing from hoops the pressed block was cut into 3-4 mm thick uniform sized slices and these were dried in hot air oven for four hours at 60°C. Some part of the coagulum was made into small balls and spread into round shape of about 3-6 mm range of thickness for comparison of experimental product with traditional one. These were allowed to dry under sun over a clean cloth over wooden planks or some other suitable clean surface.

Parameters estimated: All the analytical procedures (physic-chemical and sensory) were carried out in duplicate in the laboratory of the Division of Livestock Products Technology, Faculty of Veterinary sciences and Animal Husbandry, SKUAST-Kashmir.

Physico-chemical parameters: The pH of milk samples was recorded by directly dipping the combined electrode of digital pH meter (Tanco Lab. Equipments), after proper calibration of the instrument, into the samples. Two readings were taken for each sample and average pH recorded. For determination of specific gravity (SG) of the procured milk from the local market, Zeal type lactometer was used. After recording the temperature of the sample correctly lactometer reading was recorded. The corrected lactometer reading was calculated to arrive at the correct specific gravity. For estimation of titrable acidity (TA), 10 ml quantity of thoroughly mixed milk samples were taken in a conical flask with the help of dry pipette. To this few drops of phenolphthalein indicator were added. Then the milk was carefully titrated against 0.1N sodium hydroxide till faint pink colour appeared and persisted for 15 sec. The volume of 0.1N sodium hydroxide used was recorded and titratable acidity (expressed as a percentage of lactic acid) was calculated as per formula given below:

$$\left[\begin{matrix}\text{Percent titratable}\\ \text{acidity}\end{matrix}\right] = \frac{\left[\begin{matrix}\text{No. of ml of 0.1 N}\\ \text{NaOH used}\times 0.009\end{matrix}\right]}{\text{Weight of sample in grams}}\times 100$$

Electrical conductivity (EC) of milk samples was taken by dipping the electrode of Electrical digital conductivity meter (brand TANCO, India Lab. Equipments) into the sample after proper calibration of instrument. Two or three readings were taken for each sample and average electric conductivity was calculated. Total solids (TS) of milk and whey samples were calculated by the lactometer/formula method. Since Zeal type of lactometer was used in the experiment so the following formula used for determination of TS:

$$\text{TS (\%)} = \left[\begin{matrix}0.25\times\text{Corrected lactometer}\\ \text{reading(Z)}+1.2\times\text{Fat (\%)}+0.5\end{matrix}\right]$$

Solids Not Fat (SNF) of the milk was calculated by indirect method. The difference between total solids (%) and fat (%) gave the SNF content in milk. Proximate analysis viz. moisture and fat of *Maush kraer* samples was done using the standard procedures of Association of Official Analytical Chemists (AOAC, 2005).

Sensory characteristics: The sensory evaluation of the *Maush kraer* was carried out by a semi-trained experienced panel consisting of scientists of LPT

(a) (b)

Fig. 1: (a) Traditional method of *Maush kraer* preparation and (b) Removal of whey during the process of *Maush kraer* preparation

Table 1: Physico-chemical characteristics of raw milk used for *Maush kraer* preparation (Mean±S.E)

Parameter	Values
pH	6.83±0.04
Sp. Gravity	1.027±0.001
TA (% LA)	0.15±0.003
EC (m S/cm)	4.75±0.17
TS (%)	11.81±0.39
Fat (%)	3.79±0.24
SNF (%)	8.02±0.19

Division and PG students of F.V.Sc. and A.H, SKUAST-K. The panelists evaluated the coded samples of *Maush kraer* for various sensory attributes viz., appearance, flavour, body and texture and overall acceptability as per 9 point Hedonic scale, where 9 denoted extremely desirable and 1 denoted extremely poor.

Statistical analysis: The data obtained were analyzed statistically following the method of Snedecor and Cochran (1980) using SPSS software package. The one way analysis of variance was used and significance of means tested by using Least Significant Difference test at 5% level of significance.

RESULTS AND DISCUSSION

Raw milk characteristics: The data pertinent to the characteristics of raw milk used for *Maush kraer* preparation is shown in Table 1. The results revealed the values as 6.83±0.04, 1.027±0.001, 0.15±0.003 (%LA), 4.75±0.17 (m S/cm), 11.81±0.39%, 3.79±0.24% and 8.02±0.19% for pH, SG, TA, EC, TS, Fat and SNF, respectively. Similar values for the above mentioned characteristics have been cited by other researchers (De, 1980; Eckles *et al*., 1995; Sharma, 2006; Winton and Winton, 2006; Parihar and Parihar, 2006; Khan, 2010). There was clear uniformity found for the values of different milk characteristics when milk was tested at various intervals.

Physico-chemical characteristics of *Maush kraer*: The data of various parameters of *Maush kraer* prepared using natural and chemical coagulants are depicted in Table 2. The results revealed that use of citric acid resulted in decrease of moisture content in the *Maush krear* with increase in concentration from 2 to 5%. Similar results have been reported by Sen (1985); Sachdeva and Singh (1988) and Kumar *et al.* (2007) with regard to the paneer. They reported that the concentration of citric acid is inversely related to moisture content of sample. In the present study, the overall mean value for moisture was 23.85±0.65 which is within the limits of class of hard cheese varieties (Porter, 1975). Further, the use of citric acid resulted in significant ($p>0.05$) increase of fat content in *Maush krear* with highest value of 37.08±0.49% in the group wherein 5% (T4) citric acid was used compared to 34.15±1.13% in control. The increase in the citric acid level resulted in proportional increase in fat percent, thus confirming the findings of Kumar *et al.* (2007). It was found that all the treatments had fat content within the range prescribed for hard cheese varieties by Porter (1975) with overall mean value as 35.84±0.60. The yield of all the treatments was not significantly different with each other. The control sample had a yield of 12.31±0.57 whereas overall mean was to the tune of 12.45±0.39. Comparable values of yield have been reported for paneer and cheese by Sachdeva and Singh (1988); Singh and Kanawjia (1990); Agnihotri and Pal (1996); Peters (2005); Jadhavar *et al.* (2009) and Deshmukh *et al.* (2009).

Physico-chemical characteristics of whey: The results of physico-chemical characteristics of whey samples is shown in Table 3. There was no difference ($p>0.05$) in the values of total solids of whey among various

Table 2: Effect of natural and chemical coagulants on physico-chemical characteristics of *Maush kraer* (Mean±S.E)

	Natural coagulant	---------- Chemical coagulant (Citric acid) ----------			
Parameter	Control (T_1)	2 % (T_2)	3% (T_3)	5% (T_4)	Overall mean
Moisture (%)	22.34±0.58^a	26.36±0.33^b	25.02±1.73^{ab}	23.11±1.0^a	23.85±0.65
Fat (%)	34.15±1.13^a	34.66±0.70^a	37.08±0.49^b	37.46±1.36^b	35.84±0.60
Yield (%)	12.31±0.57	12.58±0.88	12.46±1.32	11.66±0.33	12.45±0.39

Means with different superscripts row-wise differ significantly ($p<0.05$)

Table 3: Effect of natural and chemical coagulants on the physico-chemical characteristics of whey (Mean±S.E)

	Natural coagulant	---------- Chemical coagulant (Citric acid) ----------			
Parameter	Control (T_1)	2 % (T_2)	3 % (T_3)	5 % (T_4)	Overall mean
T S (%)	6.06±0.20	5.48±0.17	5.71±0.14	5.83±0.35	5.77±0.11
Yield (%)	85.66±0.26	86.53±0.14	86±0.36	85.36±0.33	85.89±0.17

Table 4: Effect of natural and chemical coagulants on sensory quality of *Maush kraer* (Mean±S.E)

	Natural coagulant	---------- Chemical coagulant (Citric acid) ----------			
Parameter*	Control (T_1)	2 % (T_2)	3% (T_3)	5% (T_4)	Overall mean**
Appearance	8.2±0.13^a	7.5±0.15^b	7.85±0.18^{ab}	7.75±0.12^b	7.82±0.07
Flavor	7.3±0.20^a	6.6±0.15^b	7.1±0.14^a	6.9±0.14^{ab}	6.97±0.08
Body and texture	7.6±0.13^a	6.8±0.11^b	6.9±0.12^b	6.8±0.09^b	7.02±0.06
Overall acceptability	7.4±0.11^a	6.9±0.06^b	6.9±0.16^b	6.8±0.09^b	7.00±0.06

Means with different superscripts row-wise differ significantly ($p<0.05$); *9-point Hedonic scale (9 = like extremely, 1 = dislike extremely); **N = 104

treatment groups. The overall mean value was to the tune of 5.77±0.11. Similar values for total solids of whey have been reported for paneer and cheese by Parihar and Parihar (2006); Lucey *et al.* (2007); Goyal and Gandhi (2009) and Khan (2010). Further, there was again no effect on the yield of whey between the samples produced from buttermilk and citric acid coagulants. The overall mean was to the tune of 85.89±0.17. Similar values for yield of whey during preparation of paneer and cheese has been reported by Sharma (2006) and Khan (2010).

Sensory characteristics of *Maush kraer*: The data on sensory evaluation of *Maush kraer* prepared using natural and chemical coagulants are presented in Table 4. Various sensory attributes viz. appearance, flavor, body and texture and overall acceptability were determined. The results revealed that for all these attributes, highly desirable scores were achieved for the samples prepared using natural coagulant (buttermilk) when compared with the samples prepared using citric acid at different levels. Bhattacharya *et al.* (1971), Shukla *et al.* (1984); Sachdeva *et al.* (1985); Tamime (1993); Pal *et al.* (1999) and Masud *et al.* (2007) have also reported the variability in the sensory attributes by using different coagulants.

Conclusion: In conclusion, use of chemical coagulant citric acid results in decreased moisture and increased fat content in *Maush krear*. Highly desirable scores in terms of sensory attributes were achieved for buttermilk group than the citric acid groups, hence buttermilk, a natural coagulant, is recommended for quality preparation of *Maush krear*.

REFERENCES

Agnihotri, M.K. and U.K. Pal, 1996. Quality and shelf-life of goat milk Paneer in refrigerated storage. Small Ruminant Res., 20: 75-81.

Ahmad, S.R., V. Pathak, Z.F. Bhat and S.A.A. Bukhari, 2014. Efficacy of sorbic acid on the storage quality of Kaladhi-An acid coagulated milk product. J. Food Sci. Technol. Mysore, 51: 4040-4046.

Aneja, R.P., B.N. Mathu, R.C. Chandan and A.K. Banerjee, 2002. Technology of Indian Milk Products. Dairy Indian Yearbook, New Delhi, India.

AOAC, 2005. Official Methods of Analysis. Association of Ofticial Analytical Chemists. 16th Ed. Washington, DC, USA.

Bhattacharya, D.C., O.N. Mathur, M.R. Srinivasan and O. Samlik, 1971. Studies on the method of production and shelf life of paneer (cooking type of acid coagulated cottage cheese). J. Food Sci. Technol., 8: 117-120.

De, S., 1980. Outlines of dairy technology. Oxford University Press, Delhi.

Deshmukh, D.S., P.N. Zanjad, V.D. Pawar and G.M. Machewad, 2009. Studies on the use of acidified and cultured whey as coagulant in the manufacture of paneer. Int. J. Dairy Technol., 62: 174-181.

Eckles, C.H., W.B. Combs and H. Macy, 1995. Milk and milk products. 4th Ed. Tata Mcgraw Hill publishing company limited, New Delhi 110032, pp: 344-346.

Goyal, N. and D.N. Gandhi, 2009. Comparative analysis of Indian paneer and cheese whey for electrolyte whey drink. World J. Dairy Food Sci., 4: 70-72.

Jadhavar, V.V., B.D. Patil, B.K. Pawar and D.Z. Jagtap, 2009b. Studies on yield and chemical composition of paneer prepared from cow and soy mix milk. J. Maharashtra Agric. Univ., 34: 49-53.

Khan, S.U., 2010. Optimization of the processing variables for the production of paneer using reconstituted milk. M.V.Sc. Thesis submitted to SKUAST-K, J and K, India.

Kumar, S., D.C. Rai and D.N. Verma, 2007. Effect of different levels of citric acid on the physico-chemical and sensory attributes of buffalo milk paneer. Proceedings of the International Conference on Traditional Dairy Foods. NDRI, Karnal-India, pp: 14-17.

Lucey, S.G., I.T. Lin, J.J. Jaeggi, C.J. Martinelli, M.E. Johnson and J.A. Lucey, 2007. Effect of type of concentrated sweet cream buttermilk on the manufacture, yield and functionality of Pizza Cheese. J. Dairy Sci., 90: 2675-2688.

Masud, T., S. Shehla and M. Khurram, 2007. Paneer (White Cheese) from buffalo milk. Biotechnology and Biotechnological Equipments, pp: 451-452.

Pal, M.A., B.S. Beniwal and R.K. Karwasra, 1999. Comparative efficacy of citric and malic acids as coagulants for paneer manufacture. Ind. J. Dairy Sci., 52: 156-159.

Pal, M.A., S.A. Wani, A.H. Malik, S.D. Mir and Ishrat, 2003. *Maush kraer*-A hitherto undocumented traditional dairy product of Kashmir. Bev. Food World, pp: 55-56.

Pal, M.A. and C.M. Kapoor, 2007. Sensory characteristics of Processed Paneer manufactured with varying proportions of various emulsifying salts. Bev. Food World, 34: 40-44.

Parihar, P. and L. Parihar, 2006. Dairy microbiology. Agrobios (India) Agro house, behind Nasrani cinema, Chopasani road, Jodhpur 342002, pp: 282-291.

Peters, R.H., 2005. Review Economic aspects of cheese making as influenced by whey processing options. Int. Dairy J., 15: 537-545.

Porter, J.W.G., 1975. Milk and Dairy foods, Oxford University, Press, Oxford.

Sachdeva, S., S. Singh and S.K. Kanawjia, 1985. Recent developments in paneer technology. Ind. Dairyman, 37: 501-505.

Sachdeva, S. and S. Singh, 1988b. Optimisation of processing parameters in the manufacture of paneer. J. Food Sci. Technol. Mysore, 25: 142-145.

Sen, D.C., 1985. Influence of calcium lactate strength on yield and sensory properties of chhana. Asian J. Dairy Res., 4: 3638.

Sharma, R., 2006. Production, processing and quality of milk and milk products. Ist Ed. International book distributing Co. Chaman studio building, second floor, Charbagh, Lucknow-226004, U P India, pp: 196-202.

Shukla, F.C., B. Madhu and S.C. Jain, 1984. Studies on the technological aspects of processing and preservation of paneer. A Report on ICAR Project.

Singh, S. and S.K. Kanawjia, 1990. Effect of hydrogen peroxide and delvocid on enhancement of shelf life of recombined milk paneer. Brief Communications of the XXIII International Dairy Congress, Montreal, October 8-12, Vol. II.

Snedecor, G.W. and W.G. Cochran, 1980. Statistical methods. 7th Ed. The Iowa State University Press, Ames, I.A.

Sukumar, C., S. Aneesh and V. Sridhar, 2010. Public private partnership in Indian dairy industry initiating white revolution-II. Technopak Advisors Pvt Ltd.

Tamime, A.Y., 1993. Modern Cheesemaking: Hard Cheeses, In: Modern Dairy Technology, Vol. 2 (Ed. R. K. Robinson), Elsevier Applied Science Publishers, London.

Wani, S.A., M.H. Wani, S.A. Saraf, R. Rehana and K. Imran, 2012. Prospectus of livestock enterprise for livelihood security in Jammu and Kashmir. Agric. Econom Market Res. Report, 1: 39-40.

Winton, A.L. and K.B. Winton, 2006. Milk and milk products. Agrobios (India) Agro house, behind Nasrani cinema, Chopasani road, Jodhpur 342002, pp: 180-197.