

EFFECT OF DIFFERENT TIME-TEMPERATURE COMBINATIONS ON MOISTURE AND SENSORY QUALITY OF *MAUSH KRAER*, A TRADITIONAL DAIRY PRODUCT OF J&K

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Abstract: An investigation was carried out to study the effect of different time-temperature combinations on the sensory quality of *Maush Kraer* preparation with a view to introduce suitable interventions. For this purpose milk and buttermilk in the ratio of 1:1 were used to prepare the product. The buttermilk used was produced under controlled fermentation conditions of 48 hours duration. Drying was done at different time-temperature combinations viz., for 4 hours, 5 hours and 6 hours at 40 °C, 4 hours, 5 hours and 6 hours at 50 °C and similarly at 4 hours, 5 hours and 6 hours at 60 °C. The products produced after drying were evaluated for moisture content and subjected to sensory evaluation. In terms of moisture content, best drying was adjudged in the time-temperature combination of 4 hrs at 60 °C upon sensory evaluation and had moisture content of 21.20 ± 0.66 . Further, two time-temperature combinations i.e., 4 hrs at 60 °C and 6 hrs at 40 °C yielded products with comparatively more sensory scores and within these two the former combination got more scores for all sensory attributes and thus, was regarded the best combination for drying the *Maush Kraer*.

Keywords: Buttermilk, Dairy product, *Maush Kraer*, Sensory quality.

Introduction

The state of Jammu & 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). During lean periods shortage may occur, however, in the glut period there is enough raw material available to be got converted into products. *Paneer* and *Maush Kraer* are rather the only culinary preparations of dairy origin in Kashmir (Pal and Kapoor, 2007). The word “*Maush*” implies the buffalo and “*Kraer*” is understandably a modified form of “*Krai*” meaning the pan. The origin of *Maush Kraer* can be traced back to the nomadic tribesmen (Gujjars and Bakarwals), who first prepared the product with an aim of preserving surplus milk in the absence of a market outlet. The product is a fermented, heat and acid coagulated dairy product and is prepared mostly in summer season when these tribal people

are on highland pastures with their livestock. The preparation of this product, if properly channelized to the market can prove a supportive livelihood option for this class of society. This product is believed to possess anti-diarrheal, anti-cold and anti-tussive properties besides being a salubrious food (Pal *et al.*, 2003).

In order to improve the quality and yield of this product, it would be pertinent to contemplate identifying the technological gaps and bridging them using the current scientific tools. With this background oven drying was incorporated in the present study at different time-temperature combinations viz., for 4 hours, 5 hours and 6 hours at 40 °C, 4 hours, 5 hours and 6 hours at 50 °C and similarly at 4 hours, 5 hours and 6 hours at 60 °C with the objective to incorporate the suitable time-temperature combination for drying of the product.

Materials and methods

Survey 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. These areas were selected for the survey 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 during the survey program and few technological gaps were identified. The process was, for this purpose observed and analyzed right from the process of raw material procurement through intermediate processing to the final stages of consumption of the finished product.

Source of raw materials

In all experiments fresh cow milk was procured from the local market. 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. The quantity of milk used for preparation of product was determined by the type of experiment being done. The milk thus obtained from the local market was analyzed for various physico-chemical characteristics viz. specific gravity, fat, total solids, solid not fat, electrical conductivity, pH and titrable acidity. Fresh starter culture of cow's milk was procured from the local market of Shuhama, Alusteng. This culture material was used as a natural coagulant for coagulating the milk. Citric acid used for the coagulation of milk was procured from standard firms (Thomas Baker Chemicals Ltd.) and was used at different levels viz. 2, 3 and 5 % aqueous solution for coagulating the milk. All the chemicals used were of analytical grade and obtained from standard firms (Qualigens Fine Chemicals, Nice

Chemicals Pvt. Ltd., Hi Media Lab. Pvt. Ltd. etc.).

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. This buttermilk was then mixed with the fresh milk in the proportion of 2:1 (buttermilk: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 (7.5cm x 7.5cm x 7.5cm) 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 minutes (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.

Optimization of time-temperature combination for drying of *Maush Kraer*

The experiment was carried out to optimize the drying conditions for *Maush Kraer* in the hot air oven. Drying was done at different time-temperature combinations viz., for 4 hours, 5 hours and 6 hours at 40 °C, 4 hours, 5 hours and 6 hours at 50 °C and similarly at 4 hours, 5 hours and 6 hours at 60 °C. The products produced after drying were evaluated for moisture content (AOAC 2005) and subjected to sensory evaluation. The sensory evaluation of the *Maush Kraer* was carried out by a semi-trained experienced panel consisting of scientists and postgraduate students of LPT Division, 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 from duplicate samples were averaged and the data so generated were analyzed statistically following the method of Snedecor and Cochran (1980); Gomez and Gomez (1984); Steel and Torrie (1984). The data was processed using SPSS (10.0) software

package. The analysis of variance of group mean was computed and significance of means tested by using Least Significant Difference test at 5 per cent level of significance.

Results and discussion

Raw milk characteristics

The milk used during the whole procedure of *Maush Kraer* production had mean values for various physico-chemical properties (Table 1) well within the prescribed limits for cow milk (FSSA, 2006). Similar values for these characteristics have been reported by Eckles *et al.* (1995); Parihar and Parihar (2006); Sharma (2006); Winton and Winton (2006); Khan (2010). There was clear uniformity found for the values of different milk characteristics when milk was tested at various intervals.

Table 1: Physico-chemical characteristics of raw milk used for *Maush Kraer* preparation.

Parameter	Mean \pm S.E value
Specific Gravity	1.027 \pm 0.001
Fat (%)	3.79 \pm 0.24
Total Solids (%)	11.81 \pm 0.39
Solid Not Fat (%)	8.02 \pm 0.19
Electrical Conductivity (m S cm ⁻¹)	4.75 \pm 0.17
pH	6.83 \pm 0.04
Titration Acididity (% LA)	0.15 \pm 0.003

Table 2: Effect of different time-temperature combinations on moisture content (%) of *Maush Kraer*

Samples	Moisture percentage (Mean \pm S.E)
4 hrs at 40°C (T ₁)	38.91 \pm 0.67 ^a
4 hrs at 50°C (T ₂)	31.55 \pm 0.59 ^b
4 hrs at 60°C (T ₃)	21.20 \pm 0.66 ^c
5 hrs at 40°C (T ₄)	35.83 \pm 0.54 ^d
5 hrs at 50°C (T ₅)	28.54 \pm 0.56 ^e
5 hrs at 60°C (T ₆)	19.51 \pm 0.57 ^c
6 hrs at 40°C (T ₇)	31.91 \pm 0.37 ^b
6 hrs at 50°C (T ₈)	24.50 \pm 0.41 ^f
6 hrs at 60°C (T ₉)	14.63 \pm 1.07 ^g
Overall mean	27.40 \pm 1.49

Mean \pm SE with different superscripts column-wise differ significantly (p<0.05)

Table 3: Effect of different time-temperature combinations on Sensory quality of *Maush Kraer*

Samples	Sensory quality* (Mean \pm S.E)			
	Appearance	Flavor	Body & texture	Overall acceptability
4 hrs at 40°C (T ₁)	6.85 \pm 0.15 ^a	6.15 \pm 0.19 ^a	6.6 \pm 0.15 ^a	6.2 \pm 0.17 ^a
4 hrs at 50°C (T ₂)	6.7 \pm 0.16 ^{ac}	6.15 \pm 0.18 ^a	6.15 \pm 0.18 ^b	6.15 \pm 0.15 ^a
4 hrs at 60°C (T ₃)	8.1 \pm 0.14 ^b	7.3 \pm 0.12 ^{de}	7.3 \pm 0.10 ^{ec}	7.55 \pm 0.11 ^c
5 hrs at 40°C (T ₄)	6.35 \pm 0.16 ^{bc}	6.5 \pm 0.11 ^{ac}	6.25 \pm 0.16 ^{ab}	6.2 \pm 0.13 ^a
5 hrs at 50°C (T ₅)	6.7 \pm 0.12 ^a	6.6 \pm 0.11 ^c	6.25 \pm 0.16 ^{ab}	6.4 \pm 0.13 ^a
5 hrs at 60°C (T ₆)	6.65 \pm 0.13 ^a	6.2 \pm 0.13 ^a	6.05 \pm 0.15 ^{db}	6.2 \pm 0.13 ^a
6 hrs at 40°C (T ₇)	7.95 \pm 0.13 ^b	7 \pm 0.10 ^{be}	7.3 \pm 0.10 ^c	7.35 \pm 0.15 ^{bc}
6 hrs at 50°C (T ₈)	6.7 \pm 0.12 ^a	6.3 \pm 0.14 ^{ac}	6.15 \pm 0.15 ^{fb}	6.3 \pm 0.14 ^a
6 hrs at 60°C (T ₉)	6.65 \pm 0.13 ^a	6.4 \pm 0.11 ^{ac}	6.25 \pm 0.16 ^{ab}	6.2 \pm 0.15 ^a
Overall mean**	6.96 \pm 0.06	6.51 \pm 0.05	6.47 \pm 0.05	6.50 \pm 0.06

Mean \pm SE with different superscripts column-wise differ significantly ($p \leq 0.05$)

*9-point Hedonic scale (9 = like extremely, 1 = dislike extremely), **N = 216

Moisture content of *Maush Kraer*

The results of moisture content of *Maush Kraer* under different time-temperature combinations have been presented in Table 2. Drying is an important aspect of manufacturing procedure of *Maush Kraer*. Direct method of dehydration in hard varieties of cheeses has been reported by Sanders (1943) while drum or spray drying and freeze drying below 20 °F have also been reported by Loesecke (2005). But when we talk of *Maush Kraer*, it is being traditionally dried under sun. In the laboratory oven drying was incorporated as an intervention to standardize the best time-temperature combination for drying. The samples were dried at nine different time-temperature combinations and the samples after drying were with varied range of moisture content. The percent moisture ranged from 14.63 \pm 1.07 to 38.91 \pm 0.67. But none of the samples crossed the mark of 40 % moisture content and hence all samples can be put in the class of hard cheese varieties (Porter 1975). Two pairs of samples were with comparable moisture levels due to their more or less matching drying conditions in terms of time and temperature. For example time-temperature combinations of 4 hrs at 50 °C and 6 hrs at 40 °C produced comparable values. Similarly combinations of drying for 4 hrs at 60 °C and 6 hrs at 40 °C presented comparable values. Rest samples were with significantly different moisture levels and the overall mean was to the tune of 27.40 \pm 1.49. The combination dried at time-temperature combination of 4 hrs at 60 °C was adjudged best upon sensory evaluation and had moisture content of 21.20 \pm 0.66.

Sensory characteristics of *Maush Kraer*

The results of various sensory characteristics of *Maush Kraer* under different time-temperature combinations have been presented in Table 3. Since traditionally the product is being dried under sunlight by placing the *Maush Kraer* on a clean surface. In the present experiment the intervention of oven drying was introduced. Different time-temperature combinations were selected for drying the product and finally sensory evaluation of the product was carried out. Upon sensory evaluation the scores for appearance of two samples dried at the time-temperature combinations of 4 hrs at 60 °C and 6 hrs at 40 °C were comparable with one another and both were significantly higher than rest of the samples and in turn later samples were comparable to each other. The lower scores of the samples other than mentioned earlier were probably because of two reasons, the first reason being the products were dried with the time-temperature combinations a lower order hence dried inadequately and were less desired by the panel and scored lower. The second reason was that some of the time-temperature combinations dried the product excessively and made the product too hard to be readily acceptable. These combinations can be regarded as long time and high temperature combinations. These combinations also caused the fat to melt and appear on the surface of the product as small droplets. This greasing effect of drying the natural cheese was also reported by Loesecke (2005). The scores for other sensory attributes viz., flavor, body and texture and overall acceptability presented more or less similar trend like that of scores for appearance. The relationship between the samples in the scores for flavor, body and texture and overall acceptability were almost similar as that of appearance scores. Long time and high temperature combinations produced the samples with burnt flavors while such defect was absent with short time low temperature combinations. The body and texture scores were lower for long time high temperature combinations and such samples also scored lower for overall acceptability because of difficult chewing and burnt sensation. Thus it could be concluded that although the two time-temperature combinations i.e. 4 hrs at 60 °C and 6 hrs at 40 °C obtained comparable sensory scores but former combination scored numerically more than the later and is thus recommended as a viable time-temperature combination for the preparation of *Maush Kraer*.

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