Development of khoa based roll

S. Shrimanwar Megha and K.D. Chavan*

Department of Animal Husbandry and Dairy Science,
Mahatma Phule krishi Vidapeeth, Rahuri-413 722, Maharashtra, India.
Received: 14-11-2018 Accepted: 23-03-2019

ABSTRACT
The khoa roll samples were prepared by using of 0.5, 1.0, 1.5, 2.0, 2.5, 3.0 and 3.5 per cent cocoa powder and @ 22% sugar. On the basis of sensory evaluation, without addition of cocoa powder (T0), addition of 2.0% cocoa powder (T1), 2.5% cocoa powder (T2) and 3.0% cocoa powder (T3) and 22% sugar level were selected for experimental trials. The experimental samples were evaluated for sensory, chemical and microbiological qualities. Experimental data was analyzed using standard method. The sensory attributes i.e. colour and appearance, body and texture, flavour and overall acceptability of the khoa roll samples significantly differed (P<0.05) due to addition of cocoa powder. The sensory scores for colour and appearance, body and texture, flavour and overall acceptability of the product ranged from 7.58 to 8.06, 7.60 to 8.06, 7.60 to 8.20 and 7.60 to 8.20. There was significant differences (P<0.05) with respect to fat, protein, lactose, total solids, titratable acidity and pH of khoa roll samples due to addition of cocoa powder. The mean fat, protein, lactose, total solids, titratable acidity and pH value ranged from 21.4 to 21.84 %, 17.31 to 18.74 %, 23.43 to 23.48 %, 67.27 to 69.63, 0.62 to 0.68 % LA and 6.18 to 6.21, respectively. The SPC and YMC count ranged from 5.4 x 102 cfu/g (T0) to 8.2 x 102 cfu/g (T1), 2.2 x 102 cfu/g (T2) to 10.6 x 102 cfu/g (T3), respectively. On the basis of results of sensory quality the better quality khoa roll can be prepared by blend of 2.5 per cent cocoa powder and 22 % sugar in khoa.

Key words: Chemical quality, Cocoa powder, Khoa roll, Microbiological quality, Sensory quality.

INTRODUCTION
Since time immemorial, a significant proportion of milk has been used in India preparing a wide variety of dairy delicacies, an unending array of sweets and other specialties from different regions of the country. Milk is highly perishable in nature and processing aims to extend the shelf-life of milk, while converting it into mouth-watering tit-bits. Thus, the diverse methods to prepare as well as preserve milk products have been developed. Over the millennia, these processes have largely remained unchanged, being in the hands of halwais, the traditional sweetmeat makers, who form the core of this cottage industry (Aneja et al., 2002).

Khoa based sweets are one of the important variety of indigenous products. Khoa is known by various names in India i.e. khoya, mava, kava and khava, etc. sweets prepared from khoa are basically gulabjamun, kalajamun, kalakand, and burfi etc. Khoa is one of dairy product consumed maximum quantity in India as compared to cheese and butter. There are three major varieties of khoa, viz., Pindi, Dhap and Danedar are present. The chemical composition, consistency, sensory characteristics and the uses of each variety are found to very differently. (De, 1982 ).

In order to improve the acceptability of any milk products, it is a common practice of adding different coloring and flavoring agents in them and khoa is not an exception to it. In old practices, charoli and saffron etc are added for increasing taste and acceptability of khoa but now a day’s addition of cocoa powder in khoa is gaining popularity. Cocoa powder rich in Flavonoids, dietary fibre and several minerals. Steady stream of science has emerged, showing that cocoa and the confection made from it posses health promoting properties. In fact if cocoa were consumed judiciously and regularly it would prove the single greatest life saving medication of all time.

Cocoa powder is one of the flavouring agent as well as nutrient supplying ingredients is incorporated in khoa to increase its flavour, palatability and taste. Cocoa powder is commonly used as a flavouring agent in ice-cream, buttermilk, burfi and peda etc. looking to the popularity of chocolate bars among children; it is assumed that value addition of chocolate flavoured khoa may capture a market. It was therefore decided to explore the possibility to utilize cocoa powder in khoa to prepare khoa based roll.

MATERIALS AND METHODS
Milk: Composite samples of fresh crossbred cow’s milk were obtained from Research Cum Development Project on Cattle, Department of Animal Husbandry and Dairy Science, MPKV, Rahuri, Dist. Ahmednagar Maharashtra for preparation of khoa samples.

*Corresponding author’s e-mail: krishnachavan158@gmail.com
Sugar: Good quality sugar was procured from the local market.

Cadbury Cocoa powder: Food grade Cadbury brand flavoured cocoa powder (manufactured by shree warana Sahakari Dugdha utpadak sangh Ltd) dist. Kolhapur (M. S.) was used for experiments.

Packaging material: Cardboard boxes of rectangular shape with butter paper lining were used for packaging the products.

B.O.D. Incubator: B.O.D. Incubator manufactured by STEELMET NOVATECH, Pune (India) was used for incubation.

Autoclave: Equitron, vertical autoclave Mumbai (230 VAC, 50 Hz) was used to sterilize the microbial media, Phosphate buffer solution and glassware etc.

Hot air oven: Lab HOSP make laboratory hot air oven of 45 x 45 x 45 cm size was used to determine moisture content and total solids content in khoa roll samples.

Muffle furnace: Tempo make (India) muffle furnace was used for determination of ash content in the samples.

Colony counter: A colony counters with magnifying lens was used for counting the colonies formed by microorganisms.

Laminar Air Flow: An instrument manufactured by Kirloskar Electronic Ltd. (India) was used for microbiological work.

pH meter: A digital pH meter manufactured by Lab Techno, Mumbai (India) was used for determination of pH.

Chemical analysis of cow milk: Fat, protein, lactose. Total solids, Titratable acidity (% L A.), and pH of milk samples were determined by as per BIS (1981).

Chemical analysis of khoa: Fat, protein, lactose. Total solids, Titratable acidity (% L A.) and pH of khoa samples were determined by as per BIS (1981).

Preliminary trails were conducted to decide the levels of addition of cocoa powder in the khoa. The khoa based roll samples were prepared by addition of 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5 per cent levels of cocoa powder by weight of khoa and 22 per cent sugar. The prepared samples of khoa based rolls were subjected to sensory evaluation by five semi trained panel of judges.

On the basis of results of sensory evaluation 2.0, 2.5, 3.0 % cocoa powder levels and 22% sugar levels were selected for experimental trails.

Treatment details

T<sub>0</sub>: Control (Without addition of cocoa powder)

T<sub>1</sub>: Khoa + 2.0% cocoa powder by weight of khoa + 22% sugar.

T<sub>2</sub>: Khoa + 2.5% cocoa powder by weight of khoa + 22% sugar.

T<sub>3</sub>: Khoa + 3.0% cocoa powder by weight of khoa + 22% sugar.

Preparation of khoa roll: Khoa samples were prepared by using the method of De (1982) with slight modifications.

Sensory evaluation: The sensory evaluation of khoa roll samples prepared under preliminary trails and experimental trails was done by using the method described in the IS: 6272, Part I and Part II (1971) using 9 point Hedonic scale.

Microbiological analysis of khoa roll

Standard plate count (SPC): Standard plate count (SPC) was determined by using standard procedure using Standard Plate Count Agar (SPCA) media as mentioned by Amin, (1997).

Yeast and mould count (YMC): Yeast and mould count (YMC) was determined as per procedure described in IS: 5403 (1999) using Potato Dextrose Agar (PDA).

Coliform count: Coliform count of khoa roll samples was determined as per procedure described in BIS(1981) by using violet red bile agar.

Preparation of dilution blanks

Phosphate buffer (Stock solution): The potassium dihydrogen phosphate 3.4 g was dissolved in 100 ml of distilled water. The pH was adjusted with 1 N NaOH solution so that after sterilization it would be 7.2.

Phosphate buffer dilution blanks: For use of dilution blanks, 1.25 ml of stock phosphate buffer solution was added

Receipt of milk  
↓  
Filtration  
↓  
Continuous vigorous heating (55-60°C)  
↓  
Boiling (stirring/scrapping)  
↓  
Preparation of khoa  
↓  
Add ground sugar in khoa  
↓  
Heating  
↓  
Divide the mixture into two equal parts  
↓  
Add in one portion cocoa powder and plane khoa  
↓

Spread cocoa mixture on parchment paper in rectangle shape  
↓  
Place the plain khoa on cocoa sheet (such that cocoa sheet cover the khoa rolls)  
↓  
Roll it back and forth  
↓  
Cut into pieces  
↓  
Packaging  
↓  
Storage (At temp 27± 2°C)

Fig 1: Flow chart for preparation of khoa based roll.
to 1000 ml of distilled water. The pH was adjusted to 7 by using 1 N NaOH solution. The 9.3 ml was taken into glass test tube (18 x 150 mm) and sterilized at 121°C for 15 min. at 15 lb pressure.

**Statistical design:** The experiment was laid down in the Completely Randomized Design with 3 replications for preliminary trials and five replications for experimental trials. The experimental data was tabulated and analyzed according to Snedecor and Cochran (1994).

**RESULTS AND DISCUSSION**

**Chemical composition of milk:** The average chemical composition of milk used during study had 4.0, 3.43, 4.45, 0.65, 12.53 and 0.13 per cent fat, protein, lactose, ash, total solids and lactic acidity (% L.A), respectively.

**Chemical composition of khoa:** The *khoa* prepared had 21.50 % fat; 17.34 % protein; 23.39 % lactose; 3.80% ash; 66.27% total solids and 0.61 % lactic acid (% LA).

**Chemical composition of cocoa powder:** The chemical composition of cocoa powder used for study had average fat 11.9, protein 24.0, carbohydrates 52.1 and dietary fibre 33/100 gm (As per Cadbury Brand).

**Sensory evaluation of khoa roll**

**Colour and appearance:** The colour and appearance of *khoa* roll samples as influenced by different levels of cocoa powder is depicted in Table 1. The colour and appearance is one of the important quality attributes of sensory evaluation. It is revealed that the sensory score for colour and appearance of the *khoa* roll samples ranged from 7.58 (T₃) to 8.06 (T₁). The addition of cocoa powder in the *khoa* significantly (P <0.05) influenced the colour and appearance of the product.

| Treatments (T) | Colour and appearance | Body and texture | Flavour | Overall acceptability |
|---------------|------------------------|-----------------|---------|----------------------|
| T₀            | 7.60⁺                   | 7.60⁺           | 7.60⁺   | 7.60⁺                |
| T₁            | 7.58⁻                   | 7.78⁻           | 7.74⁻   | 7.76⁻                |
| T₂            | 8.06⁺                   | 8.06⁺           | 8.20⁺   | 8.20⁺                |
| T₃            | 7.96⁺                   | 7.68⁻           | 7.70⁺   | 7.94⁺                |
| S.E. ±        | 0.031                   | 0.030           | 0.033   | 0.036                |
| CD at 5%      | 0.094                   | 0.092           | 0.101   | 0.108                |

The *khoa* roll samples significantly (P<0.05) differed among themselves. Treatment T₃ and T₁ were on par. The *khoa* roll sample containing 2.5% cocoa powder had the highest colour and appearance score.

Shelke (2007) reported the score of colour and appearance for mango *burfi* as 7.06 to 8.80. Bankar (2011) prepared pineapple *burfi* and reported that the colour and appearance score in the range of 7.81 to 8.59.

**Body and Texture:** It was observed that body and texture score (Table 1) for T₀, T₁, T₂ and T₃ were 7.60, 7.78, 8.06 and 7.68, respectively. The addition of cocoa powder in the *khoa* roll samples significantly (P<0.05) influenced the body and texture of the product. All the treatment samples significantly (P<0.05) differed among themselves. The treatment T₃ had highest body and texture score over the rest of the treatments in the study.

Golande (2007) studied on sweet orange *burfi* and recorded the body and texture score as 7.15 to 8.00. Shelke (2007) observed the score for body and texture of mango *burfi* ranged between 7.50 to 8.25.

Bankar (2011) prepared the pineapple *burfi* and observed the score for body and texture in the range of 7.69 to 8.23. Hajare (2011) prepared the almond *burfi* and observed the score for body and texture in the range of 7.0 to 8.5.

**Flavour:** The addition of cocoa powder in the *khoa* significantly influenced the flavour of the product. The flavour score (Table 1) ranged from 7.74 (T₁) to 8.20 (T₃). The treatment T₃ had highest flavour score i.e. 8.20 over the rest of the treatments.

Satav (2014) reported that the flavor score of *burfi* was influenced with addition of higher level of walnut powder.

**Overall acceptability:** It is observed that the addition of different levels of cocoa powder in the *khoa roll* significantly (P<0.05) influenced the overall acceptability of the product. The overall acceptability of the experimental *khoa roll* samples (Table 1) range from 7.0 (T₀) to 8.20 (T₃). The highest overall acceptability score was observed in treatment T₃ containing of 2.5 per cent cocoa powder among the rest of the sample treatments. All the treatments sample significantly differ among themselves.

Shelke (2007) reported the overall acceptability score of mango *burfi* ranged from 7.31 to 8.45. Bankar (2011) prepared pineapple *burfi* and reported overall acceptability score in the range of 7.74 to 8.47.

**Chemical composition of khoa roll samples.**

**Fat:** From the Table 2, it was observed that, the fat content in the samples under experimental treatments ranged from 21.40(T₃) to 21.84(T₁) per cent. As the level of addition of cocoa powder in the *khoa* increased the fat content increased. The treatment T₃ had maximum fat content i.e. 21.84 per cent were as the sample T₁ had lower Fat content i.e. 21.40 per cent, respectively.

The fat content in *khoa* roll samples significantly (P<0.05) influenced due to addition of cocoa powder in *khoa*. The treatment T₃ had highest body and texture score over the rest of the treatments in the study.
The results are comparable with the results reported by Rajorhia and Sen (1987) and Sharma et al., (1992), who stated that fat content in burfi 27.10 per cent, 4.10 to 28.01 per cent, 8.80 to 27.00 per cent and 26.28 per cent in respective order.

Kadam (2008) recorded the fat content in the range of 21.71 to 22.86 per cent in alphaanso burfi. 

**Protein:** The influence of addition of cocoa powder on protein content in the khoa roll samples was significant (P<0.05). The protein content (Table 2) under different experimental samples ranged from 17.31(T1) to 18.74(T3) per cent. All the experimental treatment differed significantly(P<0.05) among themselves.

The highest value for protein content was observed in the treatment T1(18.74) per cent. Mandokhot and Garg (1985) studied the quality of khoa burfi and peda and observed 14.0 to 20.30 per cent protein content in burfi samples. 

Rajorhia and Sen (1987) studied on milk sweets trade in India. They reported that the protein content in burfi samples in the range of 14.0 to 20.50 per cent.

**Chemical composition of kalakand** has been studied by several workers and has reported wide variations; fat content varied from 4.75 - 26.46%, protein 9.40 - 17.97%, lactose 11.86- 21.90%, ash 1.78 - 3.48% and moisture 4.2 – 20.30%. The wide variations in chemical composition may be due to initial quality of milk, quantity of sugar added, extent to which the mixture is heated and storage conditions (Magadum, 1990).

**Lactose:** It is seen from the Table 2 that the differences due to addition of cocoa powder on lactose content in the khoa roll samples were Non-significant. The mean lactose content in the experimental samples ranged from 23.43(T1) to 23.48(T3) per cent.

**Total solids:** From the results presented in the Table 2, it is revealed that the Total solids content in the different khoa roll samples ranged from 67.27(T1) to 70.80(T3) per cent. The addition of different levels of cocoa powder in the khoa roll samples significantly influenced the total solids content in the product. The khoa roll samples T1 and T3 were significantly differed over the rest of the treatment. The sample treatments T2 and T3 were at par.

**Titratable acidity (% L.A):** The titratable acidity content of the experimental treatments significantly (P<0.05) influenced due to addition of different levels of cocoa powder in the product. The titratable acidity content (Table 2) in the different samples ranged from 0.62 to 0.68 per cent.

As the level of addition of cocoa powder increased in the khoa roll the acidity content also slightly increased. The treatment T2 had maximum Acidity content i.e. 0.68(T2) per cent whereas the treatment T3 had lower Acidity content i.e. 0.62(T3) %LA, respectively. The treatments T1 and T2 were at par. Weresas T2 and T3 significantly differed over the rest of the treatment.

**pH:** It is seen from the Table 2, that the influence of addition of cocoa powder on pH of khoa roll samples was non-significant. The pH values in the different khoa roll samples ranged from 6.18(T1) to 6.21(T3).

**Microbiological quality of khoa roll samples**

**Standard plate count (SPC):** The SPC content (Table 3) in the different khoa roll samples was ranged from 5.4 x 10^2 cfu/g x 10^2(T2) to 8.2 x10^3 cfu/g 10^2 (T1). The addition of different levels of cocoa powder in the product samples the SPC content significantly (P<0.05) influenced.

**Yeast and mould count (YMC):** The mean YMC content in (Table 3) the khoa roll samples ranged from 2.2 x10^2 cfu/g x 10^2(T2) to (T1)10.6 x10^2 cfu/g. There is a significant (P<0.05) difference in the YMC count due to addition of cocoa powder in the product. All the treatments samples significantly differed among themselves.

**Coliform Count:** No coliform was found in (Table 3) any of the khoa roll samples due to addition of cocoa powder in the product.

**CONCLUSION**

On the basis of results of sensory quality the better quality khoa roll can be prepared by blending of 2.5 per cent cocoa powder and 22 % sugar in khoa.
REFERENCES

Amin, J.B. (1997). Preparation of media reagents and sterilization of glassware. *Laboratory quality assurance in dairy industry*. 112-152.

Aneja, R.P., Mathur, N., Chandan, R.C. and Banerjee, A.K. (2002). *Technology of Indian milk products*. A Dairy India Publication, New Delhi.

Bankar, S.N. (2011). Preparation of pineapple *burfi*. M.Sc. (Agri.) Thesis, submitted to M. K.V., Parbhani (MS).

De, S. (1982). *Outline of Dairy Technology*, 2nd Ed. Oxford University Press, New Delhi.

Golande, S.S. (2007). Studies on preparation of sweet orange *burfi* M.Sc. (Agri.) Thesis, submitted to M.K.V., Parbhani (MS).

IS:1164. (1969). Specification for cocoa powder. Indian standards institute, manak bhavan, New Delhi.

Indian Standards. (1969). IS: 5401. Methods for detection and estimation of coliform bacteria in foodstuffs.

IS : 6272 (Part-I) and (Part-II) (1971). Guide for sensory evaluation of foods. Methods and Evaluation cards. Indian Standards Institution, Manak Bhavan, New Delhi, India.

IS: 5403 (1999), Method for Yeast and Mould Count of Food stuff and animal feeds. FAD 15 Food Hygiene, safety.

BIS: (1981). Handbook of Food Analysis Dairy products Part (XI) Indian Standards Institution, Manak Bhavan, New Delhi.

Kadam, R.M. (2008). Preparation of *khoa burfi* blended with Alphanso mango pulp, Ph.D. Thesis submitted to Dr. Balasaheb Sawant konkan krishi vidyapeeth, Dapoli.

Hajare, V.H. (2011). Studies on preparation of almond *burfi* M.Sc. (Agri.) Thesis, submitted to M.K.V., Parbhani (MS).

Mandokhot, U.V. and Garg, S.R. (1985). Market quality of *khoa burfi* and *peda*. The critical review. *J.Food Sci. Technol*. 22(4) : 299-304.

Magadum, R.B. (1990). Survey of bacteriological quality of market samples of Kalakand in Banglore city. *Environ. E.col*. 8(1/B) : 454-455.

Naidu, K.A. and Ranganathn, B. (1965). Studies on microbiological deterioration of Khoa. *IndianJ. Dairy Sci*. 18: 4-9.

Satav, Y. L., Narwade, S. G., Kadam, R. P. and Syed I. H. (2014). Effect of walnut powder incorporation on sensorial, nutritional and textural quality profile of *burfi*. *The Asian Journal of Animal Science*. 9 (2) : 129–133.

Sharma, G.K., Madhuro, C.V. and Arya, S.S. (1992). Studies on preparation of packaging and storage of basan (Bengalgram flour). *Burfi, J. Fd. Sci. Technol*. 29(2): 289-292.

Shelke, T.Y. (2007). Studies on preparation of mango *pulp burfi*. M.Sc. (Agri,) Thesis, submitted to M.K.V., Parbhani (MS).

Snedecor, G. W. and Cochran, W. G. (1994). *Statistical Methods*. 6th Edn. Oxford and IBH Pub. Co. Pvt. Ltd. New Delhi.

Rajorhia, G.S. and Sen, D.C. (1987). Problem of milk sweets trade in India. *Indian Dairyman*. 39(6): 283-287.