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QUALITY EVALUATION OF LOW FAT MILK NUGGETS PREPARED WITH SKIM MILK COAGULUM AND FINGER MILLET FLOUR

Jyanendra Kumar Shahi, Geeta Chauhan*, Sanjeev Kumar Roy, S.K. Mendiratta and B.D. sharma

Division of Livestock Products Technology, Indian Veterinary Research Institute, Izatnagar, Bareilly, Uttarpradesh

*Corresponding author: gchauhan2006@rediffmailcom

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ABSTRACT

Milk is rich in vital nutrients and health enhancing components. It is required by all age group people. Today's health conscious consumer is looking for protein rich and low fat food products. The present study was conducted with an objective to develop low fat milk nuggets and its quality evaluation. Preliminary experiments were conducted to standardize the basic formulation and processing conditions for the preparation of low fat milk nuggets using the coagulum prepared from skim milk. In the next experiment, the finger millet flour (FMF) was incorporated in the developed formulation at three different levels viz. 7, 11 and 15% separately. On the basis of results of sensory evaluations, 7% incorporation level was found to be optimum. This product was further studied for physico-chemical characteristics. The product with finger millet flour showed significantly higher cooking yield than the control. The study revealed that low fat milk nuggets prepared with finger millet flour can provide nutritious, tasteful and healthy product to the consumers.

Key words: Milk nuggets, skim milk, coagulum, finger millet, sensory evaluation

INTRODUCTION

Milk has a high nutritive value and it supplies body building proteins, bone forming minerals, healthful vitamins and provides energy giving lactose and milk fat. Its consumption is recommended for all the age groups. It is liked by most of the people without any social or religious restrictions.

Chhana and paneer are important traditional dairy products. These refer to the milk solids obtained by the acid coagulation of hot whole milk and subsequent drainage of whey. The acids commonly used are lactic or citric acid in both natural and chemical forms. It can be prepared from cow or buffalo milk or a combination there of. Chhana is the base for preparation of a wide range of indigenous sweetmeats. Use of chhana or milk coagulum for the preparation of the products on the salty side may explore its more varietal uses. Further, milk coagulum prepared from whole milk has high fat composition. To reduce its fat content, low fat milk and skim milk may be used.

Convenience food products are the demand of the day. Urbanization, industrialization, globalization, more working women and a large number of bachelors staying away from home are some of the important factors favouring the convenience in foods. Today, there is increased awareness and people are conscious about their health. Consumers are searching for the healthy food products. Health risks associated with high fat intake have diverted the consumer preference towards low fat food products.

Various millets are produced in India as per geographical and climatic diversity. Millets are nutritious grains. These are rich in B vitamins, especially niacin, B6 and folic acid and minerals such as calcium, iron, potassium, magnesium and zinc. Millets are a good source of various phyto-chemicals of importance and antioxidant constituents such as tannins, total free phenols and phytic acid (Hegde et al, 2004). Finger millet is called *Eleusine coracana* botanically and it is a good source of Ca and P along with other nutrients of importance (Gopalan et al, 2002).

'Nuggets' are small cube shaped convenience product. Nuggets prepared from meat are commonly available and has very good consumer acceptability. Various research studies have been conducted on meat nuggets from chicken (Huffman *et al*. 1984; Hoogen-Kamp,1988; Kondaiah etal. 1990), pork (Berry , 1994; Berry and Bigner, 1996), buffalo meat (Sahoo and Anjaneyulu ,1997; Anjaneyulu et al. 1996), mutton (Kondaiah etal. 1993, Rao et al. 1997) chevon and rabbit meat (Kumar et al. 1996) and fish (Braven and Gormley,1998). An attempt has been made by Jain (2003) and Mohapatra (2013) to prepare milk nuggets. Further, no other information is available on preparation of low fat milk nuggets using finger millet flours.

In view of the above facts, the present research study was conducted with an aim of development and quality evaluation of low fat milk nuggets using skim milk coagulum and finger millet flour.

MATERIALS AND METHODS

SOURCE OF RAW MATERIALS

MILK

Milk for pursuing this study was procured from the Dairy Technology Section of Indian Veterinary Research Institute, Izatnagar, Bareilly (U.P.). The procured milk was pasteurized one with combination of cow and buffalo milk as per daily production at dairy farm. Skim milk used in this study was prepared by separating the cream using a hand-driven centrifugal cream separator.

CHEMICALS AND INGREDIENTS

Chemicals of analytical and food grade were purchased from standard firms (Hi-media, Qualigenes, Merck etc.). Other ingredients like finger millet, refined wheat flour, sugar, spices, and condiments etc. were procured from the local market.

EXPERIMENTAL DETAILS

PRELIMINARY TRIALS

An intensive series of Preliminary trials were conducted to develop milk nuggets using skim milk coagulum and minimum level of binders. Formulation was standardized in terms of amount of milk coagulum, binders, spices and condiments etc. Mixing time, cooking time and chilling time had been also been standardized.

OPTIMIZATION OF THE LEVEL OF INCORPORATION OF FINGER MILLET FLOUR

Experiments were conducted to incorporate finger millet flour in the developed basic formulation. Finger millet flour was studied at the incorporation levels of 7, 11 and 15% separately. The millet flours were incorporated by replacing the milk coagulum in the formulations.

EVALUATION OF PHYSICO-CHEMICAL AND SENSORY CHARACTERISTICS OF DEVELOPED LOW FAT MILK NUGGETS

Nuggets prepared with different levels of FMF incorporation viz. 7, 11 1nd 15 % along with the control were studied for various sensory characteristics. Further, the product with optimum level of FMF and control product were studied for various physic-chemical characteristics.

ANALYTICAL PROCEDURES

SENSORY EVALUATION OF MILK NUGGETS

Sensory evaluation of milk nuggets was conducted by the method used by (Rajkumar et al, 2010) using nine point descriptive scale, where 9=excellent and 1=extremely poor. The experienced panel consisting of scientists and Post Graduate students of the Division of Livestock Products Technology, IVRI, Izatnagar evaluated the samples. The panelists were briefed with the nature of the experiments without disclosing the identity of the samples and were requested to rate them on a nine point descriptive scale on the sensory evaluation pro-forma for different attributes. The product was warmed for 10-15 seconds and served to the panelists. Water was provided to rinse the mouth between tasting of each sample. The panelists evaluated the samples for attributes such as appearance, flavour, body and texture, juiciness and overall acceptability.

PHYSICO-CHEMICAL ANALYSIS

Cooking yield was determined by dividing the cooked product weight by the raw uncooked weight and multiplying it by 100 and expressed as percentage.

The pH of the homogenate was recorded by immersing a combined glass electrode of a digital pH meter (EL 68 of ELICO) Model LI-120 (Trout et al., 1992).

The moisture, protein, fat and ash contents of milk nuggets were determined by standard methods using hot air oven, Kjeldahl assembly, Soxhlet extraction apparatus and muffle furnace respectively as per AOAC (1995).

STATISTICAL ANALYSIS

Data generated from various trials under each experiment were pooled and compiled and analyzed as per the standard statistical methods (Snedecor and Cochran, 1989) and interpreted. Means and standard error were computed for each parameter. The data were subjected to analysis of variance.

RESULTS AND DISCUSSION

After conducting a series of preliminary trials, a basic formulation (control) was developed to prepare milk nuggets. This was consist of 91% skim milk coagulum and other ingredients like refined wheat flour, spice mix and salt. To prepare nuggets, the batter was prepared with proper mixing and was steamed. After steaming, the cooling and cutting was done.

OPTIMIZATION OF THE LEVEL OF INCORPORATION OF FINGER MILLET FLOUR

FMF (1:1 hydration, w/w) was incorporated at the level of 7, 11 and 15% by replacing the skim milk coagulum in pre standardized low fat milk nuggets formulation and sensory attributes viz., appearance, flavour, juiciness, body and texture and overall acceptability were evaluated to find the optimum level of incorporation. The results are presented in Table 1.

Mean scores for appearance of low fat milk nuggets were ranged from 6.95±0.11 for the product with 15% FMF to 7.89±0.11 for control product. Scores of T1 (7% FMF) and control product were comparable to each other and those of T2 (11% FMF) and T3 (15% FMF) were further comparable. A decreasing trend in appearance scores was observed with increase in the level of FMF incorporation in formulation. Further, scores of

control and T1 were significantly ($p<0.05$) higher than T2 and T3 products.

Mean scores for flavour were ranged from 7.03±0.11 for product with 15% FMF to 7.82±0.11 for control product. Mean score of T1 was significantly ($p<0.05$) higher than T2 and T3 and lower than control. Further, there was no significant ($p>0.05$) difference between the flavour scores of nuggets with 11% and 15% FMF. The results depict that increase in level of incorporation of FMF showed a decreasing trend in the flavor of the product.

Mean score for juiciness was lowest for T3 product (6.80±0.08) and highest for the product with 7% level of FMF i.e. T1 (7.71±0.11). No significant difference ($p>0.05$) was observed in the juiciness score of milk nuggets among control, T1 and T2, however the score of T3 was significantly ($p<0.05$) lower than the other three products including the control.

Mean scores for body and texture were ranged from 6.95±0.11 for nuggets with 15% FMF (T3) to 7.65±0.10 for nuggets with 7% FMF. Mean scores for control and nuggets with 7% FMF (T1) and 11% FMF (T2) were comparable to each other and were significantly ($p<0.05$) higher than the product with 15% FMF.

Mean scores for overall acceptability was highest (7.69±0.12) for nuggets with 7% FMF (T1) and lowest (6.88±0.13) for nuggets with 15% FMF (T3). Mean scores for control and nuggets with 7% FMF (T1) and 11% FMF (T2) were comparable to each other and were significantly ($p<0.05$) higher than the product with 15% FMF.

Thus, on the basis of scores for sensory characteristics, the optimum incorporation level of FMF was adjudged to be 7%. The similar results were predicted by Nazni and Komathi (2014).

Table 1- Sensory attributes of low fat milk nuggets prepared with skim milk coagulum and extended with different levels of finger millet flour (Mean± S.E.)*

Parameters	Control	T1	T2	T3
Appearance	7.89±0.11^a	7.64±0.09^a	7.22±0.11^b	6.95±0.11^b
Flavour	7.82±0.11^a	7.61±0.10^b	7.34±0.10^c	7.03±0.14^c
Juciness	7.60±0.14^a	7.71±0.11^a	7.39±0.11^a	6.80±0.08^b
Body and texture	7.50±0.13^a	7.65±0.10^a	7.39±0.12^a	6.95±0.11^b
Overall acceptability	7.64±0.13^a	7.69±0.12^a	7.46±0.11^a	6.88±0.13^b

*****Mean±S.E. with different superscripts in a row differ significantly ($p<0.05$)
n=21 for each treatment, T1- 7% finger millet flour, T2- 11% finger millet flour, T3- 15% finger millet flour

EVALUATION OF PHYSICO-CHEMICAL AND SENSORY CHARACTERISTICS OF DEVELOPED LOW FAT MILK NUGGETS

On the basis of sensory evaluations, the product with 7% incorporation of FMF was selected for further study of physico-chemical quality. Mean±SE values of cooking yield, pH, moisture content, protein content, fat content and ash content of low fat milk nuggets prepared with skim milk coagulum and extended with optimum level of finger millet flour i.e. 7% (1:1 hydration, w/w) are presented in Table 2.

Mean cooking yield of milk nuggets prepared with skim milk coagulum was 93.63±0.63 percent for control product and 97.05±0.38 percent for FMF incorporated low fat milk nuggets. There was a significant difference ($p<0.05$) in cooking yield of two products, being lower for control. Higher yield in FMF incorporated product may be due to higher water absorption by FMF.

pH of milk nugget prepared from skimmed milk coagulum was 6.14±0.00 and 6.21±0.00 for the control and FMF incorporated products respectively. pH of FMF incorporated nuggets was significantly ($p<0.05$) higher than the control. This may be attributed to the replacement of milk coagulum with millet flours which had a higher pH than the former.

Moisture content of the control and FMF incorporated nuggets was 58.11±0.54 and 61.50±0.15 percent respectively. The control product showed a significantly ($p<0.05$) lower moisture content than the treatment.

Mean protein content in the control product was 24.02±0.37 percent and in FMF incorporated milk nuggets, it was 21.75±0.26 percent. The protein content in extended product was significantly lower ($p<0.05$) than the control product. This may be attributed to the lower milk coagulum in the formulation.

Mean fat content in control and FMF incorporated milk nuggets was 2.68±0.63 and 1.48±0.06 percent respectively. FMF incorporated milk nuggets had significantly ($p<0.05$) lower fat content than the control product. Thus, the incorporation of millet flours had declined the fat content.

Ash content for control and FMF incorporated milk nuggets was 3.46.±0.02 and 2.89±0.09 percent respectively. Ash content of milk nuggets incorporated with optimum level FMF was significantly ($p<0.05$) lower than control. The same findings were reported Nazni and Gomathi (2014).

Table 2- Physico-chemical characteristics of low fat milk nuggets prepared with skim milk coagulum and optimum level of finger millet flour (Mean±SE)*

Parameters	Control	Treatment
Cooking yield (%)	93.63±0.63^b	97.05±0.38^a
pH	6.14±0.00^b	6.21±0.00^a
Moisture content (%)	58.11±0.54^b	61.50±0.15^a
Protein content (%)	24.02±0.37^a	21.75±0.26^b

Fat content (%)	2.68±0.63 [a]	1.48±0.06 [b]
Ash content (%)	3.46±0.02[a]	2.89±0.09 [b]

*****Mean±S.E. with different superscripts in a row differ significantly ($p<0.05$), n=6 for each treatment
Treatment- 7% finger millet flour

CONCLUSION

On the basis of the conducted research study, this may be concluded that low fat milk nuggets with good to very good acceptability can be prepared with the use of coagulum from skim milk and other ingredients viz. refined wheat flour, spices and condiments. Finger millet flour can be acceptably incorporated in low fat milk nuggets. On the basis of sensory evaluation, the optimum level of its incorporation was adjudged to be 7%. Incorporation of FMF showed a significant increase in cooking yield. Thus, the development of low fat milk nuggets gives a healthy product along with the scope for efficient utilization of skim milk.

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