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Development and quality assessment of low fat Chhana

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Abstract
Four different types of Chhana were prepared from skim milk with the addition of different levels of soy milk. The use of skim milk and soy milk as a source of high protein and low fat. The milk blends of soy beans, with skim milk were at replacement levels of T1 (85:15), T2 (75:25), T3 (65:35), % while the skim milk T0 (100:00) served as control Chhana. The qualities of prepared Chhana were evaluated by using physical and chemical parameters. It was observed that the addition of soy milk with skim milk decreased the organoleptic score of overall acceptability the prepared Low Fat Chhana T1 (8.32) followed by T0 (7.39), T2 (7.71), T3 (6.84). Various analysis parameters were analyzed by two way ANOVA to obtained a predicted optimum result prepared low fat chhana was subjected to chemical, microbial, and sensory analysis to evaluate the suitability of low fat chhana were T1 protein (17.12%), fat (3.10%), ash (3.72%), acidity (0.22%) and carbohydrate (24.00%) as comparable to control without adversely affecting the sensory parameters. Based on the result it was indicated that beneficial component of high protein in soy milk and low fat skim milk made them more favorable choice for dairy technologist to develop low fat chhana especially for healthy sweets.

Keywords: Low fat Chhana, Skim milk, Soy milk

Introduction

Among the indigenous dairy products, chhana is a well-known coagulated milk product obtained by acid coagulation of hot milk, which is extensively used as a base material for preparation of variety of Indian delicacies. Cow milk is usually preferred since it yields a product with soft body and smooth texture, the quality of which varies depending upon type and composition of milk, conditions of coagulation, the amount of solids lost in whey and the moisture retained in the product. It is documented that buffalo milk as such is not suitable since it creates lot of difficulties in the manufacture of chhana. The major technological problem in the utilization of buffalo milk is inherent chemical make up as compared to cow milk leading to production of hard body and coarse textured product. Buffalo milk chhana podo had a semi soft body, less brown colouration, coarse texture and less slicing properties with slight cooked flavour (Dash *et al*., 1999) [3].

Milk and milk based products have been a good source of nutrition to human health. India has emerged as the largest milk producing country in the world with annual milk production estimated as 165.4 million tones. According to the recent census the livestock population in India is 512.1 million. A number of traditional techniques developed at home for preparing foods have been modified and improved Aneja *et al.* (2002) [1].

They are now being converted into technologies that are science and engineering based to make these products commercially in larger quantities for institutional uses and for establishing economically viable food industries to meet the emerging socio-economic conditions. India's total production of chhana a heat acid coagulated product is 2 million tonnes valued at Rs 7000 million As per ISI specification (1964). Channa is a coagulated product obtained by the acid coagulation of whole or standardized milk of cow, buffalo or their admixtures. The coagulant used can be sour Chhana whey, lactic acid or citric acid. Chhana shall not contain any ingredients foreign to milk. According to Prevention of Food Adulteration (PFA) rules (1976), the Channa product shall not have more than 70% moisture and not less than 50% fat on dry matter basis. Chhana serves as a base material and filler for a large variety of Indian sweet-meats like Rosogolla, Sandesh, Chum-Chum, and Chhan- Murki, etc. 100g of Rasgulla contains 186 calories and out of which carbohydrate, fat and protein

provide 153, 17, and 16 calories, respectively. Rasgulla is defined as popular Indian sweetmeat with high textural values Despite AD and Datto SC (1993) [4].The production of Chhana is confined mostly to the eastern region of the country notably West Bengal, Bihar and Orissa. This is mainly due to technological development for the preservation and packaging, leading to enhanced shelf life, better buying capacity and versatile food habits etc.

The traditional dairy products are of masses made in India since time immemorial. The products have great social, religious, cultural, meditational and economical importance. It is estimate that about 50% to 55% (approx. 42 million tonnes) of milk produced in India is converted into variety of Indian milk products valued at Rs 400 billion on products (Patil and Pal, 2005) [9].

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. An attempt has been made by Jain (2003) [5] and Mohapatra (2013) [8].

In countries or regions where animal proteins are not available or where the prices of meat are beyond the purchasing power of the average population, soybeans and soybean products may be used for their substitutes. Soymilk is the rich creamy milk of whole soybeans with its unique nutty flavor and rich in nutrition. soy milk is available as a plain unflavored beverage or in a variety of flavors including chocolate, vanilla and almond. The soy food products which are widely consumed and accepted by world people are tofu, soymilk and beverages Li and Hsieh, (2004) [6].

Soy milk

Soybean is a new prospective oil crop in India. It is regarded as an ideal food for the people of India as it contain high quantity of protein and superior quantity of edible oil. Most of the people of our country can't afford to get protein-enriched food like fish, meet, egg, milk etc. due to their high cost. So, to supplement protein at low cost, soybean should be cultivated in more areas in our country Tiwari B.D. and Sukumar D.C. (1976) [16].

Soybean accounts for approximately 50% of the total production of oil seed crop in the world. Soybean are not consumed directly, but are processed into a large number of variety of popular products. The most of popular soybean products are Temphe (fermented soybeans), Tahu or Tofu (soybean curd), Taoge (soybean sprouts), Kecap (soy-sauce), Tauco (fermented mixture) which are usually consumed as side dished with rice. Other popular soybean products are yaba, soy-milk and sere Thoenes P. (2007) [15].

Soybeans are an excellent and cheap source of calories and quality protein. They content 35–40% protein and 18–20% fats and can there for be useful combating protein calories malnutrition in the poorer starter of population. Regarding this soy-milk (prepared from soybean) can be used as replaced to milk to meet deficiency of whole milk Schroder *et al*. (1986) [14].

Skim milk

Skim milk is a dairy product which contains an extremely low fat percentage. In some countries skim milk is defined as fat free milk, since many labeling laws allow foods with negligible fat contents to be labeled as fat free. Most grocery stores and dairies stock skim milk, along with low-fat and whole milk products. For people who are concerned about the amount of fat in their diets, skim milk is an excellent alternative to whole milk, although some individuals do not enjoy the flavor. Traditionally, dairy was allowed to sit after milking, to allow the fat to rise to the top. The fat was skimmed to make butter and cream products, and the remaining milk was consumed or processed into other foods like cheese. Modern dairy production uses centrifuges, since they are much more time efficient. After being centrifuged, the fatty part is used to make cream and butter, or it may be added back into the skimmed milk to raise the fat percentage. Skimmed milk is sometimes consumed with the intention of reducing or limiting calorie consumption. It has been argued that the reduction in calories keeps the body further from satiety, causing it to ultimately seek out the same amount of calories that would have otherwise been consumed, and in some cases possibly more or from sources less beneficial. The extent to which animal fat contributes to weight gain is also brought into question, along with claims that skimmed milk is more beneficial to heart health since non-skimmed milk has higher low-density lipoprotein content. Milk fat, however, affects only large, non-dense (Pattern A) LDL particles, which studies have shown to carry far less risk of coronary heart disease than small, dense (Pattern B) LDL particles. Skimmed milk also contains almost no Vitamin A. Ravnskov *et al*. (February 2002) [11].

Materials and methods

The experiment "Development and quality assessment of low fat chhana prepared by using Soy milk and Skim milk." was carried out in research lab, Warner College of Dairy Technology, Sam Higginbottom University of Agriculture Technology and Sciences, Allahabad-211007, U.P. (India).

Raw Material
a. Soy seed: soy seed was purchased from local market of Allahabad.
b. Skim milk: Skim milk was purchased from local market of Allahabad.
c. Magnesium chloride: was purchased from local market of Allahabad

Treatment Combination

| Treatment	Skim Milk	Soy Milk
T0	100	
T1	85	15
T2	75	25
T3	65	35

Preparation of soy-milk
Fresh soybean seeds were collected from local markets. The method used by was modified slightly for making soy-milk.

Socking of soybean seeds: For preparation of soy-milk, 2000 gm of fresh and clean soybean seeds were soaked overnight in 0.5 percent sodium bicarbonate to make the husk soft and also to remove bitterness.

Removal of husk: After socking overnight outer coating of the seeds (husk) were removed physically by means of pressure applied by two hands. After removing all husks, the collected seeds were washed in fresh and clean cold water.

Preparation of soy-milk: One litre (1000 ml) of clean water was added with the washed soybean seeds and about 2–3 gm of cardamom was also added to remove the beany flavour present in soybean seeds. The mixture was grinded in a grinder for about thirty to forty minutes. After satisfactory grinding the residue of soy-milk was removed by filtering with a fine muslin cloth and the soy-milk was collected in a beaker. At the first time about 2 liter of soy-milk was obtained.
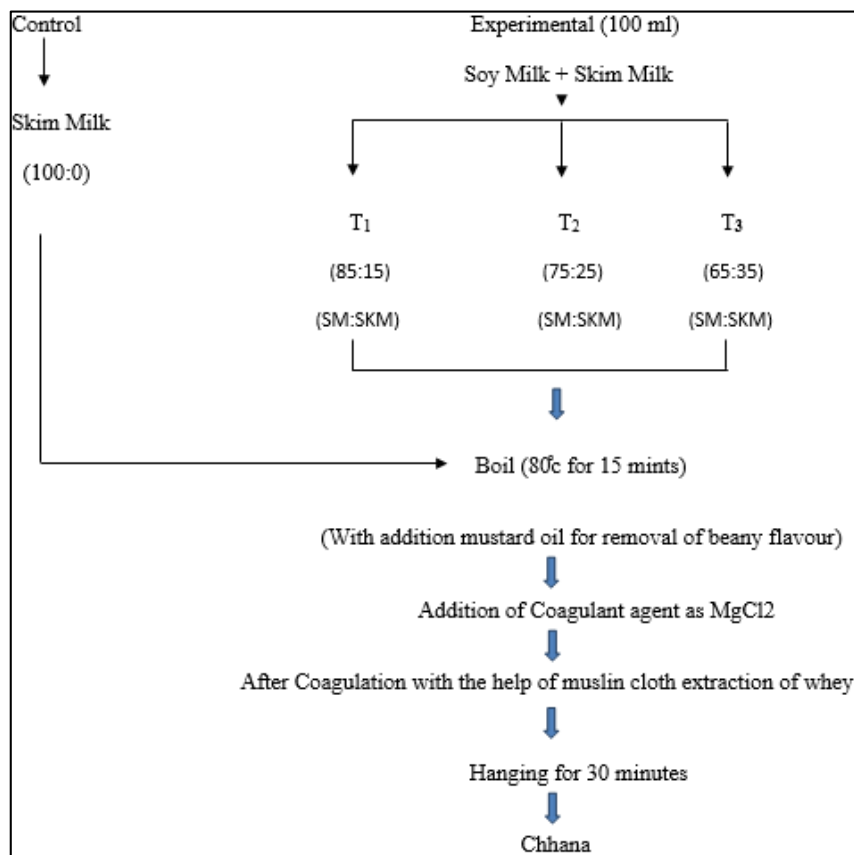
Fig 1: Flow diagram for preparation of low fat chhana

Sensory analysis
The consumer acceptability of developed products was evaluated by a testing panel. The panelists were untrained and selected from the students, teachers and employees of the Warner College of Dairy Technology Sam Higginbottom University of Agriculture Technology and Sciences, Allahabad-211007, U.P. (India). The panelists (06) were asked to assign appropriate score to each product tested on a 1 t o 9 point hedonic scale for characteristic colour, flavour, sweetness and overall acceptability of various mixed samples. The scale was arranged such that; 9 = Like extremely, 8 = Like very much, 7 = Like moderately, 6 = Like highly, 5 = Neither like nor dislike, 4 = Dislike slightly, 3 = Dislike moderately, 2 = Dislike very much, and 1 = Dislike extremely.

Physico-chemical analysis
Proximate composition (Moisture, Protein, Fat, Ash and Carbohydrate). Moisture, Protein, Fat and Ash of prepared Low Fat Chhana samples were analyses in triplicate following standard procedures Moisture content by drying in an oven at 105 °C for 24 h. Fat was determined by (AOAC 934.01). Protein content (Nx6.25) by the Kjeldahl method using an Auto Kjeldahl System and Ash by incineration in a muffle furnace at 600 °C for 6 h (AOAC 900.02A.). Carbohydrate content were calculated by difference method i.e.
%Carbohydrate = 100-(%Moisture + %Protein + %Fat +%Ash)

Acidity. 5 g sample was taken and blended, homogenized in a blender with distilled water and carefully transfer to a 250ml beaker. The mixture was boiled for 1hr periodically adding water to replace the loss by evaporation. Cooled and transferred to a 100ml volumetric flask. Then volume was made to 100ml and filtered. 30ml filtered liquid was titrated against 0.1N NaOH using phenolphthalein as an indicator. The titration was done in triplicate and titratable acidity was calculated from the following relationship Ranganna (1994) [10].

$$\%Acidity = \frac{Eq.\ wt\ of\ lactic\ acid \times Normality\ of\ NaOH \times Volume \times T.\ V.}{1000 \times wt\ of\ sample \times ml\ of\ extract\ taken\ for\ estimation} \times 100$$

Microbiological analysis
The microbiological analysis i.e. standard plate count, coliform and yeast and mould test of the low fat Chhana samples of different treatments was done by using standard procedure laid down in I.S. 1947 PART III.

Statistical analysis
Data was analysed using Analysis of Variance (ANOVA) and Critical difference (C.D) in WASP software and excel software. The significance were separated at ($p<0.05$).

Results and Discussion
The data collected on the different aspects were tabulated and analyzed statistically using the method of analysis of variance and critical difference technique. The significant and non-

significant differences observed have been analyzed critically within and between the different treatment combinations.

The analyzed data is presented in this chapter under the following headings:

1. Chemical characteristics
2. Organoleptic characteristics
3. Microbial characteristics

Table 1: Average data for different parameters of control and experiments (in percent)

Particulars	T0	T1	T2	T3
A. Physico-chemical analysis (%)				
Total Solids%	47.672	48.006	47.892	47.892
Fat%	1.702	3.108	4	4.942
Protein%	16	17.15	17.48	17.81
Carbohydrates%	26.08	24.00	22.87	21.70
Ash%	3.892	3.724	3.558	3.444
Acidity%	0.202	0.226	0.282	0.292
B. Organoleptic Score				
Colour and appearances	6.86	8.57	8.37	7.16
Body and texture	7.57	8.37	7.77	6.58
Flavour and taste	7.57	7.96	6.99	6.78
Overall acceptability	7.39	8.32	7.72	6.84
C. Microbiological analysis				
Yeast &Mould (cfu/ml)	3	3.8	4.6	4
Coliform	NIL	NIL	NIL	NIL

Effect of addition of skim milk and soy milk on organoleptic score of Low Fat Chhana samples.

The low fat Chhana samples were subjected to organoleptic evaluation before a panel of trained judges by using a 9 point hedonic scale. The samples were evaluated for colour& appearance, body & texture, flavor and taste and overall acceptability. The mean value of colour and appearance content in T0, T1, T2 and T3 were noted as 6.86, 8.57, 8.37 and 7.16 respectively the data shown that colour and appearance content in samples of different treatments and control, the highest mean value of colour and appearance was recorded in the sample of T1 (8.57) and lowest mean value of colour and appearance was recorded in the sample of T0 (6.86). Similarly, the mean value of flavour and taste content in T0, T1, T2 and T3 were noted as 7.57, 7.96, 6.99 and 6.78 respectively. The data shown that flavour and taste content in samples of different treatments and control, the highest mean value of flavour and taste was recorded in the sample of T1 (7.96) and lowest mean value of colour and appearance was recorded in the sample of T3 (6.7). Similarly, the mean value of body and texture content in T0, T1, T2 and T3 were noted as 7.57, 8.37, 7.77 and 6.58 respectively the data shown that body and texture content in samples of different treatments and control, the highest mean value of body and texture was recorded in the sample of T1 (8.37) and lowest mean value of body and texture was recorded in the sample of T3 (6.58). Likewise, the mean value of overall acceptability content in T0, T1, T2 and T3 were noted as 7.39, 8.32, 7.72 and 6.84 respectively the data shown that overall acceptability content in samples of different treatments and control, the highest mean value of overall acceptability was recorded in the sample of T1 (8.32) and lowest mean value of overall acceptability was recorded in the sample of T3 (6.84).The organoleptic scores are presented graphically in Fig 2. From the figure, it can be observed that treatment T_1 scored was significantly higher values for body & texture, flavour and taste and overall acceptability as compared to other treatments including control. Therefore, low fat Chhana samples of T_1 treatment was taken as the optimized product.
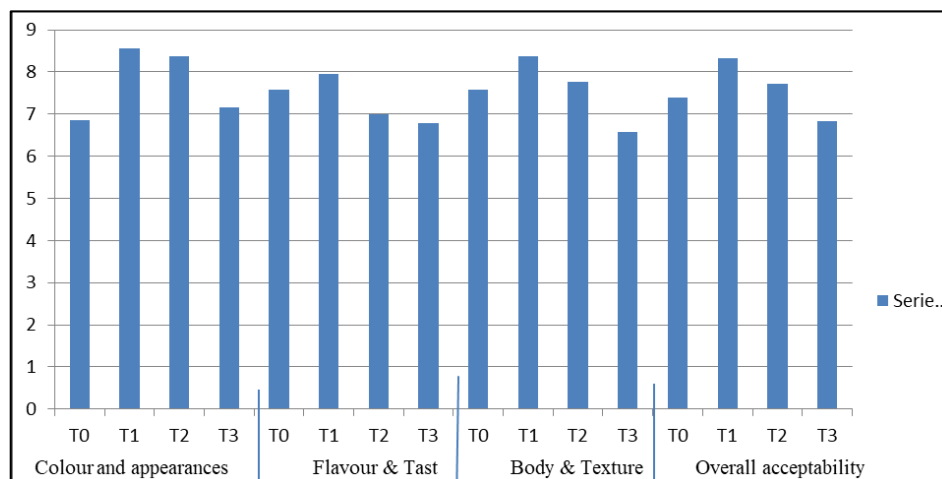
Fig 2: Average values for flavour, colour and appearance, body & texture and overall acceptability of low fat chhana

Effect of addition of skim milk and soy milk on physico-chemical, microbiological quality of low fat Chhana samples

The carbohydrate percentage for low fat Chhana samples of T0, T1, T2 and T3 treatments was found to be 26.08%, 24.00%, 22.87% and 21.70% respectively. The carbohydrate of different treatment decreased significantly ($P<0.05$). The protein percentage of low fat Chhana samples of different treatments of T0, T1, T2 and T3 was found to be 16.00%, 17.15%, 17.48% and 17.81% respectively. There was significant difference among the treatments ($P<0.05$).The fat percentage of low fat Chhana samples of different treatments of T0, T1, T2 and T3 was found to be 1.70%, 3.10%, 4.00% and 4.94% respectively. There was significant difference among the treatments ($P<0.05$). The ash percentage for low fat Chhana samples of T0, T1, T2 and T3 treatments was found to be 3.89%, 3.72%, 3.55% and 3.44% respectively. There was significant difference among the treatments ($P<0.05$).The total solid of T0, T1, T2 and T3 was found to be 47.67%, 48.00%, 47.89% and 47.89% respectively. The total solid percentage of different treatments decreased significantly ($P<0.05$). The acidity percent of T0, T1, T2 and T3 was found to be 0.20%, 0.22%, 0.28% and 0.29% respectively. The acidity percentage of different treatments increased significantly ($P<0.05$).

Yeast and mould count of low fat Chhana samples of different

treatments viz., T0, T1, T2 and T3 was found to be 3.00 cfu/g, 3.8 cfu/g, 4.6 cfu/g and 4.00 cfu/g respectively. There was significant difference among the treatments. The coliform counts of different samples were found to be absent.

Summary and conclusion

The carbohydrate percentage in samples of different experimental treatments and control, the highest mean value of carbohydrate percentage was recorded in the sample of T_0 (26.08) and lowest was T_3 (21.70). Similarly, the Protein percentage in samples of different experimental treatments and control, the highest mean value of protein percentage was recorded in the sample of T_3 (17.81) and lowest was T_0 (16.00). Similarly, the fat percentage in samples of different experimental treatments and control, the highest mean value of fat percentage was recorded in the sample of T_3 (4.94) and lowest was T_0 (1.70). The ash percentage in samples of different experimental treatments and control, the highest mean value of ash percentage was recorded in the sample of T_0 (3.89) and lowest was T_3 (3.44). The total solid percentage in samples of different experimental treatments and control, the highest mean value of total solid percentage was recorded in the sample of T_3 (47.89) and lowest was T_0 (47.67) and acidity percentage in samples of different experimental treatments and control, the highest mean value of acidity percentage was recorded in the sample of T_3 (0.29) lowest was and T_0 (0.20). The differences in these values of carbohydrate, protein, ash, fat, Total Solid (TS) and acidity percent of all treatment were significant.

Yeast and mould score in samples of different treatments and control, the highest mean value of Yeast and mould score was recorded in T_2 (4.6) and lowest was T_0 (3.00). The differences in these values of Yeast and mould scores all treatments were significant. Similarly, the coil form count in control and experimental sample of low fat chhana were found to be absent.

In view of the experimental result obtained during the present investigation, it may be concluded that low fat Chhana can be successfully prepared by using Soy milk and Skim milk. Low Fat Chhana made with Soy milk and Skim milk in treatment T_1 was best in terms of organoleptic characteristics and received highest score (colour & appearance, body & texture, Flavour & taste, overall acceptability).

Low Fat Chhana is liked by all age group people Therefore, Soy milk & Skim milk can be easily incorporated in Low Fat Chhana to utilize its nutritional properties, And commercial manipulation in the market.

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