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Studies on the Utilization of Maize Milk for the Preparation of Shrikhand

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Abstract:- *The primary objective of this research was to boost the utilization of maize or maize-based new products and the development in the form of shrikhand. The present investigation was planned with the objective of developing shrikhand from skim milk partially replaced with maize milk by 10%, 20% and 30 % and labelled as T_1, T_2 and T_3 was converted into shrikhand. Four treatments combination were repeated five times and used in the present study. The physico- chemical analysis results show that treatment (T_3) possess maximum carbohydrate, fat, ash content, acidity, total solid, crude fiber, energy while the control sample (T_0) has maximum protein and moisture. Treatment (T3) possess maximum in yeast and mold count.*

Keywords: Corn milk, maize milk, shrikhand, *lactobacillus bulgaricus*

1. Introduction

Dairy products or 'lacticinia' are a type of food, produced from milk of mammals, primarily cattle, buffaloes, goats, sheep, camels etc. Dairy products include food items such as yogurt, cheese, ice cream, butter etc., and one such popular product is '*shrikhand*'. It is an acid coagulated and sweetened milk product, which is a popular delicacy in the states of Gujarat, Maharashtra and partly in Karnataka. S*hrikhand* preparation involves production of curd (*dahi*) by lactic fermentation of whole milk, either cows or buffalo's milk, followed by the draining of whey from the curd through a suspended muslin cloth or bag. The resulting solid mass (known as *chakka*) is uniformly mixed with sugar, cream and other ingredients like fruits, nuts, cardamom, saffron and other spices etc. to improve physico-chemical, rheological and sensory attributes of the final product. Indian fermented milk products utilize about 7% of total milk produced in three different fermented dairy products i.e. *dahi*, *shrikhand* (sweetened concentrated curd) and *lassi*, which may be considered as the western equivalent to yogurt and stirred yogurt, respectively [1]. Fermented milks were developed as a means of preserving the nutrients. Fermented dairy products is highly rich in calcium and vitamin B. Calcium is good for teeth and bones and hence it is known for maintaining health. Vitamin-B in take which calcium is extremely beneficial [2]. *Shrikhand* constitutes 39.0% moisture, 10.0% fat, 11.5% protein, 78.0% carbohydrate, 61.0% total solid, and 0.5% ash, on dry matter basis with a pH of about 4.2-4.4 [3], [4]**.** Shrikhand is a very refreshing delicacy, particularly during summer months. It is usually flavored with saffron, nutmeg, cardamom, almonds and pistachios. It is enjoyed during festivals with hot puffed puris. Shrikhand with different aroma and taste was prepared by incorporating by different fruit pulps and spices [5]. *Shrikhand* has got longer shelf life than *dahi* due to higher sugar content. Self-life of *shrikhand* is 35-40 days at 5℃, while storage at ambient temperature results very short i.e. 2-3 days. The composition of shrikhand given in percent was as moisture 31.00, fat 8.0, protein 17.0, lactose 1.5 and sucrose 40-50 were present in shrikhand prepared by using buffalo milk blended with sweet corn milk [6].

Maize (*Zea mays subsp. mays*) also known as corn is a cereal grain first domesticated by indigenous people in southern Mexico about 10,000 years ago. Maize milk is suggested as a new great innovation specially in the yielding of shrikhand products. It will be a substitute solution or alternative for the animal-based milk with newly introduced vegetable based maize milk. Made out of quality ingredients and according to the all aspects shrikhand with maize milk is more beneficial in several areas like reduces the risk of Anemia. Prepared 100 gm of corn milk contained vitamin-A, vitamin-B1, vitamin-B2, vitamin-B6, vitamin-C and niacin. It is very famous, specially between health-conscious peoples and consumers, since consumers were aware of nutritional goodness and benefits over different varieties of vegetable food and drink, also low in fat and cholesterol. Maize is rich is in vitamin B_{12}, folic acid and iron which helps in the production of red blood cells in the body, energy enhancer, lowers blood sugar, cholesterol level, helpful during pregnancy and healthy skin. Sweet corn and corn oil increases the blood flow, lowers cholesterol absorption and also regulates insulin. Sweet corn also has been processed to produce corn milk, either pasteurized or heat-treated in UHT treatment. The attractive colour, aroma and appearance, together with the sweetness of the corn milk, are the main sensory characteristics that are sought by its

consumers. The corn milk also has a best source of vitamin composition [7]**.** This research especially focused to developing shrikhand product with maize (corn) extract as functional-food adding culture of *Lactobacillus bulgaricus*.

2. Materials and methods

The experiment "Studies on the utilization of Maize milk for the preparation of *Shrikhand*" was carried out in research lab, Warner College of Dairy Technology, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj - 211007, U.P. (India).

2.1 Procurement and collection of ingredients.

Skim Milk

Cow or buffalo skim milk used for manufacturing *shrikhand* was procured from "Aggies Dairy", WCDT, SHUATS, Prayagraj. Fresh skim milk, after carried out, was strained through a muslin cloth and chemical analysis of milk was done.

Sugar

For preparation of *shrikhand* with sweetener of good quality, granular form of sugar, free from impurities was purchased from local market of Prayagraj.

Sweet corn

It was purchased from local market in Prayagraj.

Dahi culture

It was procured from department of Warner College of Dairy Technology, SHUATS, Prayagraj.

Standardization of milk.

Milk was standardized to 0.2% fat and 8.7 % solid not fat for making skim milk.

2.2 The Preparation of maize milk

The sweet-corn (Frozen) was selected for use as the primary raw materials, it has a high sugar content. After weighing whole corn for taking gross weight and then washed. After that, the washed-cleaned corn was put into mixer-grinder for the good extraction process and boiled with water for 10-15 minutes and finally extracted through muslin clothes.

2.3 The Mixing of Maize milk and skim milk

The corn grinded with water using the ratio of 1:1 and then removed the residues through filtration to get fine solution. The finest solution was added with skim milk (0.2 % Fat and 8.7 % SNF) in the ration of 10:90, 20:80 and 30:70. The prepared amount was taking temperature at 70^{o}C to 80^{o}C with appropriate stirring until the solution is ready for the inoculation after cooling at 35^{o}C. Subsequently, 1% of starter culture consisted of *lactobacillus bulgaricus*, was inoculated to each formulation. Each treatment was incubated in incubator for 24 h at 37^{o}C. To get the best final formulation, all formulation was analyzed.

2.4 Development of product

One litre of milk was standardized to 0.2% and 8.7% solid not fat for making skim milk. This standardized milk was heated to 85ºC for 25-30 minute and mixed with 10%, 20%, 30 % maize milk and was cooled to 35C. This milk then inoculated by lactic starter culture @ of 1% and incubated at 35-40 for 10 to 12 hours until a firm coagulum (*dahi*) was formed. The *dahi*, so formed was broken and transferred to muslin cloth to 16 hours, for the drainage of whey is called '*chakka*'. The *chakka* addition of Sugar 30% and flavour mixed in *chakka*, to obtain the final product *shrikhand*.

2.5 Details of Treatment

After preparing different trial formulation percentage of chakka and sugar was same only changes with skim milk and maize milk.

Treatment Combination (Ratio)

Treatment	Skim milk (%)	Maize milk (%)	Sugar (%)
T_0	100	-	30
T_1	90	10	30
T_2	80	20	30
T_3	70	30	30

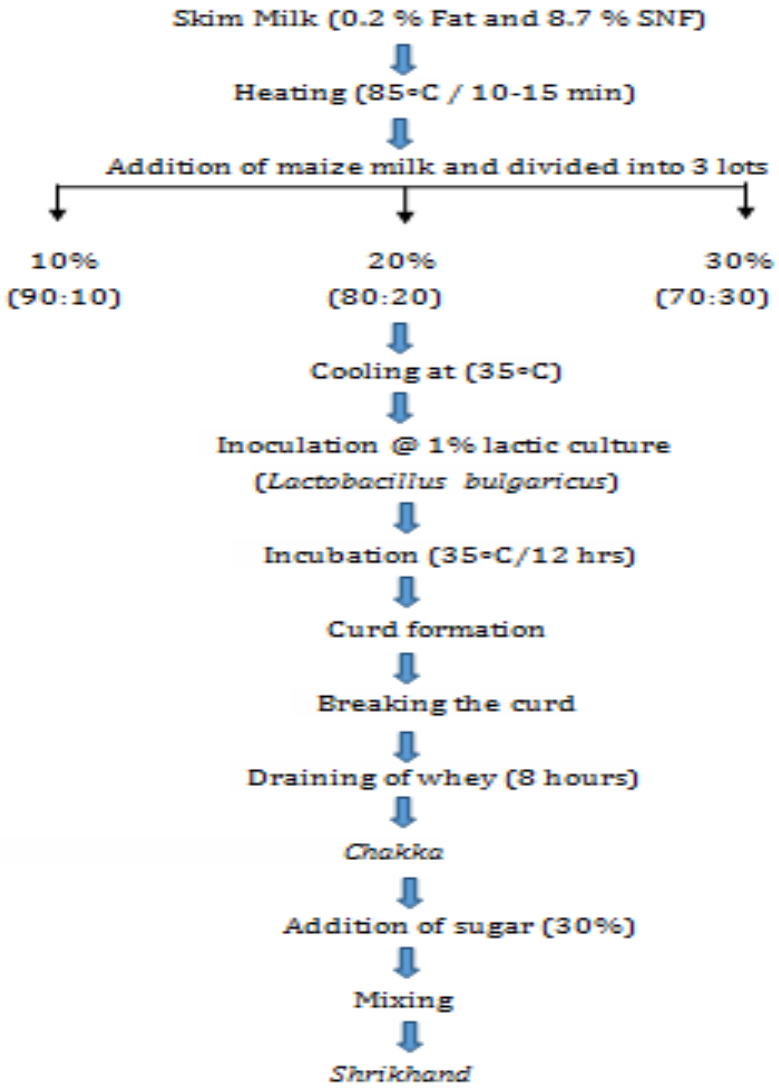

Figure 1 Flow diagram for manufacturing *shrikhand* by using maize milk

2.6 Analysis

Fat% - The fat content of the developed product will be determined by the gravimetric method. Protein % - The protein content will be determined by Kjeldahl method described in AOAC (1975). Carbohydrate (Difference Method) % = 100-(%Protein+%Fat+%Ash+%Moisture). Ash % - Ash content will be determined according to the method described in AOAC (1975). Moisture – The moisture percentage will be determined as per procedure laid down in IS.1165 (1957). Acidity (LA) –The acidity percentage determined by Titration Method. Total Solids -The moisture percentage will be determined as per procedure laid down in IS.1165 (1957). Yeast and Mold - Determined as per the method suggested by Marshall using Potato Dextrose Agar (1993). Coliform count- Determined as per procedure laid down in IS:1947 part 3 and manual in Dairy Bacteriology, ICAR Publications (1972). The data obtained in the present study were subjected to statistically by analysis using SPSS.

3. Result and Discussion

The requisite samples of Shrikhand blended with sweet corn milk, skim milk and sugar, the finished product were subjected for the proximate analysis viz. carbohydrate, fat, protein, moisture, ash, total solids, acidity, crude fibre, energy and microbiological analysis. The results obtained on account of this parameter are presented in table below:

Table 1-The different parameters of control and experimental maize milk *shrikhand*

Parameter	Treatment (Mean Value)			
	T_0	T_1	T_2	T_3
Physio-Chemical Analysis				
Carbohydrates (%)	95.43±0.02	95.86±0.18	95.59±0.33	95.50±0.24
Fat (%)	0.10±0.00	0.20±0.17	0.22±0.16	0.36±0.13
Protein (%)	3.49±0.03	3.03±0.02	3.24±0.13	3.15±0.03
Moisture (%)	40.32±0.13	40.26±0.01	40.18±0.02	40.07±0.01
Ash (%)	0.97±0.01	0.90±0.00	0.94±0.01	0.97±0.01
Total solids (%)	59.68±0.13	58.73±0.01	59.81±0.02	59.92±0.00
Titrable Acidity (%)	1.52±0.08	156±0.05	1.64±0.05	1.78±0.08
Crude Fibre (%)	0.00±0.00	0.05±0.01	0.06±0.01	0.07±0.01
Energy (%)	432.10±0.22	445.60±0.18	445.67±0.13	445.89±0.18
Microbial Analysis				
Yeast and Mold count (cfu/g)	18.00±1.65	20.00±1.09	19.00±1.64	22.00±1.92
Coliform Count	Nil	Nil	Nil	Nil

*Data are presented as Mean± S.D.

3.1. Different Physio-Chemical parameters of maize milk Shrikhand

From the above table1, the carbohydrate content ranges from 95.43, 95.86, 95.59 and 95.50 for treatment T0. T1, T2 and T3, respectively. Carbohydrate content were found to be in increasing from T0 to T3. It might be due to high total sugar content in maize milk and addition of sugar content. All treatment combinations studied were found to be significant ($P<0.05$) with each other.

Fat content ranges from 0.1, 0.2, 0.22 and 0.36 for treatment T0, T1, T2 and T3 respectively. The highest fat content was recorded for treatment T3 (0.36) percent and the lowest fat content were recorded for treatment T0 (0.1) percent. The fat content in the finished product was increased T0 to T3 i.e. 0.35 percent.

The protein content ranges from 3.49, 3.03, 3.24 and 3.15, for treatment T0, T1, T2 and T3, respectively. It was also observed that the highest protein content was in T0 and the lowest was found in T1. The protein content in the finished product was decreased due to the less amount of protein in maize milk. Mane [8] also observed similar trends in their study and mentioned the same reason as found that is protein content decreased with increased in maize milk.

The moisture content ranges from 40.32, 40.26, 40.18 and 40.07, for treatment T0, T1, T2 and T3, respectively. The moisture content was highest in T0 (40.32) percent and lowest in T3 (40.07) percent. It was also observed that, with the increase in levels of maize milk in shrikhand, there was mutinous decrease in its moisture.

Ash content ranges from 0.97, 0.90, 0.94 and 0.97, for treatment T0, T1, T2 and T3 respectively. The ash content was highest in T0 and lowest in T1. It was found similar results in the study of Maurya [9] gives comparative studies on the physico-chemical properties of shrikhand.

Total solids ranges from 59.68, 58.73, 59.81 and 59.92 for treatment T0, T1, T2 and T3 respectively. The highest total solids content was recorded for treatment for T3 (59.92) and lowest total solids contents was recorded for treatment T0 (59.68). It was also found that is total solid content increased with increase in the proportion of maize milk in the blends for manufacture of shrikhand.

The acidity content of maize milk shrikhand from 1.52, 1.56, 1.64 and 1.78 for treatment T0, T1, T2, and T3 respectively. The highest acidity percentage was observed in treatment T3(1.78) and lowest acidity percentage was observed in T0(1.52). It indicates that increase the proportion of maize milk, the increase the value of acidity.

The crude fibre content ranges from 0.00, 0.05, 0.06 and 0.07, for treatment T0, T1, T2 and T3, respectively. It was also observed that the highest crude fibre content was in T3 and the lowest was found in T0. This result indicates that crude fibre content in control was nil.

Energy ranges from 432.10, 445.60, 445.67 and 445.89 for treatment T0, T1, T2 and T3 respectively. The highest energy content was recorded for treatment for T3 (445.89) and lowest energy contents was recorded for treatment T0 (432.10). The energy content in the finished product was increased from T0 to T3 i.e. 13.79 percent. It was also found that is energy content increased with increase in the proportion of maize milk in the blends for manufacture of shrikhand.

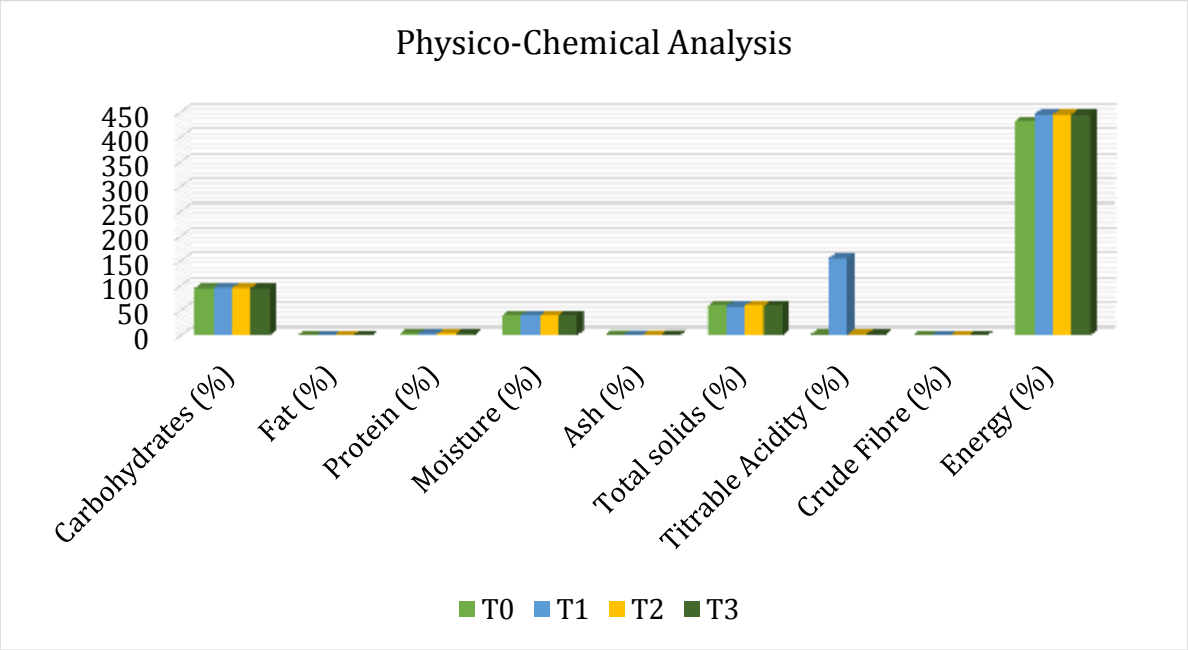

Figure 2 Graphical representation of Physico-Chemical Analysis of Maize milk Shrikhand

3.2 Different Microbial parameters of maize milk Shrikhand

From the above Table 1, Yeast and Mold count (cfu/g) in samples of different treatments and control, the highest mean value of Yeast and Mold count was recorded in the sample T_3 (22.00) followed by T_1 (20.00), T_2 (19.00) and T_0 (18.00). In each treatment of prepared *shrikhand* the coliform count was nil.

4. Conclusion

The purpose of using maize as a milk in shrikhand is to improve its nutritional value and enriched with proteins, fibre, vitamins and minerals. Maize milk is highly useful for women because it contains folic and pantothenic acid which is help to protect organs during pregnancy. So, this shrikhand would be use as a good dairy product in all seasons because of their nutritional values and health benefits. From present investigation it can be concluded that maize milk can be very well utilized with skim milk for the preparation of nutritious *shrikhand* by mixing them in different formulations. The finished product obtained was subjected for physico-chemical and microbial evaluation. It was observed that as the quantity of maize milk increased, then increase in value of ash, acidity, total solid, fat, and carbohydrate and there was decrease the value of protein and moisture content.

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BIOGRAPHIES

Mr. Ashutosh Masih completed his B. Tech in Biotechnology from Sam Higginbottom Institute of Agriculture, Technology and Sciences (SHIATS) in the year 2014. Currently, he is a M. Tech research scholar at Warner college of Dairy Technology, SHUATS. His interests involve the preparation of new food products using biotechnology. He has also completed his training over Advance Biotechniques and Recombinant DNA Technology (RDT) in MRD Life-Science.

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Dr. Rekha Rani working as assistant professor (Dairy Technology) in Warner college of Dairy Technology SHUATS, Prayagraj. She has guided eight Masters Student of Dairy and Food Technology. She is teaching condensed and dried milk, packaging of dairy products to B. Tech (Dairy technology), M.Sc/M.Tech (Dairy technology and Food technology) and Ph.D. Students. She received best article award-2017 by AFSTI, Mysore in IFCON-2018

Miss Prachi Wasnik is a Ph. D. Dairy Technology Scholar in Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj. She has published a large number of national and international research papers. She has been also received many national award in the field of Dairy Technology.

Mr. Binod Kumar Bharti is working as an Assistant Professor cum Jr. Scientist in the Department of Dairy Chemistry, Faculty of Dairy Technology, Sanjay Gandhi Institute of Dairy Technology, Bihar Animal Sciences University, Patna (Bihar). He has been published more than 30 research papers in National and International Journal. He has been also received most prestigious award like Young Scientist Award, Science Investigator Award, Excellence in Teaching Award in the field of Dairy and Food.