Development and quality evaluation of probiotic shrikhand

K.Reshma Ramakrishnan[1], K.Radha[2*] and C.T.Sathian

Department of Dairy Science,
Kerala Veterinary and Animal Sciences University
College of Veterinary and Animal sciences, Mannuthy-680651, Kerala, India

ABSTRACT

Probiotic shrikhand was prepared by incorporating probiotic *Bacillus coagulans* culture along with curd starter culture. The probiotic and control shrikhand samples were examined for the physico-chemical, microbiological and sensory properties.There was no significant difference in fat, ash and protein content between control and probiotic shrikhand. Sensory quality of the probiotic shrikhand was similar to that of control. There existed a significant difference in acidity and total solids content between control and probiotic shrikhand. Probiotic count could be maintained within the minimum recommended level during 15 days of refrigerated storage.

Key words: Shrikhand , Functional shrikhand , Probiotic shrikhand, *Bacillus coagulans.*

INTRODUCTION

Fermented dairy products have long been an important component of healthy diet. Lactic acid bacteria are commonly used as starters in the industrial production of dahi, Shrikhand, mishtidoi, lassi and yoghurt. Shrikhand is an indigenous fermented and sweetened milk product having a typical pleasant sweet-sour taste. It is prepared by blending Chakka, a semi-solid mass obtained after draining whey from dahi with sugar and other ingredients like fruit pulp, nut, flavour, spices and colour to achieve the finished product of desired composition, consistency and sensory attributes. Shrikhand has a typical semi-solid consistency with a characteristic smoothness, firmness and softness that makes it suitable for direct consumption. Probiotics are "live microorganisms which when administered in adequate amounts confer health benefits to the host" (FAO/ WHO 2001). *Bacillus coagulans* is a beneficial probiotic that helps to promote digestive health, reduces diarrhoea caused by antibiotics, encourages a healthy immune system, normalizes nutrient absorption in the body and helps to balance gut micro flora. It produces lactic acid inside the digestive tract which inhibit the growth of harmful bacteria.

[1] M.Sc. Scholar, Department of Dairy science, College of Veterinary and Animal Sciences, Mannuthy, Thrissur, Kerala, INDIA.
[2] *Corresponding Author
Assistant professor, Department of Dairy Science, College of Veterinary and Animal Sciences, Mannuthy-680651, Thrissur, Kerala, INDIA.
Email: radhavet@gmail.com
Professor & Head, Department of Dairy Science, College of Veterinary and Animal Sciences, Mannuthy-680651, Thrissur, Kerala, INDIA.

MATERIALS AND METHODS

Fresh whole milk required for the study was collected from the University Dairy Plant, College of Veterinary and Animal Sciences, Mannuthy. Freeze dried mixed dahi culture (NCDC-352) was procured from National Collection of Dairy Cultures, National Dairy Research Institute, Karnal. *Bacillus coagulans* culture was procured from Unique biotech Ltd. Hyderabad, India.

Dahi was prepared from fresh clean milk which was heated to a temperature of 71°C for 10 minutes with constant stirring. It was then inoculated with curd culture (NCDC 352) at 1 per cent level and incubated at 30^0C for 8 hours. It was then stirred and hung in a muslin cloth for 6 to 8 hours, to drain off whey in order to obtain chakka. Chakka was mixed with food grade cane sugar (20%) to get shrikhand. Probiotic shrikhand (T) was prepared from whole cow milk by incorporating *Bacillus coagulans* culture. Control shrikhand samples were prepared without the addition of probiotic culture.

1. Chemical analysis

Control and treatment groups of shrikhand were analyzed for titratable acidity, fat, total solids, ash and protein.The titratable acidity, fat, protein, total solids and ash content of shrikhand samples were determined according to the procedure described by the FSSAI (2016).

2. Microbiological quality of shrikhand

The coliform count, yeast and mould count of shrikhand samples were determined according to the procedure described by BIS (1981).

3. Sensory evaluation

The fresh shrikhand samples were evaluated for their sensory characteristics such as color and appearance, flavor, body and texture and overall acceptability as per the method recommended by BIS (2003).

RESULTS AND DISCUSSION

Acidity

The mean titratable acidity values of control and probiotic shrikhand were 1.02±0.004 and 1.42±0.019 (Table 1). There was a significant difference in titratable acidity ($P<0.05$) between control and probiotic shrikhand. The control samples had significantly ($P<0.05$) lower acidity than the probiotic samples. Similar findings were reported by earlier researchers (Jagdishbhai 2013, Swapna*et al*., 2013). According to FSSAI (2017), maximum permitted titratable acidity in shrikhand is 1.4 per cent lactic acid.

In the present study incorporation of probiotic cultures had increased the acidity of probiotic shrikhand.

Fat

The mean fat per cent of control and probiotic shrikhand were 9.15±0.075 and 9.13±0.072 (Table 1). There was no significant difference ($P>0.05$) in fat per cent between control and probiotic shrikhand.

Phate (2004) studied the quality of shrikhand prepared from cow milk using

probiotic culture. He reported that the fat per cent was 9.75.

Total solids

The mean total solids per cent of control and probiotic shrikhand were 55.97±0.622 and 58.09±0.088 (Table 1). There was a significant difference ($P<0.01$) in total solids content between control and probiotic shrikhand. Similar observations were made by Phate (2004). He reported that the total solids content of probiotic shrikhand prepared from cow milk was 59.52 percent.

Sivasankari *et al.* (2017) had reported that the total solids content of control shrikhand was 54.88 per cent whereas, the total solids content of probiotic shrikhand was 56.62 per cent

Ash

The mean ash per cent of control and probiotic shrikhand were 0.92±0.014 and 0.91±0.022 (Table 1).There was no significant difference ($P>0.05$) in ash content between control and probiotic shrikhand. According to FSSAI (2017) total ash content in shrikhand should be not more than 0.9 per cent on dry matter basis.

Protein

The mean protein per cent of control and probiotic shrikhand were 9.07±0.021 and 8.97±0.034(Table 1). There was no significant difference ($P>0.05$) in protein content between control and probiotic shrikhand. Jagdishbhai (2013) had also reported no significant difference in protein content between control and probiotic shrikhand samples.

Gupta and Sharma (2015) studied the qualities of probiotic shrikhand. They had reported that the protein content was 8.6 per cent.

Microbiological analysis

Coliform count

Coliforms were present on the 1st day and 5th day of storage. The mean coliform counts of control shrikhand (C) were 1.13±0.09 and 0.55±0.25 log cfu/g on 1st and 5th day respectively. In probiotic shrikhand the mean coliform counts were 1.18±0.08 and 0.93±0.20 log cfu/g respectively(Table 2). Coliforms were absent on 10th and 15th day of storage. There was no significant difference in coliform count between control and probiotic shrikhand. According to FSSAI (2016), coliform count of shrikhand should not be more than 10 cfu/g. The prepared samples met with legal standard.

Yeast and Mold count

The mean yeast and mould count of control shrikhand (C) were 1.05±0.06, 1.36±0.038, 1.50±0.02, and 1.58±0.02 log cfu/g for the 1st, 5th, 10th and 15th days of storage respectively. The corresponding values for probiotic shrikhand (T) were 1.06±0.17, 1.42±0.04, 1.47±0.04 and 1.56±0.03 log cfu/g(Table 2). There was no significant difference in yeast and mould count between control and probiotic shrikhand samples during storage. Jagdishbhai (2013) conducted a study on the microbial quality of probiotic shrikhand. They have reported a significant increase in the yeast and mold count of shrikhand samples during storage at refrigerated temperature.

Probiotic count

The mean values of probiotic count during 1st, 5th, 10th and 15th day were 7.11±0.03, 7.04±0.18, 7.02±0.04 and 7.00±0.17 log cfu/grespectively(Table 2). The probiotic count decreased during storage days. At the end of storage for 15 days, the probiotic count was higher than 6.000 log cfu/g which is the minimum requirement for probiotic products.

In a study conducted by Adriano et al. (2007), the probiotic count of shrikhand on 0 day ranged from 7.445 to 9.428 log cfu/g. The probiotic count on 28th day ranged from 6.709 to 8.963 log cfu/g.

Sensory evaluation

The mean sensory scores for flavour, colour and appearance, body and texture, container and overall acceptability of control were 48.83±0.17, 29.00±0.26, 14.33±0.21, 4.33±0.21 and 96.50±0.50 respectively. The corresponding scores for probiotic shrikhand were 47.33±0.67, 28.83±0.31, 14.17±0.31, 4.33±0.21 and 94.67±0.84 respectively (Table 3). No significant difference in sensory scores was observed between control and probiotic shrikhand. Jagdishbhai (2013) had also reported that no significant difference existed in sensory scores between control and probiotic shrikhand.

Shinde*et.al.* (2017) reported that sensory quality of probiotic shrikhand was more acceptable than control shrikhand.

CONCLUSION

From the above results it can be concluded that, acceptable quality probiotic shrikhand can be prepared by using *Bacillus coagulans* as a probiotic culture. A significant increase in acidity and total solids was observed in probiotic shrikhand. Sensory quality of the probiotic shrikhand was comparable to control. Probiotic count could be maintained within the acceptable limit during storage.

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FLOW CHART FOR PREPARING PROBIOTIC SHRIKHAND

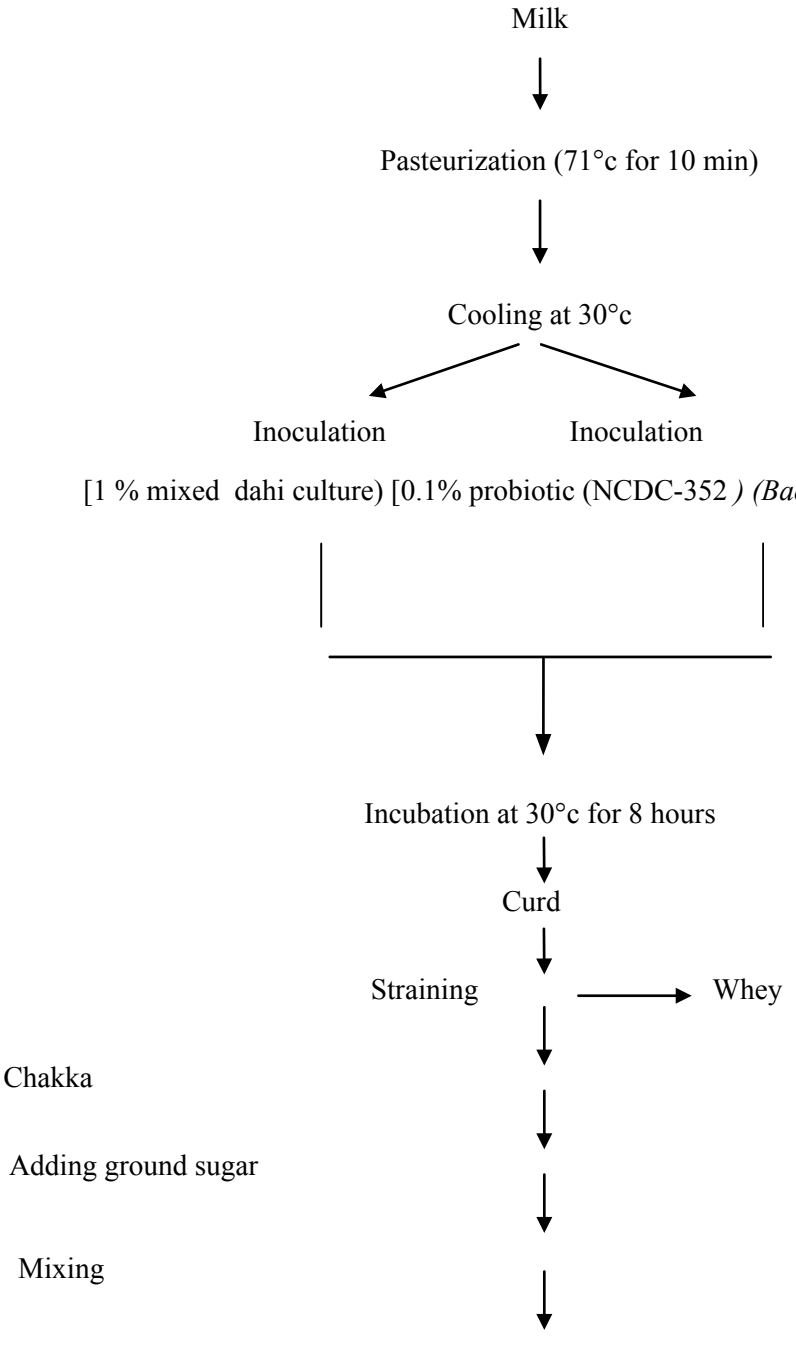

Table.1 Results of physico-chemical analysis of shrikhand

Parameters	Control shrikhand (Mean±SE)	Probiotic shrikhand (Mean±SE)	t-value
Acidity	1.02±0.004	1.42±0.019	-25.033*
Fat	9.15±0.075	9.13±0.072	0.191^{ns}
Total solids	55.97±0.622	58.09±0.088	-19.28**
Ash	0.92±0.014	0.91±0.022	0.508^{ns}
Protein	9.07±0.021	8.97±0.034	2.918^{ns}

** Significant at 0.05 level*
^{ns}*Non significant*
*** Significant at 0.01 level*

Table. 2 Results of Microbiological analysis of shrikhand

Microbiological analysis	Sample	1st day (Mean±SE)	5th day (Mean±SE)	10th day (Mean±SE)	15th day (Mean±SE)
Coliform count	C	1.13±0.09	0.55±0.25	0	0
	T	1.18±0.08	0.93±0.20	0	0
	t value	-0.418^{ns}	-1.206^{ns}	0^{ns}	0^{ns}
Yeast and Mould count	C	1.05±0.050	1.36±0.038	1.50±0.02	1.58±0.02
	T	1.06±0.17	1.42±0.04	1.47±0.04	1.56±0.03
	t value	-0.075^{ns}	-1.118^{ns}	0.681^{ns}	0.620^{ns}
Probiotic count	T	7.11±0.03	7.04±0.18	7.02±0.04	7.00±0.17
	F-value	0.136^{ns}			

^{ns}*Non significant*

Table 3. Sensory evaluation (Mean ± S.E) of shrikhand

Sample	Flavour	Colour and appearance	Body and texture	Container	Total
C	48.83±0.17	29.00±0.26	14.33±0.21	4.33±0.21	96.50±0.50
T	47.33±0.67	28.83±0.31	14.17±0.31	4.33±0.21	94.67±0.84
t value	2.18*	0.42^{ns}	0.45^{ns}	0.00^{ns}	

^{ns}*Non significant*