



E-ISSN: 2278-4136  
P-ISSN: 2349-8234  
JPP 2019; 8(5): 297-299  
Received: 25-07-2019  
Accepted: 27-08-2019

**Prafull Kumar**  
Ph.D. (DT) Scholar,  
WCDT, SHUATS, Prayagraj,  
Uttar Pradesh, India

**Anamika Das**  
Assistant Professor  
WCDT, SHUATS  
Prayagraj, India.

**Srishti Upadhyay**  
Ph.D. (FST) Scholar,  
WCDT, SHUATS, Prayagraj,  
Uttar Pradesh, India

**John David**  
Dean, WCDT, SHUATS,  
Prayagraj, Uttar Pradesh, India

**Sangeeta Shukla**  
Assistant Professor  
WCDT, SHUATS, Prayagraj,  
Uttar Pradesh, India

**Correspondence**  
**Prafull Kumar**  
Ph.D. (DT) Scholar  
WCDT, SHUATS, Prayagraj,  
Uttar Pradesh, India

## Effect of incorporation of lactulose and litchi pulp on physico-chemical and microbial attributes of Shrikhand

**Prafull Kumar, Anamika Das, Srishti Upadhyay, John David and Sangeeta Shukla**

### Abstract

Shrikhand is a nutritious traditional fermented milk product which is widely consumed in western parts of India. In the present investigation, shrikhand was prepared using different combinations of litchi pulp and lactulose. Lactulose was added @ 3%, 6% and 9% where litchi pulp was added @ 5% and 10% in different formulations. The physico-chemical analysis result shows that with increase in the litchi pulp concentration from 5 to 10% and lactulose concentration from 3 to 9%, pH increased while fat, protein and acidity decreased. Carbohydrate and total solids content decreased with increase in litchi pulp concentration from 5 to 10% and it increased when lactulose concentration increased from 3 to 9%. Ash, antioxidant and crude fiber increased with increase in litchi pulp concentration from 5 to 10% and decreased when lactulose concentration increased from 3 to 9%.

**Keywords:** Shrikhand, lactulose, litchi pulp, physico-chemical, microbial

### Introduction

Shrikhand is one of the most popular fermented milk products known for its taste and therapeutic value. Shrikhand contains an appreciable amount of milk protein and is obtained by lactic acid fermentation through the action of *Lactobacillus bulgaricus*, *Streptococcus lactis* and *Streptococcus thermophilus*. Shrikhand is a delicious and delightful dessert of western India. It is made with chakka which is finely mixed with sugar and flavouring agent. It has a nutritive goodness of fermented milk product like dahi, it is very refreshing particularly during summer month (Nigam *et al.*, 2009) [13]. It shows characteristics flavour and taste due to the addition of several ingredients such as cardamom, pistachios, nutmeg powder, etc.

Litchi is one of the most delicious subtropical fruit of India with sweet, white, translucent and juicy flesh. It is a rich source of sugar, vitamins and minerals like Magnesium, Iron, Phosphorous, Potassium, Calcium and Copper (Marisa, 2006) [12]. It has been reported that litchi plays a therapeutic role in fighting blood pressure, arthritis, asthma and cardiovascular disease.

Lactulose is a disaccharide and produced by the isomerization of lactose. It is widely established as a laxative agent in the treatment of constipation and reduces the risk of colon cancer. Lactulose has also an important application in lowering blood glucose level and reduces the pancreatic insulin production and thus lactulose shows anti-diabetic effect. Unlike many other carbohydrates such as lactose, lactulose is not hydrolyzed by digestive enzymes in the small intestine to be absorbed as monosaccharides into the bloodstream. Instead, it is transported to the large intestine where it is hydrolyzed by resident saccharolytic microflora. Using lactulose as an energy source, some gram positive bacteria such as bifidobacteria species produce lactic and acetic acids, lowering pH and raising osmotic pressure. These in turn soften intestinal contents and may prevent the proliferation of some gram negative, putrefactive and pathogenic species such as clostridium, bacteroides, salmonella, shigella and *Escherichia coli*. The present study has been undertaken to incorporate litchi and lactulose in different proportion and to study its effect on physico-chemical and microbial attributes of shrikhand.

### Materials and Methods

#### Procurement of raw materials

Fresh buffalo milk was collected from Prayagraj. Litchi pulp was collected from National Litchi Research Institute, Bihar. Lactulose was procured from Azelis (India) Private Limited, Navi Mumbai. Mesophilic mixed culture NCDC-167 (*Lactococcus lactis* ssp. *lactis*, *L. lactis*

ssp. *cremoris*, *L. lactis* ssp. *diacetylactis* and *Leuconostoc citrovorum*) was procured from National Collection of Dairy Cultures, NDRI, Karnal. It was maintained by propagating in sterilized reconstituted skimmed milk (12g/100ml) by sub-culturing once in four days.

Polystyrene cups (100/ml) with lids were obtained from Aggies Dairy of Warner College of Dairy Technology, S.H.U.A.T.S., Prayagraj and used for packaging and storage of shrikhand.

### Treatment combinations

Six treatments viz., T1, T2, T3, T4, T5 and T6 were formulated in which litchi pulp was added @ 5% and 10%. Lactulose was added @ 3%, 6% and 9%. T1 has 5% litchi pulp and 3% lactulose. T2 has 10% litchi pulp and 3% lactulose. T3 has 5% litchi pulp and 6% lactulose. T4 has 10% litchi pulp and 6% lactulose. T5 has 5% litchi pulp and 9% lactulose. T6 has 10% litchi pulp and 9% lactulose.

### Preparation of shrikhand

Fresh buffalo milk was received. Required quantity of milk was standardized to 6 percent fat and 9 percent SNF and filtered. Milk was heated at 85 °C for 30 minutes. It was cooled to 30 °C and inoculated by the starter culture i.e. NCDC 167 (combination of *Lactococcus lactis* ssp. *lactis*, *Lactococcus lactis* ssp. *cremoris* and *Lactococcus lactis* ssp. *diacetylactis*) at the rate of 2 percent and incubated at 32 °C for 10-12 hours until a firm coagulum was formed. Coagulum was then broken and transferred to a muslin cloth and hanged for expulsion of whey for 8 to 10 hours. The semi solid mass left after drainage of whey is called chakka which is the base for shrikhand. Chakka was mixed with litchi pulp and lactulose (as mentioned in treatment). 35 percent sugar was added. The mixture was well kneaded to smooth paste. It was then filled into sanitized polystyrene cups, sealed and kept for storage at 5-7 °C.

### Physico chemical analysis

Carbohydrate was determined by Lane Eynon method described in SP: 18, Part XI, 1981. The fat percentage of shrikhand supplemented with lactulose and litchi pulp was determined as per procedure described in A.O.A.C. (1990) [2]. Determination of protein was done as per the procedure of Maneffee and Overman (1940) [11]. Determination of ash content was done as per the procedure to A.O.A.C. (1975) [3]. Total solids of Shrikhand supplemented with lactulose and litchi pulp was determined by gravimetrically as per the procedure for milk laid down in IS 2802, 1964. Titratable acidity of shrikhand sample was carried out by titration method. The pH of shrikhand samples was determined by potentiometric method using a digital pH meter at a temperature of 25 °C. Determination of crude fiber contents was done as per A.O.A.C. (1995) [1]. Antioxidant activity was determined by the method of Brand-Williams *et al.*, (1995) [5].

### Microbiological analysis

Lactic acid bacteria count, Yeast and mould count and Coliform count were carried out as per the procedure given by (APHA), standard method for the examination of Dairy products (1992).

### Statistical analysis

Data was analysed using Analysis of Variance (ANOVA) and Critical difference (C.D) in WASP software (Factorial design) and MS office, 2007.

## Results and Discussions

### Physico chemical analysis

The carbohydrate (%), fat (%), protein (%), ash (%), total solids (%), acidity (%), pH, antioxidant activity and crude fiber (%) of shrikhand supplemented with lactulose and litchi pulp were compiled in Table 1.

**Table 1:** Average data for different parameters of shrikhand supplemented with lactulose and litchi pulp.

	T1	T2	T3	T4	T5	T6
Carbohydrate (%)	40.36	39.47	42.15	41.33	44.00	43.24
Fat (%)	13.01	12.49	12.68	12.18	12.37	11.90
Protein (%)	7.66	7.37	7.47	7.21	7.30	7.05
Ash (%)	0.67	0.69	0.65	0.67	0.64	0.65
Total Solids (%)	61.70	60.03	62.95	61.40	64.31	62.85
Acidity (%LA)	0.91	0.90	0.89	0.87	0.86	0.85
Ph	5.34	5.40	5.46	5.58	5.65	5.71
Antioxidant	1.98	3.49	1.93	3.40	1.88	3.32
Crude Fiber (%)	0.10	0.20	0.09	0.19	0.09	0.19

Carbohydrate content of different samples of different treatments were found to range from 39.47 to 44.00 percent. With increase in the litchi pulp concentration from 5 to 10 percent the carbohydrate percentage decreased significantly ( $P<0.05$ ). When the lactulose concentration increased from 3 to 9 percent carbohydrate percentage increased significantly ( $P<0.05$ ) and similar trend was observed.

Fat content of different samples of different treatments were found to range from 11.90 to 13.01 percent. With increase in the litchi pulp concentration from 5 to 10 percent and lactulose concentration from 3 to 9 percent the fat percentage decreased significantly ( $P<0.05$ ) and similar trend was observed. Nigam *et al.*, (2009) [13] reported that addition of different level of papaya pulp significantly affect the fat of shrikhand. They conducted the study using 0, 20, 40 and 60 per cent papaya pulp on the basis of chakka. They found that levels of papaya pulp increase with decreased fat of shrikhand. Deshpande *et al.*, (2005) reported that with increasing the incorporation of mango pulp for preparation of shrikhand there was decrease in fat content of product.

Protein content of different samples of different treatments were found to range from 7.05 to 7.66 percent. With increase in the litchi pulp concentration from 5 to 20 percent and lactulose concentration from 3 to 9 percent the protein percentage decreased significantly ( $P<0.05$ ) and similar trend was observed. Deshpande *et al.*, (2005) reported that with increasing the incorporation of mango pulp for preparation of shrikhand there was decrease in fat content of product.

Ash content of different samples of different treatments were found to range from 0.64 to 0.69 percent. With increase in the litchi pulp concentration from 5 to 10 percent the ash percentage increased significantly ( $P<0.05$ ). When the lactulose concentration increased from 3 to 9 percent ash percentage decreased significantly ( $P<0.05$ ) and similar trend was observed. Jain (1996) [10] stated 0.417-0.683 per cent ash content of shrikhand manufactured and sold in cities of Gujarat State.

Total solids content of different samples of different treatments were found to range from 60.03 to 64.31 percent. With increase in the litchi pulp concentration from 5 to 10 percent the total solids percentage decreased significantly ( $P<0.05$ ). When the lactulose concentration increased from 3 to 9 percent total solids percentage increased significantly ( $P<0.05$ ) and similar trend was observed. Nigam *et al.*, (2009) [13] reported that addition of different levels of papaya pulp

significantly affected the total solid of shrikhand. They conducted the study using 0, 20, 40 and 60 per cent papaya pulp on the basis of chakka. The total solid content significantly decrease with increase in the level of papaya pulp. While shrikhand prepared with 0 per cent papaya pulp obtained highest total solid.

Titrateable acidity of different samples of different treatments were found to range from 0.85 to 0.91 percent. With increase in the litchi pulp concentration from 5 to 10 percent and lactulose concentration from 3 to 9 percent the acidity percentage decreased significantly ( $P < 0.05$ ) and similar trend was observed. Ghatak and Dutta (1998)<sup>[7]</sup> studied cow and buffalo milk for compositional and sensory quality of shrikhand and observed 1.06 per cent acidity of shrikhand prepared from buffalo milk. Shinde (1995)<sup>[14]</sup> reported 1.005 per cent acidity while working on utilization of SMP for preparation of shrikhand.

pH of different samples of different treatments were found to range from 5.34 to 5.71 percent. With increase in the litchi pulp concentration from 5 to 10 percent and lactulose concentration from 3 to 9 percent the pH increased significantly ( $P < 0.05$ ) and similar trend was observed.

Antioxidant content of different samples of different treatments were found to range from 1.88 to 3.49 (expressed in terms of mg ascorbic acid). With increase in the litchi pulp concentration from 5 to 10 percent the antioxidant activity increased significantly ( $P < 0.05$ ). When the lactulose concentration increased from 3 to 9 percent antioxidant activity decreased significantly ( $P < 0.05$ ) and similar trend was observed.

Crude fiber content of different samples of different treatments were found to range from 0.09 to 0.20 percent. With increase in the litchi pulp concentration from 5 to 20 percent the crude fiber percentage increased significantly ( $P < 0.05$ ). When the lactulose concentration increased from 3 to 9 percent crude fiber percentage decreased significantly ( $P < 0.05$ ) and similar trend was observed.

#### Microbiological analysis

Lactic acid bacteria count of shrikhand samples of different treatments viz., T1, T2, T3, T4, T5 and T6 was found to be  $6.50 (\times 10^4 \text{ cfu/g})$ ,  $6.75 (\times 10^4 \text{ cfu/g})$ ,  $6.50 (\times 10^4 \text{ cfu/g})$ ,  $6.75 (\times 10^4 \text{ cfu/g})$ ,  $5.50 (\times 10^4 \text{ cfu/g})$  and  $5.75 (\times 10^4 \text{ cfu/g})$  respectively. There was significant difference ( $P < 0.05$ ) among the lactic acid bacteria count. The yeast and mold count of different treatments viz., T1, T2, T3, T4, T5 and T6 was found to be 5.50, 3.00, 5.25, 5.00, 5.50 and 6.25 (per g) respectively. There was significant difference ( $P < 0.05$ ) among the yeast and mould. The coliform count of different samples was found to be absent in first dilution.

#### Conclusion

From this study it may be concluded that the shrikhand can be supplemented with lactulose and litchi pulp without adversely affecting the physico-chemical characteristics of the product. There is a great scope of manufacturing shrikhand supplemented with lactulose and litchi pulp as it is found to have improved nutritional properties as well as health benefits as compared to plain shrikhand. The addition of fruit pulp will increase the crude fiber content of shrikhand which otherwise is deficient in the same.

#### References

1. A.O.A.C. Official methods of analysis, 16<sup>th</sup> edition, Association of Official Analytical Chemists, Washington, D.C. USA, 1995.
2. A.O.A.C. Official methods of analysis, 15<sup>th</sup> edition, Association of Official Analytical Chemists, Washington, D.C. USA, 1990.
3. A.O.A.C. Official methods of analysis, 12<sup>th</sup> edition, Association of Official Analytical Chemists, Washington, D.C. USA, 1975.
4. APHA. Standard methods for the examination of dairy products, 16<sup>th</sup> edition, American Public Health Association. Washington, D.C., 1992, 213-216.
5. Brand-Williams W, Cuvelier ME, Berset C. Use of free radical method to evaluate antioxidant activity. *Lebensm Wiss Tech.* 1995; 28:25-30.
6. Deshpande S, Bargale PC, Jha K. Suitability of soy milk for development of shrikhand. *J Food Sc. Tech.* 2008; 45(3):284-286.
7. Ghatak PK, Dutta S. Effect of admixing of cow milk and buffalo milk on compositional and sensory quality of shrikhand. *Ind. J Nutri. Dietet.* 1998; 35(2):43.
8. IS: (SP: 18). ISI Handbook of Food Analysis, Part XI: Dairy Products, Indian Standards Institution, New Delhi, 1981.
9. IS: 2802. Indian standards institute, Manak Bhavan, Bahadur shah zafar marg, New Delhi, 1964.
10. Jain A. A comparative appraisal of quality of shrikhand manufactured and sold in selected cities of Gujrat state. M.Sc. (Dairy technology) thesis submitted to Gujrat Agricultural University, Anand campus, Gujrat, 1996.
11. Maneffee SS, Overman OR. A semi Kjeldahl method for determination of total nitrogen in samples. *J Dairy Sci.* 1940; 23(A):143.
12. Marisa MW. Ascorbic acid and mineral composition of longan, lychee and Rambutan cultivars grown in Hawaii. *J Food Comp. Anal.* 2006; 19:655-663.
13. Nigam N, Singh R, Upadhyay PK. Incorporation of chakka by papaya pulp in manufacture of shrikhand. *J. Dairying, Food and H. Sc.* 2009; 28(2):115-118.
14. Shinde SN. Utilisation of skim milk powder for preparation of shrikhand. M.Sc. (Ag.) thesis submitted to Konkan Krishi Vidyapeeth, Dapoli, 1995.