

Original Research Article

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Development of Soy Milk in Litchi Pulp Based Shrikhand for Development of a Novel Fermented Milk Product

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ABSTRACT

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The present investigation was undertaken to explore the possibility of the use of soy milk in litchi pulp based shrikhand to produce a novel fermented milk product. The product was prepared as per the standard method using constant level of litchi pulp (15%) and sugar (40%). Different levels of soy milk (10, 20, 30 and 40%) were tried as substitute of standardized milk. It was found that incorporation of soy milk at 20% level slightly improved the colour and appearance scores of the developed product. Other sensory parameter (Flavour, Body and texture, Sweetness and Overall Acceptability) scores were decreased as the level of soy milk incorporation increased, but the scores were comparable with control samples at 20% soy milk incorporation. The moisture and protein content was increased and fat, titrable acidity and total solids were decreased in 20% soy milk incorporated developed shrikhand. It is concluded that litchi pulp (15%) based shrikhand can be prepared by replacing 20% soy milk with standardized milk without compromising its quality.

Introduction

Fermented milk products constitute a vital component of the human diet in many regions of the world (Swapna and Chavannavar, 2013). Indian fermented milk products utilize 7 per cent of total milk produced and mainly include three sweetened products i.e. dahi, shrikhand and lassi. These products have enjoyed reputation for their nutritional and therapeutic value from time immemorial (Aneja *et al.*, 2002) and play an important role in synthesis of vitamin B complex in human

body. These products also prevent the stomachic diseases, because several lactic organisms produce natural antibiotics (Zhao *et al.*, 2006). Shrikhand is popular dessert and forms part of a delicious supplement on religious functions, particularly in the state of Maharashtra, Gujarat, Karnataka and some parts of South India (Aneja *et al.*, 2002).

With the restricted availability and high cost of animal milk, the scientists have been making attempts to switch over to the utilization of plant proteins. Soya bean is

nutritious and used to prepare soy milk based fermented food products. Fermentation of soy milk improves the flavour, enhances the nutritional quality of food, increases the digestibility, eliminates the anti-nutritional factors, prolongs shelf life, adds therapeutic value and is relatively economic as compared to dairy milk products (Hasseltine and Wanghua, 1980).

Litchi (*Litchi chinensis* Sonn.) is a tropical and subtropical fruit native to China, and now widely Cultivated throughout the World. It is well received by consumers because of its delicious taste and possible health benefits, and its processing production has steadily increased in late decades. Litchi fruit pericarp (LFP) accounts for approximately 15% by weight of the whole fresh fruit and contains significant amounts of phenolics which are usually discarded as a waste in the process (Gavane *et al.*, 2010; Deshpande *et al.*, 2008). The phenolics of LFP have been confirmed to have antioxidant, anticancer (Gandhi and Jain, 1977), immunomodulatory (9) activities. LFP has been considered a new source of pharmaceuticals and food industry.

Soy milk based fruit juice beverage would offer several distinct nutritional advantages over the plain fruit beverage to the consumer.

It is also a common practice of using fruits in preparation of various dairy products like ice cream, yoghurt and shrikhand (Zhao *et al.*, 2006). Fruit pulp provides sweetness and masks the beany flavor of soy milk to some extent (Lee *et al.*, 1990). Various workers have tried pulp of various fruits in the preparation of shrikhand (Gavane *et al.*, 2010).

Hence, the present investigation was undertaken to explore the possibility of the use of soy milk in litchi pulp based shrikhand to produce a novel fermented milk product.

Materials and Methods

Soy bean, litchi fruits and powdered Sugar were purchased from local market and fruit pulp was used for enhancing the flavour and acceptability of product.

Standardized milk having 4.5% fat and 8.5% SNF was purchased from local market of Varanasi Uttar Pradesh and the mixed starter culture NCDC-263 (*Streptococcus thermophiles* and *Lactobacillus bulgaricus*) was procured from National Collection of Dairy Cultures, NDRI, Karnal.

The litchi pulps were prepared with standard methods in hygienic conditions and pasteurization was done at 76 °C for 1 min. The pulp were packaged in polythene bags and sealed aseptically.

Soy milk was prepared in the Animal Husbandry and Dairying institute of agricultural sciences Banaras Hindu University Varanasi as per standard procedures (Deshpande *et al.*, 2008) and packed in glass bottles. Both the ingredients were shifted to cold storage ($4\pm 1^{\circ}\text{C}$) room for further use (Gandhi and Jain, 1977).

Treatments were prepared by replacing standardized milk with soy milk at different levels (10, 20, 30 and 40%). Litchi pulp (15%) and sugar (40%) was added to both control and treated samples as per the standardized method (Zhao *et al.*, 2006; Thakur *et al.*, 2014) and further processed for preparation of shrikhand as per the method followed by Sonawane (Zhao *et al.*, 2006).

Method of Trout (Trout *et al.*, 1992) was followed for determining the pH of the samples and the acidity (titration) and proximate composition of sample were determined by following the method described by AOAC (AOAC, 2002).

The nine point hedonic scale was employed for sensory evaluation following the methodology described by Harry and Hildegarde (Harry and Hildegarde, 1998).

The experiment was replicated thrice along with duplicate samples and data obtained were subjected to one way ANOVA followed by Duncans Multiple Range Test by using SPSS software (Snedecor and Cochran, 1994).

Results and Discussion

Sensory Evaluation

The colour and appearance score was slightly improved with addition of soy milk at T1 and T2 treatment levels as compared to control (C) for development of litchi based shrikhand (Table 1), however, it was significantly ($p \leq 0.05$) decreased with further incorporation of soy milk (T3 and T4) as compared to control as well as T1 and T2 samples. The colour and appearance scores of T2 were statistically comparable with C, and hence selected. These results of colour and appearance for soya milk incorporation are in accordance with the findings of Deshpande (Deshpande *et al.*, 2008; Deshpande *et al.*, 2005; Deshpande *et al.*, 2008). Who reported lower average colour and appearance in shrikhand prepared from buffalo milk blended at higher levels of soy milk as compared to control.

It was evident from the results that the flavor score was decreased as the level of soy milk increased. It was due to beany flavor of soy milk as reported by (Deshpande *et al.*, 2006). The treatment T2 was selected by judges because it contain higher proportion of soy milk than T1 with acceptable scores and statistically comparable with control samples. The lower flavor score in soy milk incorporated shrikhand are in agreement with the results of (Deshpande *et al.*, 2008) and

(Borate *et al.*, 2011), who reported lower average flavor score in shrikhand prepared from buffalo milk blended at higher levels of soy milk due to its dominating beany flavor as compared to control.

The body and texture score was slightly decreased with addition of soy milk at T1 and T2 treatment levels as compared to control (C) for development of litchi based shrikhand, however, it was significantly ($p \leq 0.05$) decreased with further incorporation of soy milk as compared to control as well as T1 and T2 samples. The body and texture scores of T2 were statistically comparable with C, and hence selected. (Deshpande *et al.*, 2006) also reported the similar results for body and texture scores with incorporation of soy milk in standardized buffalo milks shrikhand. The lower body and texture scores in soy milk incorporated shrikhand are also in agreement with the results of (Deshpande *et al.*, 2008) and (Borate *et al.*, 2011). However, the sweetness scores were decreased as the level of soy milk incorporation increased, but the significant decline was recorded at T3 and T4 levels of treatments as compared to C including T1 and T2 treatments. The sweetness score of treatment T2 was comparable with control and hence selected. These results of soy milk incorporated shrikhand might be due to higher acidity and lower average sweetness scores in shrikhand prepared from buffalo milk blended with soy milk as compared to control samples (Deshpande *et al.*, 2008; Borate *et al.*, 2011). The overall acceptability score was slightly decreased with addition of soy milk at T1 and T2 treatment levels as compared to control for development of litchi based shrikhand, however, it was significantly ($p \leq 0.05$) decreased with further incorporation of soy milk at T3 and T4 as compared to C as well as T1 and T2 samples. The overall acceptability scores of T2 treatment were statistically comparable with C.

Table.1 Effect of soy milk incorporation on sensory score of litchi pulp based shrikhand

Sensory attributes	C	T ₁	T ₂	T ₃	T ₄
Colour and appearance	7.86 ^a ±0.16	8.00 ^a ±0.00	8.00 ^a ±0.00	7.56 ^b ±0.21	7.00 ^b ±0.36
Flavour	8.18 ^a ±0.25	7.93 ^a ±0.16	7.65 ^a ±0.20	7.00 ^b ±0.12	6.42 ^c ±0.20
Body and texture	8.23 ^a ±0.32	7.82 ^a ±0.83	8.08 ^a ±0.20	7.18 ^b ±0.08	6.42 ^c ±0.20
Sweetness	8.40 ^a ±0.25	7.93 ^a ±0.16	7.53 ^a ±0.16	7.20 ^b ±0.10	6.33 ^c ±0.21
Overall acceptability	7.83a±0.16	7.73a±0.10	7.75a±0.17	6.67b±0.16	6.00c±0.00

Table.2 Physico Chemical properties of soy milk blended litchi based shrinkhand

Parameters	Treatment	
	Strawberry based Shrikhand (Control)	Litchi based Shrikhand with 20% Soya milk
Moisture (%)	51.73 ^b ±0.24	54.87 ^a ±0.11
Total Solids (%)	48.27 ^a ±0.21	45.13 ^b ±0.32
Protein (%)	5.60 ^b ±0.03	6.47 ^a ±0.04
Fat (%)	8.92 ^a ±0.01	7.12 ^b ±0.08
Ash (%)	0.57±0.03	0.55±0.02
Sucrose (%)	24.92±0.72	24.29±0.83
pH	3.71±0.02	3.74±0.05
Titrate acidity (%)	1.62 ^a ±0.01	1.45 ^b ±0.04

Mean±SE with different superscript in a row differ significantly ($p\leq 0.05$). (n=6)

Treatments

Control (C)	Chakka prepared from 100% standardized milk.	
T1	Chakka prepared from 90% standardized milk	10% soy milk
T2	Chakka prepared from 80% standardized milk	20% soy milk.
T3	Chakka prepared from 70% standardized milk	30% soy milk.
T4	Chakka prepared from 60% standardized milk	40% soy milk.

The lower acceptability scores at higher level of soy milk incorporated shrikhand are also in agreement with the results of (Deshpande *et al.*, 2008) and (Borate *et al.*, 2011). On the basis of sensory evaluation, the litchi (15%) based shrikhand incorporated with 20% soya milk was selected for further studies.

Physico-chemical properties

Moisture content strawberry (15%) based shrikhand was significantly ($P\leq 0.05$)

increased with addition of 20% soy milk (Table 2). Total solids of control was significantly ($P\leq 0.05$) higher than soya milk added product. This might be due to the fact that soy proteins have high affinity for water binding and thus having high water holding capacity. Similar results were also reported by (Deshpande *et al.*, 2008; Deshpande *et al.*, 2005) and (Borate *et al.*, 2011)

There was a significant ($P\leq 0.05$) increase in protein content of soya milk added shrikhand

as compared to control. Present findings for protein content of soy milk blended shrikhand are in line with that reported by (Borate *et al.*, 2011). Fat content of soya milk added shrikhand was significantly ($P \leq 0.05$) lower than control. It might be due to more water retained in soy milk added shrikhand which affected the proportionate nutritional parameters (Deshpande *et al.*, 2008; Deshpande *et al.*, 2005; Borate *et al.*, 2011).

Ash, sucrose content and pH level did not show any significant ($P \leq 0.05$) differences between control and soya milk treated shrikhand and the pH value of developed shrikhand and control sample were within the range prescribed by Datta and Ghatak (Datta and Ghatak, 2001).

The per cent titrable acidity of control shrikhand was significantly ($P \leq 0.05$) higher than that of titrable acidity of soya milk added developed product. Lower acidity in the fresh shrikhand prepared from buffalo milk blended with soy milk has been reported than shrikhand prepared only from buffalo milk (Borate *et al.*, 2011). However, the titrable acidity in both control and soya treated products was found well within the permissible limits of 1.4 per cent as per the BIS specification for shrikhand.

It is concluded that litchi pulp based shrikhand can be prepared with incorporation of 20% soy milk without compromising the sensory, nutritional and physico-chemical quality of the developed shrikhand.

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