Physicochemical properties and Cost of production of cow milk shrikhand blended with Calcutta betel vine (*Piper betel*) extract

Abstract

The present investigation was conducted at Section of Animal Husbandry and Dairy Science, Nagpur. An effort was made to find out the physicochemical properties and calculate the cost structure. Some of the findings emerged from the present investigation are summarized as follows. Concerning the chemical composition of Calcutta betel vine leaves extract added in shrikhand, it was observed that the fat, protein and titratable acidity content were slightly decreased with addition of different levels of Calcutta betel vine leaves extract. The moisture, ash and pH of shrikhand was significantly increased. The total solids and solids not fat content of shrikhand was decreased with increase the level of Calcutta betel vine leaves extract. As regards to the cost of production per kg shrikhand was lowest in T_1 (Rs. 238.23 kg^{-1}) and highest in T_5 (Rs.294.81 kg^{-1}). Which indicates that, increase in the level of Calcutta betel vine leaves extract showed increase in cost of production for preparation of shrikhand. The present study concluded that acceptable quality shrikhand can be prepared by adding 6 % Calcutta betel vine leaves extract.

Keywords: Cow milk, Chakka, Betel vine, Shrikhand, Physico-chemical, cost of production.

Introduction

"Milk is an almost ideal food. It has high nutritive value. It supplies body-building proteins, bone forming minerals and health-giving vitamins and furnishes energy-giving lactose and milk fat. Besides supplying certain essential fatty acids, it contains the above nutrients in an easily digestible and assimilable form. All these properties make milk an important food" (Sukumar, 2013). **"**Preservation of milk using fermentation with lactic acid bacteria is one of the oldest and efficient methods to preserve milk with its valuable nutrients as it's a 'probiotic' product" (Kongo and Malcata, 2016). "The name shrikhand is derived name from the Sanskrit word "Shikharani" meaning a curd prepared with added sugar, flavouring agents like saffron, fruits and nuts. It is popular in western India and is very refreshing particularly during summer months and is recommended for people to lower the risk of chronic degenerative diseases" (Swapna *et al*., 2013).

"The betel vine leaves are commonly used as masticatory as they are rich nutritionally and are known medicinally as a stimulant, carminative, antiseptic and expectorant. Its chlorophyll is beneficial in maintaining healthy teeth, clearing the mouth and helping in a digestion by encouraging salivation and neutralizing excess acid with good source of water and oil soluble vitamins" (Guha, 2006). "The leaves of betel vine have long been use in the Indian local system due to its medicinal properties. It helps in curing various diseases like hypertension, diabetes, brain toxin, boils and abscesses, headaches, leucorrhoea, cuts and injuries, ringworm infestation, swelling of gum, voice problems, rheumatism, wound healing. obesity, conjunctivitis, constipation, abrasion, etc". (Aishwarya *et al*., 2016). The present investigation on "Preparation of cow milk shrikhand blended with calcutta betel vine (*Piper betel)* leaves extract" was undertaken with following objectives, to study the physico - chemical properties, to calculate the cost structure.

Material and Methods

Fresh, clean, whole cow milk was used for shrikhand preparation. Cow milk was procured for every trial from Livestock Instructional Farm of Section of Animal Husbandry and Dairy Science, College of Agriculture, Nagpur. Betel vine leaves, clean crystalline cane sugar and dahi culture was procured from local market. Muslin cloth, electrical mixer, glassware. Method was used for preparation of shrikhand suggested by Aneja *et al.* (1977) with slight modification. Cow milk was standardized at 4 per cent fat and then it was heated to 72°C for 15 sec. After heating it was cooled to 30°C and inoculated with 1% starter culture. Then it was allowed for incubation for 10-12 hours at room temperature. After which it was followed by break down the coagulum and hanging in muslin cloth (for 6-8 hours) for drainage of whey. After expulsion of whey, sugar was added @ 45% by weight of shrikhand and mixed betel vine leaves extract as per treatments. The shrikhand was packaged in plastic coated cups and stored at refrigerated temperature for further evaluation and analysis.

Treatment Details

Table No. 1: Treatment Details	
T_1	**100 % shrikhand as per standard (Control)**
T_2	**T1 + 2 % BLE**
T_3	**T1 + 4 % BLE**
T_4	**T1 + 6 % BLE**
T_5	**T1 + 8 % BLE**

(BLE: - Betel vine leaves extract)

(In all treatments sugar was used @ 45% by wt. of chakka)

The experiment was based on total five treatments and four replications. Completely Randomized Design was used as statistical design (Table 1).

Results and Discussion

The present study and investigation entitled as "preparation of cow milk shrikhand blended with calcutta betel vine (*Piper betel*) leaves extract", was carried out in the following order. The present study shifts in consumption pattern of the Indian consumers from milk to innovative milk products brings a large scope for dairy processing in the country. It is a great challenge to innovate methodologies and technologies at the same time encouraging the value addition as well as the by-product utilization of these commodities.

Fat

Fat content of shrikhand for treatments T_1, T_2, T_3, T_4, and T_5 were 8.25, 8.19, 8.02, 7.94 and 7.87 % respectively. The control treatment T_1 (8.25 %) recorded significantly highest fat per cent over treatments T_2, T_3, T_4 and T_5. The fat percentage decreases as the levels of betel vine leaves extract increases from T_1 to T_5. Sameem *et al*. (2018) studies that "the highest mean value for fat percentage in dragon fruit pulp shrikhand (11.2) was obtained from the treatment T_0 (control) followed by T_1 (10.86%), T_2 (10.52%). The minimum score (10.19%) was obtained in T_3. There were significant differences found among the treatments. F Value was 447.15, indicating significant effect of treatment on fat percentage" (Table 2).

Protein

The protein content of the functional shrikhand prepared by using different levels of betel vine leaves extract ranged from 8.76 to 9.01 %. shrikhand as treatments T_1, T_2, T_3, T_4, and T_5 were as 9.01, 8.93, 8.88, 8.82 and 8.76 %, respectively. The control treatment (T_1) had significantly highest protein content (9.01%) while, shrikhand prepared with 8 percent betel vine leaves extract had lowest (8.76%) (Table 2). The protein content in shrikhand was decreased as the proportion of betel vine leaves extract increased in the product. Though protein content decreased with increases in level of betel vine leaves extract it's maintained as per the value of ISI standard. Singh *et al.* (2018) manufacture of paneer by used of buffalo milk and betel vine and noted that the protein content in shrikhand decreased significantly

with increasing level of betel vine. Protein content of shrikhand was significantly varies due to the addition of different level of betel vine.

Moisture

Addition of betel vine leaves extract had significant effect on moisture content of shrikhand. The mean moisture content in shrikhand under treatments T_1, T_2, T_3, T_4 and T_5 were as, 41.56, 42.43, 42.83, 43.54 and 43.72 %, respectively. The moisture content was higher in T_5 (43.72%) i.e. shrikhand prepared from cow milk with 8.0 % betel vine leaves extract. Lowest moisture content in shrikhand was transparent in T_1 as 41.56 %. It was determined that increased in the level of betel vine leaves extract increase the moisture content in shrikhand. Sameem *et al*. (2018) studies that the highest mean values for moisture percentage in dragon fruit pulp shrikhand (46.52) was obtained from the treatment T_3 followed by T_2 (45.25), T_1 (43.98). The minimum score (42.7) was obtained in T_0 (control). There was significant difference found among the treatments. F Value was 1462.58, indicating significant effect of treatment on moisture percentage (Table 2). The present results were in accordance with Jerish *et al.* (2020) reported that as the percentage of curry leaves extract increases the moisture percentage of shrikhand prepared by using encapsulated curry leaves extract increased.

Total solids

The total solids content of functional shrikhand prepared by using different levels of betel vine leaves extract had found significant effect on the total solids content of shrikhand and it was observed that added betel vine leaves extract for preparation of shrikhand decreased the total solids content in shrikhand. The total solids content was higher in T_1 (58.43%) and lowest total solids content in shrikhand was observed in T_5 (54.52%) as shrikhand prepared from addition of 8 per cent betel vine leaves extract (Table 2). These differences might be due to less total solids content of betel vine leaves extract. Chorage *et al*. (2018) prepared probiotic shrikhand using yoghurt culture with incorporation of ginger. It was noted that the total solids contents of shrikhand decreased with an increase in the level of ginger juice.

Solids Not Fat

The average solids not fat content in the shrikhand was significantly affected due to addition of betel vine leaves extract. The solids not fat content in treatment (T_1) was highest (50.18%) among all the treatments. The lowest solids not fat content (46.72) was observed in shrikhand blended with 8 % betel vine leaf extract (T_5). Shambharkar *et al*. (2011) prepared shrikhand from cow milk, chakka and by added sapota pulp i.e. 5 % (T_1), 10 % (T_2), 15 % (T_3) and 20 % (T_4). Fat content of shrikhand in T_1 (8.05 %) was showed highest among all the treatments. Total solids content of shrikhand was highest in T_1 (65.67 %) and lowest in T_5 (54.31 %) (Table 2).

Ash

Addition of betel vine leaves extract in preparation of shrikhand significantly affected the ash content of shrikhand. The mean ash content in shrikhand under treatments T_1, T_2, T_3, T_4 and T_5 were 0.91, 0.95, 1.96, 1.99 and 1.01 %, respectively. David (2015) studied that the highest mean value for ash percentage in herbal shrikhand prepared with basil extract was obtained from the treatment T_4 (0.84), followed by T_3 (0.82), T_2 (0.78) and T_1 (0.74). The minimum score (0.72) was obtained in T_0 (control) sample (Table 2).

Titratable acidity

The average titratable acidity content of shrikhand were 1.20, 1.19, 1.16, 1.15 and 1.14 in treatments T_1, T_2, T_3, T_4, T_5, respectively. The titratable acidity content was higher in treatment T_1 i.e. 1.20 %, shrikhand prepared from cow milk with addition of 0 % betel vine leaves extract. Lowest titratable acidity content in shrikhand was observed in treatment T_5 (1.14 %) i.e. shrikhand prepared from cow milk with 8 % betel vine leaves extract (Table 2). Sontakke (2022) prepared shrikhand blended with mint leaf extract on physico chemical attributes of shrikhand. It was found that as the level of mint leaf extract in shrikhand increased, there was significant decrease in the acidity of the shrikhand. Dubey *et al.* (2018) reported that effect of moringa powder on quality of shrikhand. The highest mean of acidity percentage was recorded in experiment shrikhand sample of T_0 (1.16) followed by T_1 (1.12), T_2 (0.99), T_3 (0.92). The differences in these values of acidity per cent was significant.

pH

The pH of shrikhand prepared by using different levels of betel vine leaves extract was ranged from 4.60 to 4.74. The mean pH of shrikhand for treatments T_1, T_2, T_3, T_4, and T5 were 4.60, 4.63, 4.65, 4.69 and 4.74 respectively. The maximum pH was observed with the treatment T_5 (4.74) shrikhand and minimum for the treatment T_1 (4.60). The difference in pH of shrikhand was significant with the different levels of betel vine leaves extract (Table 2). These results of the present study were in line with the findings of Kumar *et al.* (2019) prepared shrikhand with incorporation of lactulose and litchi pulp on physico chemical and microbial attributes of shrikhand. It was found that as the level of lactulose and litchi pulp in shrikhand increased, there was significant increase in the pH value of the shrikhand.

Table No. 2: Mean values Fat, Protein, Moisture, Total Solids, Solids not fat, Ash, Acidity and pH

Treatments (% betel vine leaves extract)	Fat (%)	Protein (%)	Moisture (%)	Total Solids (%)	Solids not fat (%)	Ash (%)	Acidity (%)	pH
T_1	8.25	9.01	41.56	58.43	50.18	0.90	1.20	4.60
T_2	8.19	8.93	42.43	57.59	49.39	0.95	1.18	4.64
T_3	8.02	8.88	42.83	56.19	48.16	0.97	1.16	4.67
T_4	7.94	8.82	43.54	55.76	47.81	0.99	1.15	4.69
T_5	7.87	8.76	43.72	54.52	46.72	1.02	1.14	4.71
'F' test	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
SE (m)±	0.011	0.016	0.110	0.069	0.066	0.006	0.008	0.007
CD at 5 %	0.033	0.049	0.334	0.209	0.200	0.018	0.023	0.022

Cost of production of shrikhand

Cost of production of shrikhand (per kg) for treatment T_1, T_2, T_3, T_4 and T_5 were Rs. 182.10, 180.52, 179.73, 178.94 and 178.15 respectively. The shrikhand prepared from cow milk chakka blended with betel vine leaves extract proportionally decreased the cost of production. The cost of production of without addition of betel vine leaves extract shrikhand T_1 (control) was considered to be highest than the shrikhand blended with betel vine leaf leaves extract. Increased level of betel vine leaves extract showed slight decreased in cost of production of shrikhand. However, the best treatment selected by judges was T_4 (addition of 6.0 per cent betel vine leaves extract) and the cost of production of shrikhand of this treatment was found Rs. 280.34 kg^{-1}.

Table No. 3: Cost of Production of Shrikhand

Sr.	Particulars	Treatments

No.		T_1		T_2		T_3		T_4	T_5		
		Qty.	**Amt. (Rs)**	**Qty.**	**Amt. (Rs)**	**Qty.**	**Amt. (Rs)**	**Qty.**	**Amt. (Rs)**	**Qty.**	**Amt. (Rs)**
1.	Quantity of cow milk used in (ml)	1000	50.00	998	49.00	986	48.50	984	48.00	982	47.50
2.	Preparation of shrikhand										
	A) Chakka used	200	50.00	198	49.00	196	48.50	194	48.00	192	47.50
	B) Betel vine leaves extract (gm) Rs. 3 per leaves	-	-	2	6.00	4	12.00	6	18.00	8	24.00
	C) Sugar@45% (by weight of chakka) Rs 40/kg	180	7.20	180	7.20	180	7.20	180	7.20	180	7.20
	D) Cost of shrikhand (Total = A+B+C)	380	57.20	380	62.20	380	67.70	380	73.20	380	78.70
	E) Miscellaneous cost (Rs) Electricity charges Rs. 5/Unit, Labour charges Rs. 100/4 hr, Gas Rs. 3.33		33.33		33.33		33.33		33.33		33.33
3.	Total cost of production for preparation of shrikhand (gm)**(D+E)**	380	90.53	380	95.53	380	101.03	380	106.53	380	112.03
4.	Cost of production for preparation of shrikhand / kg.	1.00	238.23	1.00	251.39	1.00	265.86	1.00	280.34	1.00	294.81

Conclusion

According to results of present investigation following conclusions are drawn. It was concluded from the present investigation that, in respect to physico - chemical composition of shrikhand *i.e.* fat, protein, total solids, solids not fat and titratable acidity were decreased with increases in the levels of betel vine leaves extract, while moisture, ash and pH were increased with increases in the level of betel vine leaves extract in shrikhand preparation. The most acceptable shrikhand could be prepared by blending 6.0 % betel vine leaves extract. Which could give positive nutritional and health benefits to the all type of society members. The cost of most acceptable shrikhand prepared with 6.0 % betel vine leaves extract (T_4) was Rs. 280.34 kg^{-1} of shrikhand, was economic and could be suitable for marketing.

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