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Effect of addition of strawberry (*Fragaria ananassa*) pulp on physicochemical properties and production cost of *Burfi*

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Abstract

The study was conducted on the topic “Studies on Preparation of *Burfi* by Using Strawberry (*Fragaria ananassa*) Pulp”. The *burfi* was prepared by blending strawberry pulp at 3, 6 and 9 percent levels and was analysed for its Physicochemical Properties and cost of production. The physico-chemical composition of *burfi* blended with strawberry pulp at 3, 6 and 9 percent levels (T_2 , T_3 and T_4) showed significantly increased moisture content (17.66, 19.14 and 20.75 percent) and ash content (2.85, 2.94 and 2.99 percent) as compared to control T_1 (16.53 and 2.80 percent, respectively). However, significantly decreased fat content (20.40, 19.79 and 19.18 percent), protein content (14.79, 14.41 and 14.00 percent) and total solids content (82.35, 80.86 and 79.26 percent) were observed in T_2 , T_3 and T_4 as compared to control T_1 (21.00, 15.42 and 83.47 percent, respectively). The cost of production of *burfi* blended with 3, 6 and 9 percent strawberry pulp was Rs. 334.77, 332.92 and 331.08 per kg, respectively, which was lower than the control T_1 (Rs. 336.62 per kg). Thus, incorporation of strawberry pulp, particularly at 6 percent level, improved the sensory quality of *burfi* while reducing the cost of production.

Keywords: Strawberry pulp, *burfi*, physicochemical, cost of production

Introduction

India has been the world's largest milk producer since 1998 and contributes about 25.00 percent of the global milk production. Milk production in the country has increased over the last decade, i.e., from 146.30 million tonnes in 2014-15 to 247.87 million tonnes in 2024-25. Milk production witnessed an annual growth rate of 3.58 percent in 2024-25, and the per capita availability of milk was estimated to be 485 g per person per day as against the global average of around 350 g. (Department of Animal Husbandry and Dairying, 2025) [3].

Burfi is one of the important traditional Indian milk sweets prepared mainly from khoa and sugar. It is widely consumed because of its characteristic flavour, rich taste and desirable body and texture. The development of fruit-based milk sweets provides an opportunity to diversify traditional dairy products and improve their sensory appeal. (Aggarwal *et al.* 2018) [2].

Strawberry (*Fragaria ananassa*) is an attractive fruit possessing characteristic colour, flavour and aroma. Its incorporation into dairy products can provide desirable sensory characteristics and increase the variety of value-added dairy products. However, the level of fruit pulp incorporated into a khoa-based product is important because excessive pulp may increase moisture and adversely influence body, texture and storage stability.

The dairy sector is vital to India's nutritional security, rural employment, and the livelihoods of millions of farming families. Milk is considered a near-complete food as it provides high-quality proteins, fat, lactose, vitamins, and minerals essential for growth, bone health, and overall well-being. The dairy industry also contributes significantly to the rural economy and supports women's participation in dairy farming and allied activities. Among various value-added dairy products, *burfi* is a popular traditional Indian milk-based confectionery with high consumer acceptability. Incorporation of fruit pulp, particularly strawberry pulp, can enhance the colour, flavour, aroma, and overall acceptability of *burfi* while providing scope for product diversification and value addition. Hence, determining the appropriate level of strawberry pulp is important to obtain desirable sensory quality along with an economical cost of production (Press Information Bureau, 2025) [11].

Material and Methods

The present research was conducted during 2025-2026 in the Department of Animal Husbandry and Dairy Science, College of Agriculture, Latur. Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani.

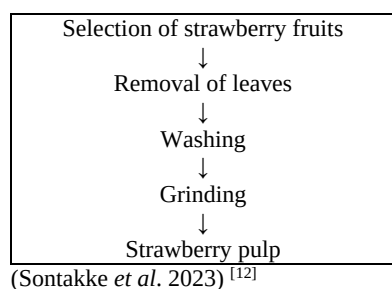
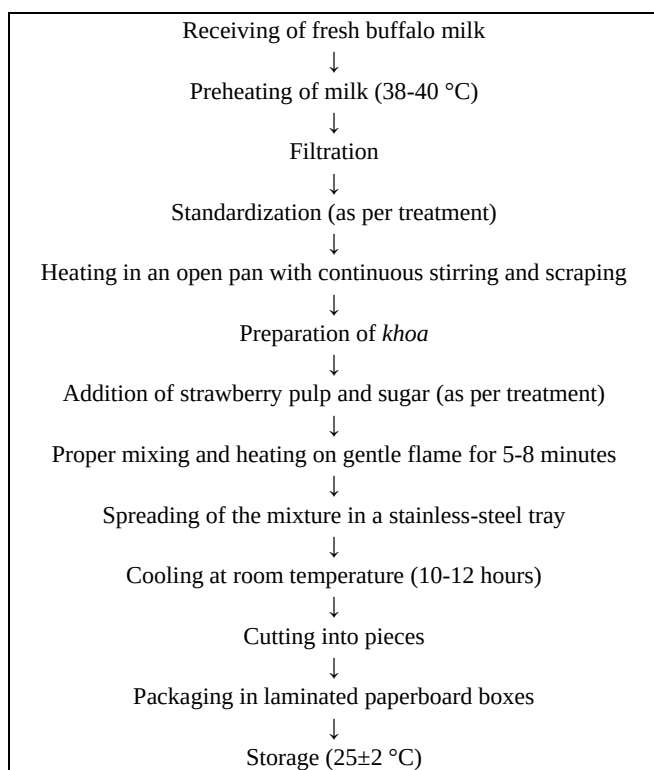


Fig 1: Preparation of strawberry pulp

Fresh strawberries were selected. Leaves were removed and the fruits were washed thoroughly. The cleaned fruits were ground to obtain a uniform strawberry pulp.

Preparation of Strawberry (*Fragaria ananassa*) Burfi



(Kuchi *et al.* 2017)^[9]

Fig. 2: Flow diagram for preparation of strawberry pulp burfi

Methods

Treatment combinations

Burfi was prepared by incorporating different levels of strawberry pulp with khoa as follows:

- T₁-100 parts khoa by weight (Control)
- T₂-97 parts khoa + 3 parts strawberry pulp
- T₃-94 parts khoa + 6 parts strawberry pulp
- T₄-91 parts khoa + 9 parts strawberry pulp

Burfi blended with strawberry pulp was prepared using 30 percent sugar by weight of khoa for control and 30 percent by weight of khoa and strawberry pulp as per treatment

1. Physico-Chemical Analysis

The prepared burfi samples were evaluated for selected physico-chemical parameters, including moisture, fat, total solids, ash and protein content. Moisture content was determined according to the method described by Anonymous (1959)^[11]. Fat content was estimated as per IS: SP 1224 (Part II) (1977), while total solids were determined following IS 1479 (Part II) (1961). Ash content was estimated according to IS: SP (Part XI) (1981), and protein content was determined using the Lowry method (1951)^[10]. The results obtained for the different treatments were recorded and compared to assess the effect of strawberry pulp incorporation on the physico-chemical characteristics of burfi.

2. Cost of Production

The cost of the finished product was calculated based on the prevailing market prices of milk, strawberry pulp, and sugar. The cost of fuel and other miscellaneous expenses was also included in order to determine the total cost of production.

Results and Discussion

Physiochemical composition of finished product

Moisture content of burfi blended with strawberry pulp

Table 1: Moisture content of burfi blended with strawberry pulp (percent)

Treatment	Replication				Mean
	R ₁	R ₂	R ₃	R ₄	
T ₁	16.57	16.52	16.58	16.45	16.53 ^d
T ₂	17.83	17.19	17.76	17.84	17.66 ^c
T ₃	18.97	19.05	19.17	19.36	19.14 ^b
T ₄	20.79	20.69	20.63	20.87	20.76 ^a
S.E.±0.094 C.D at 5% 0.289					

The value with different superscripts differ significantly ($p < 0.05$)

The mean value of moisture content for control (T₁) and burfi blended with strawberry pulp (T₂, T₃ and T₄) were 16.53, 17.66, 19.14 and 20.76 percent, respectively. The percent moisture content of the control (T₁) sample was (16.53 percent) lower and differ significantly from all treatments. Among the treatment, the percent moisture content of T₄ was (20.76) higher than all other treatments and differ significantly from each other. The results of the present study are in agreement with the finding of Thikare *et al.* (2020)^[13], who observed that incorporation of strawberry pulp at 5, 10, 15 and 20 percent levels in kalakand increased moisture content from 26.49 to 31.47 percent significantly. Similar findings were also reported by Kamble *et al.* (2010)^[8], who observed an increase in moisture content from 16.85 to 19.26 percent with incorporation of pineapple pulp at 5, 10, 15, 20 and 25 percent levels in burfi.

Fat content of burfi blended with strawberry pulp

Table 2: Fat content of burfi blended with strawberry pulp (percent)

Treatment	Replication				Mean
	R ₁	R ₂	R ₃	R ₄	
T ₁	21.08	20.95	21.02	20.95	21.00 ^a
T ₂	20.45	20.32	20.48	20.35	20.40 ^b
T ₃	19.82	19.75	19.88	19.71	19.79 ^c
T ₄	19.22	19.15	19.28	19.07	19.18 ^d
S.E.±0.039 C.D at 5% 0.119					

The value with different superscripts differ significantly ($p < 0.05$)

The mean fat content of the control (T_1) and *burfi* blended with strawberry pulp at different levels T_2 , T_3 , and T_4 was 21.00, 20.40, 19.79 and 19.18 percent, respectively. The fat percent content of control (T_1) sample was highest (21.00) and differ significant from all treatment T_2 , T_3 and T_4 . Among the treatment percent fat content of T_2 was (20.40) higher than all other treatment decreases significantly toward higher level of addition of strawberry pulp. The above result are in agreement with the finding of Thikare *et al.* (2020) [13], who observed that incorporation of strawberry pulp at 5, 10, 15, and 20 percent levels in kalakand significantly decreased fat content from 21.14 percent in control to 17.14 percent with increasing levels of strawberry pulp. Similar results were also reported by Deshmukh *et al.* (2020) [4] in orange pulp blended *khoa burfi*, where increasing the level of orange pulp decreased fat content from 18.92 percent in control (T_1) to 15.15 percent in T_4 , showing a reduction of 3.77 percentage points.

Protein content of *burfi* blended with strawberry pulp

Table 3: Protein content of *burfi* blended with strawberry pulp (percent)

Treatment	Replication				Mean
	R ₁	R ₂	R ₃	R ₄	
T_1	15.24	15.39	15.42	15.65	15.42 ^a
T_2	14.82	14.75	14.85	14.74	14.79 ^b
T_3	14.52	14.35	14.45	14.30	14.41 ^c
T_4	14.13	13.95	14.05	13.86	14.00 ^d
S.E.±0.057 C.D at 5% 0.176					

The value with different superscripts differ significantly ($p < 0.05$)

The mean value of percent protein for control (T_1) and *burfi* blended with strawberry pulp T_2 , T_3 and T_4 were 15.42, 15.79, 14.41 and 14.00 percent, respectively. The percent protein content of control (T_1) sample was (15.42) highest and differ significantly from all treatments. Among the treatment percent protein content of T_2 was (14.79) higher than all treatment and differ significantly. The addition of strawberry pulp decreased percent protein content in all

treatment as compared to control (15.42) and values differ significantly from each other. Thikare *et al.* (2020) [13], who observed a significant decrease in protein content from 16.38 to 13.65 percent in strawberry pulp-incorporated kalakand with increasing levels of pulp from 5 to 20 percent. Similarly, Deshmukh *et al.* (2020) [4] reported a 30 decrease in protein content from 13.90 to 11.84 percent in orange pulp-blended *khoa burfi* with increasing pulp levels of 20, 25 and 30 percent.

Ash content of *burfi* blended with strawberry pulp

Table 4: Ash content of *burfi* blended with strawberry pulp (percent)

Treatment	Replication				Mean
	R ₁	R ₂	R ₃	R ₄	
T_1	2.78	2.82	2.79	2.81	2.80 ^d
T_2	2.85	2.88	2.84	2.84	2.85 ^c
T_3	2.92	2.95	2.91	2.99	2.94 ^b
T_4	3.01	2.97	3.00	2.98	2.99 ^a
S.E.±0.012033 C.D at 5% 0.037077					

The value with different superscripts differ significantly ($p < 0.05$)

The mean value of percent ash content for control (T_1) and *burfi* blended with strawberry pulp T_2 , T_3 and T_4 were 2.80, 2.85, 2.94 and 2.99 percent, respectively. The percent ash content of control (T_1) sample was (2.80) lower and differ significantly from all treatments. Among the treatments percent ash content of T_4 was (2.99) higher than all other treatment and differ significant from each other. The percent of ash in all treatment increase significantly toward higher level of addition of strawberry pulp. The finding of the present study are in agreement with those reported by Thikare *et al.* (2020) [13], who observed a significant increase in ash content from 2.64 to 3.06 percent with increasing levels of strawberry pulp incorporation at 5, 10, 15 and 20 percent in kalakand.

Total solids content of *burfi* blended with strawberry pulp

Table 5: Total solid content of *burfi* blended with strawberry pulp (percent)

Treatment	Replication				Mean
	R ₁	R ₂	R ₃	R ₄	
T_1	83.43	83.48	83.42	83.55	83.47 ^a
T_2	82.17	82.81	82.24	82.16	82.35 ^b
T_3	81.03	80.95	80.83	80.64	80.86 ^c
T_4	79.21	79.31	79.37	79.13	79.26 ^d
S.E.±0.094 C.D at 5% 0.289					

The value with different superscripts differ significantly ($p < 0.05$)

The mean value of total solid content for control (T_1) and *burfi* blended with strawberry pulp T_2 , T_3 , and T_4 was 83.47, 82.35, 80.86 and 79.26 percent, respectively. The total solids content of control (T_1) sample was (83.47) higher and differ significantly from all treatments. Among the treatments percent total solids content of (T_2) was (82.35) higher than all other treatment and differ significantly. The findings of the present investigation are in agreement with those reported by Thikare *et al.* (2020) [13], who observed a

significant decrease in total solids content from 73.51 to 68.53 percent with increasing levels of strawberry pulp incorporation at 5, 10, 15 and 20 percent in kalakand. Similar findings were also reported by Deshmukh *et al.* (2020) [4] in orange pulp-blended *khoa burfi*, where incorporation of orange pulp at 32 20, 25 and 30 percent significantly reduced the total solids content from 85.47 to 76.47 percent.

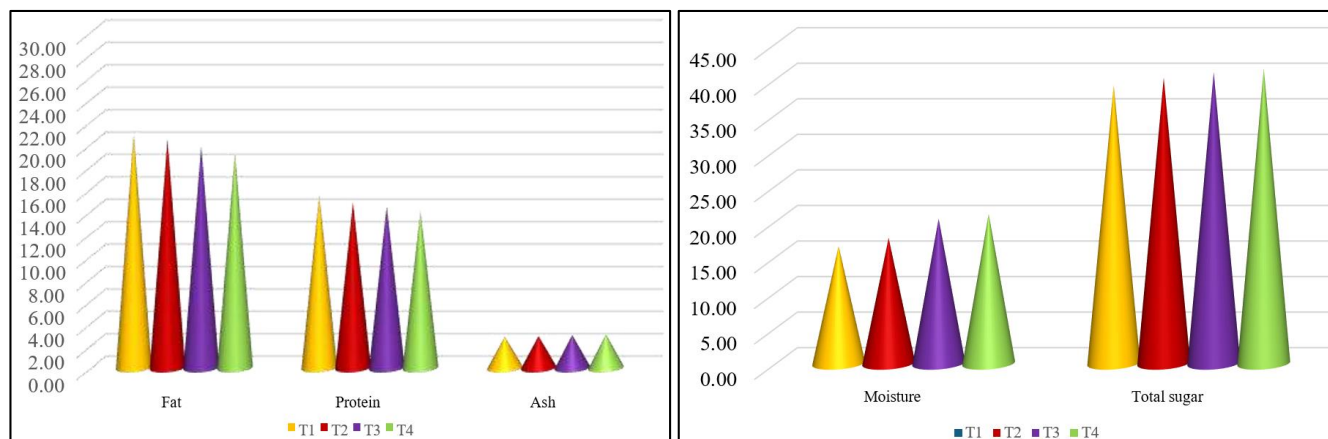


Fig 1: Graphical presentation of the Physicochemical properties of *burfi*

Blended with strawberry pulp Cost of Production

Cost of production of *burfi* blended with strawberry pulp

Sr. No.	Particulars	Cost (Rs/kg)	Treatment combination							
			T ₁		T ₂		T ₃		T ₄	
			Qty (Per gm)	Amt (Rs)	Qty (Per gm)	Amt (Rs)	Qty (Per gm)	Amt (Rs)	Qty (Per gm)	Amt (Rs)
1.	Khoa (gm)	380	1000	380	970	368.6	940	357.2	910	345.8
2.	Strawberry (gm)	300	-	-	30	9	60	18.0	90	27.0
3.	Sugar (gm)	42	300	12.6	300	12.6	300	12.6	300	12.6
4.	Labour Charges	120/8 hrs	-	30	-	30	-	30	-	30
5.	Fuel Charges	-	-	15	-	15	-	15	-	15
6.	Total cost (Rs.)	-	-	437.6	-	435.2	-	432.8	-	430.4
7.	Product Obtained (kg)	-	1.30	-	1.30	-	1.30	-	1.30	-
8.	Cost per 1 kg	-	-	336.6	-	334.7	-	332.9	-	331.0

The cost of production of *burfi* prepared with different levels of strawberry pulp is presented in Table. The variation in cost among the treatments was mainly due to the replacement of *khoa* with strawberry pulp. The cost of *khoa*, strawberry pulp and sugar was Rs. 380, Rs. 300 and Rs. 42 per kg, respectively. Labour and fuel charges were Rs. 30 and Rs. 15 per kg, respectively.

The highest total production cost was recorded in the control treatment (T₁), i.e., Rs. 437.60. With the addition of

strawberry pulp, the total cost gradually decreased and was Rs. 435.20, Rs. 432.80 and Rs. 430.40 in T₂, T₃ and T₄, respectively. The cost of production per kg was Rs. 336.60 in T₁, followed by Rs. 334.70, Rs. 332.90 and Rs. 331.00 in T₂, T₃ and T₄, respectively. The decrease in production cost with increasing levels of strawberry pulp was mainly due to the replacement of higher-cost *khoa* with comparatively lower-cost strawberry pulp.

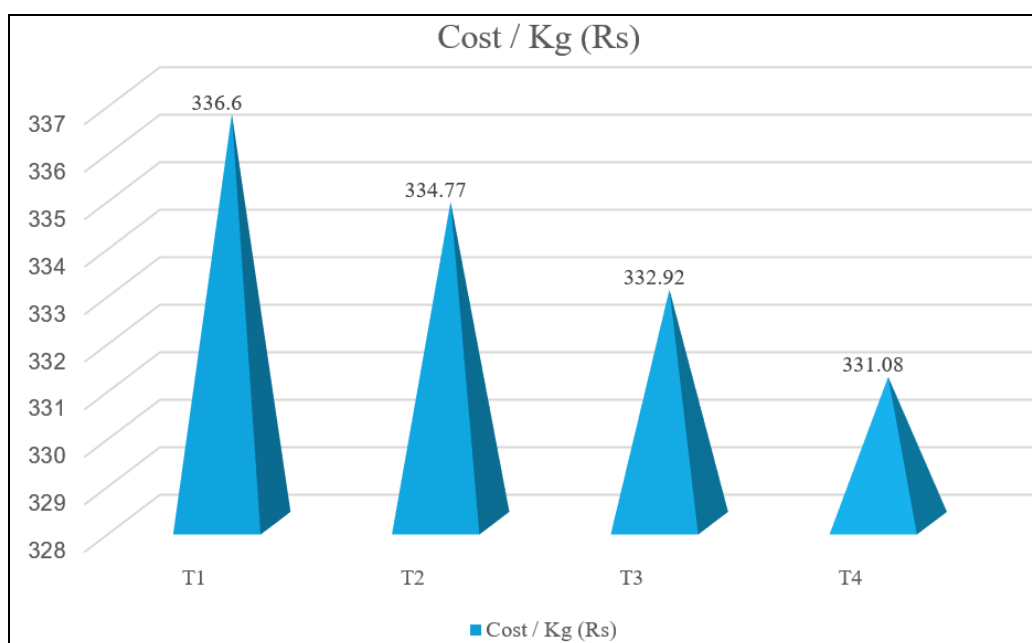


Fig 2: Graphical presentation of cost of production *Burfi* blended with Strawberry pulp

Conclusion

The physicochemical composition of burfi i.e., fat, protein, and total solids percent was significantly decreased while moisture and ash percent significantly increased with increased levels of strawberry pulp.

The production cost of burfi decreased with the increase in the levels of strawberry pulp. The cost of the most acceptable treatment prepared with 6 percent strawberry pulp (T₃) was Rs. 332.90 per kg.

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