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Studies on sensory quality and shelf life of burfi using strawberry (*Fragaria ananassa*) pulp

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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 per cent levels and was analysed for its sensory, and shelf life of burfi production. The colour and appearance scores of burfi blended with 3, 6 and 9 per cent strawberry pulp were 7.33, 8.22 and 8.83, respectively, as compared to 6.60 in control T₁. The flavour scores were 7.75, 8.25 and 8.75 in T₂, T₃ and T₄, respectively, as compared to 7.25 in control T₁. The body and texture scores were 8.00, 9.00 and 6.50 in T₂, T₃ and T₄, respectively, as compared to 7.38 in control T₁. The overall acceptability scores were 8.15, 8.27 and 7.82 in T₂, T₃ and T₄, respectively, as compared to 7.92 in control T₁. Among the treatments, T₃ containing 6 per cent strawberry pulp recorded the highest overall acceptability score (8.27). The shelf life of burfi blended with strawberry pulp showed a gradual increase in standard plate colony count and yeast and mould colony count during storage. The standard plate count increased from 4, 5 and 6 × 10² cfu/g on the 0th day to 148, 185 and 242 × 10² cfu/g on the 7th day in T₂, T₃ and T₄, respectively, whereas T₁ increased from 4 to 115 × 10² cfu/g. The yeast and mould count increased from not -detected on the 0th day to 26, 41 and 63 × 10² cfu/g on the 7th day in T₂, T₃ and T₄, respectively, while T₁ recorded 14 × 10² cfu/g. The coliform count in control T₁ as well as treatments T₂, T₃ and T₄ was zero, indicating that hygienic conditions were maintained during preparation.

Keywords: Strawberry pulp, burfi, sensory quality, Shelf life

Introduction

India has been the world's largest milk producer since 1998 and contributes about 25.00 per cent 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 per cent 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].

Khoa and *khoa*-based products such as burfi, peda, kalakand and milk cake are popular traditional dairy products in India. They are generally prepared by heating milk with continuous stirring and scraping until the desired consistency is obtained. Their characteristic flavour, aroma, texture and appearance make them highly appealing to consumers. However, their short shelf life remains a major limitation (Badola *et al.* 2022).

Strawberry is a nutritious, low-calorie fruit that is rich in vitamins, minerals and bioactive compounds. It is particularly rich in vitamin C and also provides dietary fibre, calcium and potassium. Besides these nutrients, strawberries contain valuable phytochemicals such as anthocyanins, ellagic acid and flavonoids, which are known for their antioxidant and anti-inflammatory properties. Owing to these nutritional and functional benefits, strawberries have good potential for incorporation into value-added dairy products (Ayub *et al.* 2010) [2].

Burfi is a popular traditional *khoa*-based Indian sweet, characterized by a white to light-cream colour, firm body and smooth to granular texture. Sugar is added in varying proportions, along with different ingredients according to consumer preferences. Several varieties of burfi, including plain, pista, nut, chocolate, coconut, santra and besan-rava, are available depending on the ingredients used (Aggarwal *et al.* 2018) [1].

Materials 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.

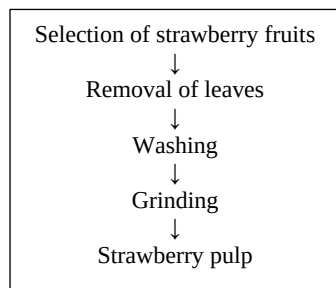


Fig 1: Preparation of strawberry pulp

Sontakke *et al.* 2023^[9] 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

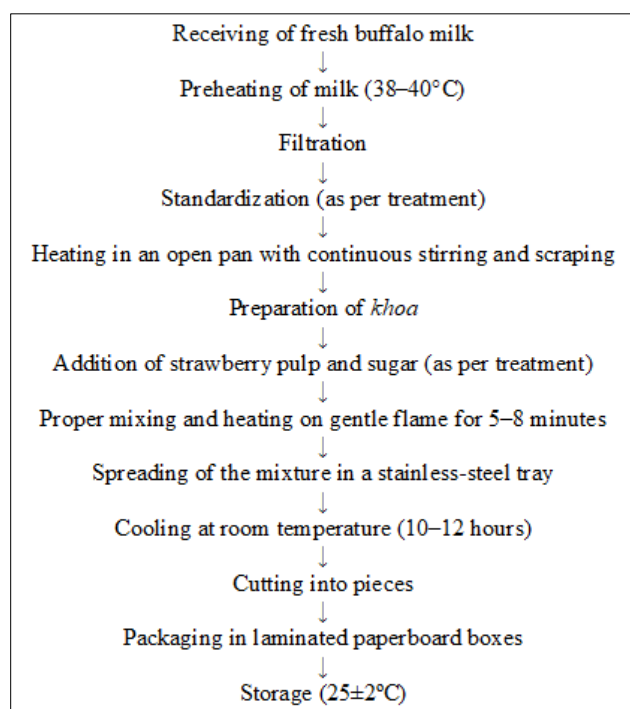


Fig 2: Flow diagram for preparation of strawberry pulp burfi (Kuchi *et al.* 2017)^[5]

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 per cent sugar by weight of khoa for control and 30 per cent by weight of khoa and strawberry pulp as per treatment

Sensory Evaluation

The sensory quality of the control and strawberry pulp incorporated burfi was evaluated by a semi-trained panel of five judges using a 9-point hedonic scale for colour and appearance, taste, body and texture and overall acceptability. A score card was provided to all judges, comparing “9-point hedonic scale” developed by the quarter master food and container institute, U.S.A (Gupta,1976)^[4].

Shelf-Life of Burfi

The strawberry burfi samples were kept at room temperature (25±2° C). The testing was done at four fixed intervals: Day 0 (fresh), Day 3, Day 5, and Day 7.

Results and Discussion

A. Sensory Evaluation

Colour and appearance score of burfi blended with strawberry pulp

Table 1: Colour and appearance score of burfi blended with strawberry pulp

Treatment	Replication				Mean
	R ₁	R ₂	R ₃	R ₄	
T ₁	6.50	6.90	6.00	7.00	6.60 ^d
T ₂	7.50	7.60	7.00	7.20	7.33 ^c
T ₃	8.50	8.11	8.00	8.25	8.22 ^b
T ₄	9.00	9.00	8.80	8.50	8.83 ^a
S.E. ± 0.155, C.D at 5%, 0.478					

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

The mean colour and appearance scores of the control (T₁) and burfi blended with strawberry pulp at different levels T₂, T₃, and T₄ are 6.60, 7.33, 8.22, and 8.83, respectively. Among the treatments, T₄ recorded the highest colour and appearance score (8.83), followed by T₃ (8.22) and T₂ (7.33); however, the differences among the treatments and the control were significant. During heat concentration, burfi slight browning. Since the changes in colour were relatively small, the differences among treatments remained statistically significant. The findings of the present study are in agreement with Thikare *et al.* (2020), who reported an improvement in the colour and appearance scores of strawberry pulp incorporated kalakand with increasing levels of strawberry pulp at 5, 10, 15 and 20 per cent. Similar observations were also reported by Sontakke *et al.* (2023)^[9] who incorporated strawberry pulp at 10, 15, 20 and 25 per cent levels in kulfi, where the treatment containing 15 per cent strawberry pulp recorded the highest colour and appearance score.

Flavour score of burfi blended with strawberry pulp

Table 2: Flavour score of burfi blended with strawberry pulp

Treatment	Replication				Mean
	R ₁	R ₂	R ₃	R ₄	
T ₁	7.00	7.50	7.50	7.00	7.25 ^d
T ₂	7.50	8.00	8.00	7.50	7.75 ^c
T ₃	8.00	8.50	8.50	8.00	8.25 ^b
T ₄	8.50	9.00	9.00	8.50	8.75 ^a
S.E. ± 0.1443 C.D at 5% 0.445					

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

The mean flavour scores of the control (T₁) and burfi blended with strawberry pulp at different levels (T₂, T₃, and T₄) were 7.25, 7.75, 8.25 and 8.75, respectively. The flavour score increased with the addition of strawberry pulp due to its pleasant aroma and natural

sweetness. The findings of the present study are in agreement with Thikare *et al.* (2020), who reported improved flavour scores in strawberry pulp-incorporated kalakand at an optimum level of strawberry pulp incorporation. Similar observations were reported by Sontakke *et al.* (2023) [9] in strawberry pulp-incorporated kulfi, where the treatment containing 15 per cent strawberry pulp received the highest flavour score.

Body and texture score of burfi blended with strawberry pulp

Table 3: Body and texture score of burfi blended with strawberry pulp

Treatment	Replication				Mean
	R ₁	R ₂	R ₃	R ₄	
T ₁	7.50	7.50	7.50	7.00	7.38 ^c
T ₂	8.00	8.00	8.00	8.00	8.00 ^b
T ₃	9.00	9.00	9.00	9.00	9.00 ^a
T ₄	6.50	6.50	6.50	6.50	6.50 ^d
S.E. $\pm$ 0.0625, C.D at 5%, 0.192582					

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

The mean body and texture scores of the control (T₁) and burfi blended with strawberry pulp at different levels (T₂, T₃, and T₄) were 7.38, 8.00, 9.00, and 6.50, respectively. The body and texture score improved with the addition of strawberry pulp due to better blending with *khoa*, which produced a soft, smooth, and uniform burfi. The findings of the present study are in agreement with Thikare *et al.* (2020), who reported improved body and texture score of strawberry pulp-incorporated kalakand with increasing levels of strawberry pulp incorporation at 5, 10, 15 and 20 per cent. Similar observation were reported by Sontakke *et al.* (2023) [9], who incorporated strawberry pulp at 10, 15, 20 and 25 per cent levels in kulfi, where the treatment containing 15 per cent strawberry pulp recorded the highest body and texture score

Overall acceptability score of burfi blended with strawberry pulp

Table 4: Overall acceptability score of burfi blended with strawberry pulp

Treatment	Replication				Mean
	R ₁	R ₂	R ₃	R ₄	
T ₁	7.95	7.89	7.90	7.93	7.92 ^c
T ₂	8.17	8.16	8.09	8.16	8.15 ^b
T ₃	8.29	8.25	8.26	8.28	8.27 ^a
T ₄	7.80	7.77	7.82	7.89	7.82 ^d
S.E. $\pm$ 0.018, C.D at 5%, 0.054634					

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

The mean overall acceptability scores of the control (T₁) and burfi blended with strawberry pulp at different levels (T₂, T₃, and T₄) were 7.92, 8.15, 8.27, and 7.82, respectively.

The higher overall acceptability of treatment T₃ may be attributed to its desirable colour and appearance, pleasant strawberry flavour, smooth body and texture, and balanced sweetness, which together enhanced the sensory quality of the product. At the higher level of strawberry pulp incorporation (T₃), the overall acceptability decreased slightly. The findings of the present study are in agreement with Thikare *et al.* (2020), who reported that the incorporation of strawberry pulp at 5, 10, 15 and 20 per cent levels improved the overall acceptability of kalakand up to the optimum level, after which the score declined. Similar observation were reported by Sontakke *et al.* (2023) [9], who incorporated strawberry pulp at 10, 15, 20 and 25 per cent levels in kulfi, where the treatment containing 15 per cent strawberry pulp recorded the

highest overall acceptability score.

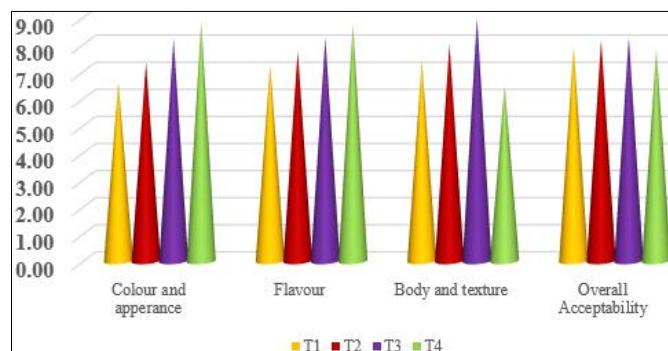


Fig 1: Graphical presentation of sensory properties of burfi blended with strawberry pulp

B. Shelf life of burfi blended with strawberry pulp

Standard plate count of burfi blended with strawberry pulp

Days/ Treatment	Standard plate count			
	0 th day	3 rd day	5 th day	7 th day
T ₁	4	18	56	115
T ₂	4	24	72	148
T ₃	5	31	94	185
T ₄	6	39	110	242

The Standard Plate Count (SPC) of burfi blended with strawberry pulp increased gradually during storage in all treatments. On the 0th day, SPC ranged from 4×10^2 cfu/g in T₁ (control) to 6×10^2 cfu/g in T₄ (9% strawberry pulp). By the 7th day, SPC increased to 115.00×10^2 , 148.00×10^2 , 185.00×10^2 , and 242.00×10^2 cfu/g in T₁, T₂, T₃, and T₄, respectively. The highest SPC was observed in T₄, while the lowest was recorded in T₁ throughout the storage period. This increase may be due to the higher moisture and natural sugars present in strawberry pulp, which promote microbial growth during room temperature storage. These results indicate that increasing the level of strawberry pulp and storage duration led to higher microbial growth, thereby reducing the shelf life of burfi. The results of the present study are similar to Pal *et al.* (2018), who reported that the standard plate count of bottle gourd and carrot burfi ranged from 13 to 17.20×100 CFU/g. Saundane *et al.* (2020) [8] reported a total plate count of 65.5 CFU/g in papaya burfi during 7 days of refrigerated storage.

Yeast and mould count of burfi blended with strawberry pulp

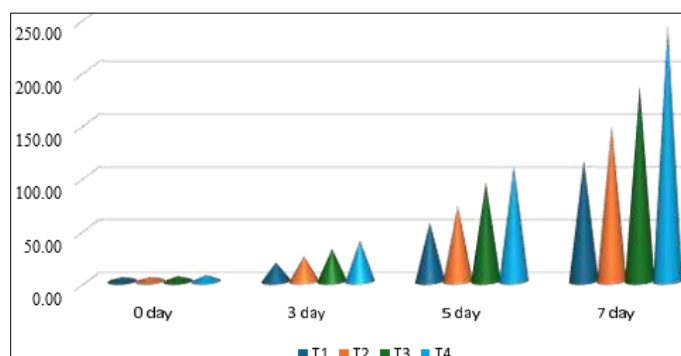
Days/ Treatment	Yeast mould count			
	0 th day	3 rd day	5 th day	7 th day
T ₁	Not -detected	2	6	14
T ₂	Not -detected	3	11	26
T ₃	Not -detected	5	18	41
T ₄	Not -detected	8	27	63

The yeast and mould count (YMC) value of burfi mixed with strawberry pulp is shown in the Table. The YMC progressively rise with the period of storage in all treatments. On day 0, no yeast and mould colonies were detected in any of the treatments. The YMC continuously increased during storage and attained the levels of 14, 26, 41 and 63×10^2 cfu/g in T₁, T₂, T₃ and T₄ i.e., on the 7th day, respectively. T₄ (9% strawberry pulp) maintained the highest YMC throughout the storage while control (T₁) maintained least count among all the treatments. The increase in YMC observed during storage could be due to the growth of

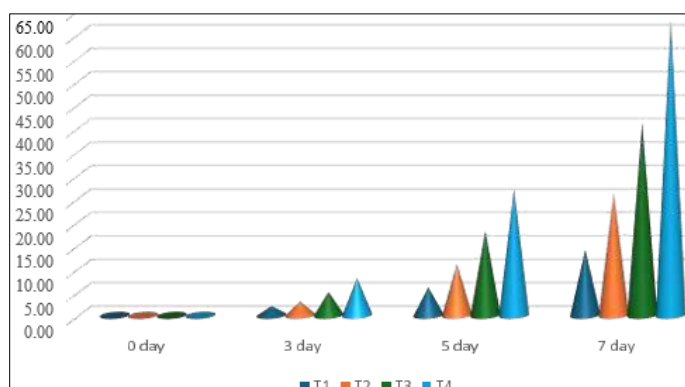
microorganisms at room temperature and high moisture content as well as higher nutrients from the incorporation of strawberry pulp that favored the growth of yeasts and moulds. The increase in yeast and mould count with increasing levels of strawberry pulp incorporation may be attributed to the higher moisture content of strawberry pulp, which favours the growth of yeasts and moulds. The results of the present study are in agreement with Pal *et al.* (2018), who reported that the yeast and mould count in bottle gourd and carrot burfi ranged from 4.20 to 6.80×100 CFU/g.

Coliform count of fresh burfi blended with strawberry pulp

Coliform count in control (T₁) and treatment T₂, T₃ and T₄ was zero. Hygienic condition was maintained during the production of burfi blended with strawberry pulp.



A. Standard plate count of burfi blended with strawberry pulp



B. Yeast and mould count of burfi blended with strawberry pulp

Fig 2: Graphical presentation of microbiological quality of burfi blended with strawberry pulp

Conclusion

The colour and appearance score of burfi blended with strawberry pulp increased significantly across T₂, T₃, and T₄ (7.33, 8.22, and 8.83) compared to control T₁ (6.60). The flavour score increased significantly from T₂ to T₄ (7.75, 8.25, and 8.75) compared to T₁ (7.25) due to the pleasant natural aroma of the fruit. The body and texture score improved significantly in T₂ (8.00) and peaked at T₃ (9.00) before declining slightly in T₄ (6.50) compared to control T₁ (7.38). Overall acceptability scores followed a similar significant trend, peaking at T₃ (8.15) over T₂ (8.27) and T₄ (7.82) compared to control T₁ (7.92), making T₃ the most preferred formulation.

The shelf life of burfi blended with strawberry pulp showed a gradual increase in standard plate count and yeast and mould count during storage. By the 7th day, the standard plate count for T₂, T₃, and T₄ increased to (148.00×10^2) , (185.00×10^2) , and (242.00×10^2) cfu/g, respectively, compared to control T₁ (115.00×10^2) cfu/g. Similarly, the yeast and mould count reached $(26 \times$

$10^2)$, (41×10^2) , and (63×10^2) cfu/g in T₂, T₃, and T₄, respectively, compared to T₁ (14×10^2 cfu/g). Coliform count in the control as well as all treatments was zero, indicating safe and highly hygienic conditions during the entire production process.

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