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Effect of different levels of strawberry pulp (*Fragaria ananassa*) on sensory quality and cost of production of Kalakand

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Abstract
The present investigation was conducted at Department of Animal Husbandry and Dairy Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola with a view to evaluate the sensory quality and to estimate the cost of strawberry Kalakand during the year 2019-2020. Present investigation was carried out with five treatments and four replications. The treatment details were T_1 control (70 part of cow milk khoa +30 part of sugar), T_2 (65 part of cow milk khoa + 5 part of strawberry pulp +30 part of sugar), T_3 (60 part of cow milk khoa + 10 part of strawberry pulp +30 part of sugar), T_4 (55 part of cow milk khoa + 15 part of strawberry pulp +30 part of sugar), and T_5 (50 part of cow milk khoa + 20part of strawberry pulp +30 part of sugar). The kalakand prepared from combination of 55 per cent cow milk khoa and 15 per cent strawberry pulp (T_4) scored significantly highest scores for flavour, body and texture, colour and appearance and overall acceptability which were found superior amongst all the treatments. The cost of production per kg of strawberry kalakand was slightly decreased with increase in rate of addition of strawberry pulp i.e. Rs. 289.77 (T_1), Rs. 277.25 (T_2), Rs. 266.31 (T_3), Rs. 256.66 (T_4) and Rs. 248.10 (T_5).

Keywords: Cow milk khoa**,** Strawberry pulp, Blending, Kalakand, Sensory evaluation, Cost of production.

Introduction
Kalakand is partially desiccated milk product with caramelized flavour and granular texture prepared from acidified milk (David, 2009) [2]. Fortification of different milk products with fruit juice or pulp has been show to improve their acceptability to a considerable extent (Dhanwade *et al*. 2006). Incorporation of fruit product in the milk products to render good flavour, increasing palatability and nutritive value is a very old practice. Strawberry (*Fragaria ananasa*) fruit is one of the most commonly consumed berries both in fresh and processed forms. It is a rich source of a wide variety of nutritive compounds such as sugars, vitamins and minerals, as well as bioactive compounds such as ascorbic acid, carotenoids, phenolic compounds and folates, most of which are natural antioxidants and contribute to the high nutritional quality of the fruit (Tulipani *et al*., 2011; Giampieri *et al*., 2015). Considering the value addition aspects present investigation was planned and under taken with the main objective to standardize the level of strawberry pulp in kalakand and work out the cost structure of strawberry kalakand.

Material and Methods
Whole, fresh, clean cow milk was collected from Livestock instructional Farm, Department of Animal Husbandry and Dairy Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. Fresh ripen strawberry (*Fragaria ananassa*) were purchased from local market in Akola city. Citric acid was used as coagulant for preparation of Kalakand. Clean crystalline sugar purchased from local market was used as an ingredient of kalakand as sweetening and thickening agent. For preparation of Kalakand from fresh cow milk standard method described by De (2015) [1] was followed with slight modification. Looking to diversified benefits of strawberry and nutritional quality value of cow milk, strawberry pulp kalakand was prepared from cow milk khoa with various treatment combinations. The treatment details were T_1 (70 part of cow milk khoa +30 part of sugar), T_2 (65 part of cow milk khoa + 5 part of strawberry pulp +30 part of sugar), T_3 (60 part of cow milk khoa + 10 part of strawberry pulp +30 part of sugar), T_4 (55part of cow milk khoa + 15 part of strawberry pulp +30 part of sugar), T_5 (50 part of cow milk khoa + 20 part of strawberry pulp +30 part of sugar) with five replications.

Sensory evaluation of strawberry kalakand: Sensory evaluation was performed by 9 point numeric score card as prescribed by Pal and Gupta (1985) [9].

Cost of production: Cost of production of kalakand was calculated by considering the prevailing rates of raw material, labour charges, gas, electricity and other miscellaneous charges, etc.

Statistical analysis: The experiment data obtained was statistically analyzed by CRD (Completely Randomized Design) as prescribed by Gomez K. A. and A. A. Gomez 1984.

Results and Discussion

Sensory evaluation of strawberry pulp blended Kalakand

In order to evaluate a good quality kalakand the panel of judges was selected and product was judged with the help of 9 point hedonic scale score cards and data generated were statistically processed and the results obtained are presented in the Table 1.

Colour and appearance of kalakand

Results from table 1, indicates that increase the level of strawberry pulp resulted in better colour and appearance of kalakand up to a certain limit and thereafter it decreases proportionately. This results are in agreement with the results reported by Nager *et al*. (2017) observed that Standardization of papaya enriched kalakand and he was reported that increased papaya pulp level beyond the limit for blending the maximum and minimum score for colour respectively. Manohar *et al.* (2018) [7] reported that the colour and appearance score for kalakand prepared buffalo milk blended with papaya pulp and observed that the score of colour and appearance was decreased by increase in the level of papaya pulp in papaya pulp kalakand

Table 1: Effect of different levels of strawberry pulp on sensory quality of Kalakand

Treatments (Part of Cow milk khoa: Straberry pulp: Sugar)	Mean values of scores obtained for five replications (* $P < 0.05$)			
	Colour and Appearance	Flavour	Body and texture	Overall acceptability
T_1(70:00:30)	8.40	8.50	8.42	8.60
T_2(65:05:30)	7.57	7.45	7.50	7.50
T_3(60:10:30)	8.12	8.10	8.12	8.12
T_4(55:15:30)	8.75	8.75	8.87	8.72
T_5(50:20:30)	8.12	8.12	7.92	8.01
'F' test	Sig.	Sig	Sig	Sig
SE (m) +/-	0.115	0.101	0.173	0.062
CD at 5%	0.350	0.308	0.525	0.189

Flavour of kalakand

Kalakand blended with 15 percent strawberry pulp T_4 recorded the highest score (8.75 out of 9) in respect of flavour for the treatment T_2 lowest score (7.45 out of 9). The result indicates that the kalakand prepared with 15 per cent strawberry pulp was superior over 0, 5, 10, 20, per cent levels. The observation of present investigation was in agreement with Shalini *et al.* (2015) reported that flavour score during utilization of papaya pulp in kalakand preparation increases papaya pulp level blended in buffalo milk khoa upto 15%, then after same was decreases beyond optimum level. Manohar *et al.* (2018) [7] reported that, the flavour score for kalakand prepared from buffalo milk blended with papaya pulp and observed that maximum and minimum score for flavour was recorded in treatment T_2 (8.8) and T_4 (7.6) respectively.

Body and texture of kalakand

It is observed from the table 1 that the body and texture score of kalakand was significantly affected due to addition of different level of pulp. The significantly highest score (8.87 out of 9) was obtained by kalakand prepared with 15 per cent (T_4) strawberry pulp while lowest score (7.50) obtained by plain kalakand (T_1). Sawant *et al.* (2007) [10] observed utilization of mango pulp for kalakand preparation and he has reported that increase in the level of mango pulp beyond the limit of 15% for blending in buffalo milk decreases the body and texture score. Patel and Roy (2015) observed that the body and texture score of papaya pulp kalakand ranged between 8.75 to 8.36 in 9 point hedonic scale, while Nager *et al.* (2017) observed that standardization of papaya enriched kalakand and reported that increase papaya pulp level beyond the limit for blending the maximum and minimum score for body & texture was recorded in treatment T_6 (7.97) and T_9 (6.07) respectively. .

Overall acceptability of kalakand

Result indicated that increase in the level of strawberry pulp resulted in better overall acceptability score of kalakand up to a certain limit and there after it decreases proportionately. It was revealed from above finding that 15 percent strawberry pulp blended kalakand recorded maximum score of overall acceptability with regard to flavour, body and texture, colour and appearance. The above results are in agreement with the results reported by following research workers. Nagar *et al.* (2017) reported that, the overall acceptability score was varied significantly. The overall acceptability score was highest in treatment T_6 (8.03) and the lowest value recorded in treatment T_9 (6.47). Kumar *et al.* (2017) [17] reported that, the overall acceptability score was highest in treatment T_3 (8.48) containing wood apple kalakand prepared by addition of 15 parts of wood apple pulp and 85 parts of khoa by weight basis with addition of 30 per cent sugar.

Cost of production: Data pertained to the cost of production of kalakand prepared from buffalo milk blended with different level of strawberry pulp is tabulated in Table 2.

From table 2 it was observed that the preparation of kalakand from cow milk blended with strawberry pulp, the cost was per kg kalakand decreased with increases level of strawberry pulp. On the basis of sensory evaluation, good quality kalakand was prepared from 55 percent cow milk khoa, 30 percent sugar and 15 per cent strawberry pulp having cost per kg Rs. 256.66. This results are in agreement with the results reported by Sawant *et al.* (2006) [11] who observed that, the cost of production of kalakand was the highest at Rs 81.13 per

kg in case of T_0, however the treatment C_1S_1, (10% sapota pulp and 6% sugar) amounted to the value of Rs. 78.34 kg. The major portion of attributed to the cost in all the combine action may be attributed to the cost of milk. There was a considerable decreased in cost of the product with the addition of sapota fruit pulp.

Table 2: Effect of different levels of Strawberry pulp on Production cost of *Kalakand* (Rs)

S. No.	Particular	T_1	T_2	T_3	T_4	T_5
1. Ingredients used						
a.	Cow milk (Lit.)	1	1	1	1	1
b.	Sugar (gm)	54	54	54	54	54
c.	Strawberry pulp (gm)	00	09	18	27	36
2. Cost						
a.	Cow milk @ Rs/Lit	40	40	40	40	40
b.	Sugar @ Rs 40/kg	2.16	2.16	2.16	2.16	2.16
c.	Strawberry pulp @ Rs 15/100 gm	00	1.35	2.70	4.05	5.40
3.	Cost of processing (i.e. utensil, handling, labour, etc)	10	10	10	10	10
4.	Total cost of production of kalakand (Rs)	52.16	53.51	54.86	56.21	57.56
5.	Quantity of kalakand obtained (gm)	180	193	206	219	232
6.	Cost of production of 1 kg kalakand (Rs)	289.77	277.25	266.31	256.66	248.10

Conclusion

The strawberry kalakand prepared from 55 per cent cow milk khoa, 30 per cent sugar and 15 per cent strawberry pulp (T_4) was most acceptable and recorded highest score 8.72 for overall acceptability. For cost of production of kalakand /Kg decreasing trend was found due to increase in rate of addition of strawberry pulp. Most acceptable level (T_4) i.e.15% strawberry pulp, 55% cow milk khoa and 30% sugar has cost of production Rs.256.66/Kg of kalakand.

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