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Standardization of papaya (*Carica papaya* L.) enriched *kalakand* and estimation of its cost of production

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Abstract

The study was made with attempts to develop *kalakand* blended with papaya pulp and sugar level in different concentrations by using whole milk. The basic aim of study was to find out the sensory parameter of *kalakand* prepared by addition of different levels of papaya pulp and sugar. There 9 samples of *kalakand* were analyzed for sensory attributes (color & appearance, flavor, body & texture, and overall acceptability). The results show that the experimental sample of *kalakand* treatment T₆ blended with 15% of papaya pulp and 10% sugar was found superior in all sensory parameters among the all treatments. It was also revealed that the optimized *kalakand* gives more profit than the control sample

Keywords: *Kalakand*, sensory evaluation, cost analysis

Introduction

The dairy industry in India has taken rapid strides during the last two decades. Today, India is the world's largest milk producer and also the biggest consumer of fluid milk but the situation is changing fast. India's milk production in 2014-15 is expected to be about 146.3 MT and per capita available milk is 322gm/day (NDDB).

140 million tones and there is a growing demand for safe, nutritious, health promoting convenience milk products.

Traditional milk products play an important role in the economic, social, religious and nutritional well-being of the Indian masses. About half of India's total milk production is utilized in the preparation of different traditional dairy products.

The increased availability of milk during the flush season coupled with inadequate facilities to keep liquid milk fresh during transit from rural production areas to urban market has led to the conversion of milk into traditional milk products. In addition manufacture of this traditional dairy product help in preservation of milk solids for longer time at room temperature and also creates employment opportunity. These sweets are specially served on various occasions such as weddings, festivals and celebrations. Traditional milk products in India have great commercial importance as they account for over 90 % of all the milk products consumed in the country (Aneja *et al.* 2002) [2].

Among the indigenous milk products, *kalakand* occupies an important place and found to be attractive product amongst all the classes of consumers. *Kalakand* is partially desiccated milk product with caramelized flavor and granular texture prepared from acidified milk (David, 2009) [3]. The granular mass is fused and held together in loosely compact body. The color of *kalakand* varies from off-white to light caramel color. Being a whole milk concentrate, *kalakand* is a good source of protein, mineral, energy giving fat and lactose. It is 4-6 times more nutritious in terms of per unit weight and calorific value.

The association of fruits with dairy products has endorsed health perception in consumer's mind as consumers connect both these foods with health and wellness. Papaya (*Carica papaya* L.) is the fifth most important crop in India, which is cultivated to 106 thousand ha of land and production of 4196 thousand MT with average productivity of 39.6 MT/ha in 2010-11 (Indian Horticulture Database, 2011) [7]. The fruits are excellent source of vitamin A (2020 IU/100g), thiamine, riboflavin, nicotinic acid and ascorbic acid. Papaya (100g) contains 9 per cent of the dietary reference intake for Cu, 6-8 per cent for Mg, but less than 3 per cent of the dietary reference intake for other minerals (Wall, 2006) [12]. Papaya also contains several unique protein- digesting proteolytic enzymes including papain and chymopapain which protects you

by digesting and destroying the defense shields of different infective microbes and tumor.

The study was made with attempts to develop *kalakand* blended with papaya pulp and sugar in different concentrations by using whole milk.

Treatment details

Kalakand was prepared by using three different levels of papaya pulp and sugar, control treatment i.e. without papaya pulp. The treatment combinations used for the study were

T₀ - 0% papaya pulp + 6% of sugar

T₁ - 10% papaya pulp + 6% of sugar

T₂ - 10% papaya pulp + 8% of sugar

T₃ - 10% papaya pulp + 10% of sugar

T₄ - 15% papaya pulp + 6% of sugar

T₅ - 15% papaya pulp + 8% of sugar

T₆ - 15% papaya pulp + 10% of sugar

T₇ - 20% papaya pulp + 6% of sugar

T₈ - 20% papaya pulp + 8% of sugar

T₉ - 20% papaya pulp + 10% of sugar

Materials and methods

Buffalo milk was obtained from the dairy farm of the Banaras Hindu University and standardized to 6% fat and 9% SNF. Good quality and well developed papaya and sugar were procured from the local market of Varanasi, Uttar Pradesh. Papayas were crushed in small pieces after washing with clean water. Control and experimental *kalakand* were prepared by the method suggested by Aneja *et al.* 2002 [2]. Control *Kalakand* (T₀) was made from buffalo milk (100%) without addition of Papayas whereas experimental samples of *kalakand* were prepared by using Papayas @ 10%, 15% and 20% with different sugar level (6%, 8% and 10%)

Standardized milk was transferred into a vessel and heated with continuous stirring by a wooden scoop in a circular motion to simmering temperature (85–90 °C) with occasional scraping of the heating surface. To aid the granulation after 10–15 min of boiling, 0.02% of citric acid (in the form of solution) was added to milk with spirited stirring to obtain a good quality *kalakand*. When the product reached in semi-solid condition the concentration of heating was reduced and

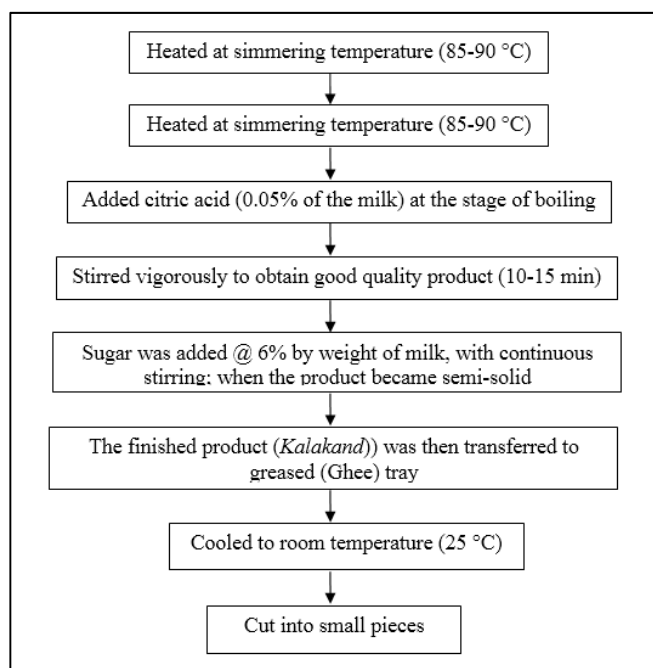


Fig 1: Process diagram for manufacturing the papaya enriched *kalakand*

6% sugar (by weight of milk) was added, with constantly stirring the product. The finished product was transfer to greased plate with ghee for the purpose of cooling and setting at room temperature.

The product was evaluated by conducting sensory evaluation of panel of 5 semi-trained judges using 9 point hedonic scale. The data collected on different aspects were tabulated and analyzed statically using the methods of One-way analysis of variance (ANOVA) and Duncan multiple range test was performed to measure the test of significance by post hoc test using SPSS 16.0 software (SPSS Italia, Bologna, Italy).

Result and Discussion

Sensory evaluation of Papaya pulp enriched *kalakand*

The sensory quality of *kalakand* samples prepared from different levels of papaya pulp and sugar were evaluated by a panel of 5 semi trained judges using 9 points Hedonic scale given by Amerin *et al.*,1965 [1] on the basis of sensory parameters such as color & appearance, flavor, body &

texture, and overall acceptability of papaya pulp enriched *kalakand*.

Table 1: Sensory evaluation of papaya pulp enriched *kalakand* and its yield

Treatment	Colour & Appearance	Flavor	Body and texture	Overall acceptability	Yield
T ₀	7.93 ^{ab}	8 ^{ab}	7.77 ^{ab}	7.97 ^{ab}	24.83 ^d
T ₁	6.4 ^d	6.7 ^e	6.4 ^{cd}	7.1 ^{bcd}	25.33 ^{cd}
T ₂	6.63 ^{cd}	7.27 ^{bcd}	7.1 ^{abc}	7.13 ^{abcd}	25.5 ^{cd}
T ₃	6.83 ^{bcd}	7.33 ^{bcd}	7.17 ^{abc}	7.37 ^{abc}	25.83 ^c
T ₄	7.27 ^{abcd}	7.6 ^{abcd}	7.43 ^{ab}	7.8 ^{ab}	27.37 ^b
T ₅	7.53 ^{abc}	7.8 ^{abc}	7.47 ^{ab}	7.87 ^{ab}	27.63 ^b
T ₆	8.1 ^a	8.2 ^a	7.97 ^a	8.03 ^a	27.87 ^b
T ₇	7.27 ^{abcd}	7.03 ^{cde}	7.03 ^{bc}	7.3 ^{abcd}	29.43 ^a
T ₈	7 ^{abcd}	6.83 ^{de}	6.33 ^{cd}	6.9 ^{cd}	29.6 ^a
T ₉	6.3 ^d	6.5 ^e	6.07 ^d	6.47 ^d	29.87 ^a
CD 5%	0.99	0.79	0.78	0.80	0.87
SE(m)	0.34	0.27	0.26	0.27	0.29

Table 1 Shows that the color & appearance score was the highest in treatment T₆ (8.10) than the lowest score was recorded in treatment T₉ (6.23). The flavor score of prepared *kalakand* was highest in treatment T₆ (8.20) and the lowest in treatment T₉ (6.50). The maximum and minimum score for body & texture was recorded in treatment T₆ (7.97) and T₉ (6.07) respectively. The overall acceptability score was highest in treatment T₆ (8.03) and the lowest value recorded in treatment T₉ (6.47).

It is clear from table 1 that the score obtained by treatment T₆ for sensory parameters as color & appearance, flavor, body & texture and overall acceptability was (8.10, 8.20, 7.97, 8.03 respectively) highest whereas the score obtained by Control sample (T₀) for color & appearance flavor, body & texture and overall acceptability was (7.93, 8, 7.77, 7.97 respectively) very near to the treatment T₆. It is revealed from the above result that the difference in the value obtained by treatment T₆ was Non - Significant ($p < 0.05$) to the value obtained by T₀ (Control) treatment.

From the obtained result, it is revealed that as the levels of papaya pulp and sugar increases, the score for sensory parameters (Color & Appearance, Flavor, Body & Texture and Overall Acceptability) of papaya enriched *kalakand* was also increases up to a certain limit and thereafter it decreases

gradually. The present findings can be supported by Kolhe (2003) [8]; Gargade (2004) [5]; Sawant *et al.* (2007) [9].

Yield of *kalakand*

The yield of *kalakand* was significantly ($p < 0.05$) increased with papaya level, highest yield is recorded in T₉ (29.87%) and lowest among treatment is of T₁ (25.33%) which was higher than control T₀ (24.83%). The differences among the groups were significant ($p < 0.05$) between different treatment. This result may show that increase the level of papaya pulp and sugar may increase the yield of papaya *kalakand*. This was due to higher moisture content (90.33%) in papaya pulp resulting into increase the yield of treatments enriched with papaya pulp as compare to lower moisture in control sample.

Cost of production estimation for papaya pulp enriched *kalakand*

This is major aspect for any product because consumer acceptability depends upon cost of production. There is need of assessment of cost of production of papaya *kalakand* prepared from one liter of milk.

Treatment T₆ were optimized on the basis of sensory evaluation, this treatment content 15 % of papaya pulp and 10 % sugar w/w of milk.

Table 2: Production cost analysis for control and optimized papaya pulp enriched *Kalakand*

S. No.	Item	Kalakand Milk 1 kg Control		Papaya Kalakand Milk 1Kg Optimized product (T ₆)	
		Amount used	Total (Rs)	Rs./Kg	Total (Rs)
1.	Expenditure				
I	Milk @ Rs. 40/Kg	1000 ml	40	850 ml	34
II	Sugar @ Rs.40/kg	60 gm	2.4	100 gm	4
III	Papaya @ Rs. 50/kg	0 gm	0	150 gm	7.5
2.	Operating cost				
I	LPG @ Rs. 1100/ 14.4 kg	75 gm	5.7	75 gm	5.7
II	Citric acid@ 240/ 500 gm	5 gm	2.4	5 gm	2.4
III	Maintenance and Service		5		5
3.	Total production cost (1+2)		55.5		58.6
4.	Yield in gm	240 gm		270 gm	
5.	Market price of <i>kalakand</i>	Rs.320/kg		Rs.320/kg	
6.	Total Income (S. No. 4 x S. No. 5)	76.8		86.4	
7.	Net profit (6 -3)	21.3		27.8	

$$\text{Benefit cost ratio} = \frac{\text{Net profit}}{\text{Total cost}}$$

- Benefit cost ratio of control sample = $\frac{21.3}{55.5} = 0.38$
- Benefit cost ratio of optimized papaya *kalakand* sample = $\frac{27.8}{58.6} = 0.47$

This result may show that value added *kalakand* made with papaya pulp are given more benefits than control (T₀) *kalakand* normally made by milk without added papaya pulp. The total manufacturing cost per kg of sweets decreased very marginally with increase in size of production. Among the treatments share of net profit was highest (47%) from T₆ followed by T₀ (38%). Similar observation was made by Singh and Kalra (2004) [10].

Conclusion

On the basis of above findings it can be concluded that the superior quality of papaya pulp enriched *kalakand* can be prepared by addition of 15% of papaya pulp and 10% of sugar as the overall acceptance for treatment combination T₆ was highest in all sensory parameters. It is also concluded that the value added *kalakand* enriched with papaya pulp give more profit than the control or normally made *kalakand*.

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