Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; Sp 9(5): 544-546
Received: 10-09-2020
Accepted: 13-10-2020

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Effect of different levels of strawberry pulp (*Fragaria ananassa*) on physico-chemical quality 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 determine the chemical composition 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). From results of chemical analysis it was revealed that the moisture content of strawberry kalakand was 26.22, 28.92, 29.79, 30.44 and 31.47 per cent, fat content was 21.14, 20.11, 19.22, 18.04 and 17.14 per cent, protein content was 16.38, 15.69, 15.01, 14.31 and 13. per cent, total sugar content was 35.74, 33.13, 32.54, 30.29 and 29.13 per cent, ash content was 2.64, 2.75, 2.86, 2.95 and 3.06 per cent, total solids content was 73.51, 71.08, 70.21, 69.65 and 68.53 per cent, acidity content was 0.55, 0.60, 0.65, 0.70 and 0.75 per cent, pH content was 6.37, 6.34, 6.33, 6.30 and 6.29 for the treatment T_1, T_2, T_3, T_4 and T_5 respectively. In short fat, protein, total sugar, total solids and pH were normally decreased while ash, acidity and moisture were increased with increase in levels of strawberry pulp

Keywords: Cow milk khoa**,** Strawberry pulp, Blending, Kalakand, Physico-chemical quality

Introduction
India is world's largest producer of milk, producing 176.4 million ton per annum, in India per capita availability is 375 g per day (NDDB, 2017-18). Out of the total milk production in India 46% of milk is consumed as whole and 54% is utilized for conversion into different dairy products. Kalakand is partially desiccated milk product with caramelized flavour and granular texture prepared from acidified milk (David, 2009). strawberries is a nutritious fruit with putative health benefits, because of their rich content of nutrients, with unique colour, flavour and taste (Giampieri *et al*., 2012; Mahmood *et al*., 2012). They are consumed widely fresh or in processed forms assorted with dairy products. Addition of strawberry pulp to kalakand results into nutritionally rich kalakand which also has better sensory acceptance as compared to plain kalakand. Hence the present investigation was planned and conducted to determine the effect of different levels of strawberry pulp on the physic-chemical quality of kalaknd.

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) 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.

Physico-chemical composition kalakand

Strawberry kalakand prepared by cow milk khoa and strawberry pulp with different treatment combinations were subjected to chemical analysis, which comprised the determination of moisture, fat, protein, total sugar, ash, total solid, acidity and pH. Fat content of strawberry kalakand was determined as per Gerber's method described in IS 1224 (1977). The protein of milk was estimated by using micro kjeldahl method as describe in IS: 1479 (part-II), 1961. Total sugar content of strawberry kalakand sample was determined by method given by IS: 1981. The ash content was determined as per the procedure described in IS 1479 (PART-II), 1961. Total solids in kalakand were determined as per A.O.A.C. (1975) for sweetened condensed milk. The percentage of total solids in kalakand was subtracted from 100 to obtain percent moisture in kalakand. The acidity of Kalakand was determined as per the procedure for estimating the acidity in cheese by Agarwal and Sharma (1961) [1]. The pH of the sample was measured using digital pH meter. Firstly the pH meter was standardized at 25 °c by using standard buffer solution the pH of the sample was observed on the dial and recorded.

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

Physico-chemical quality of strawberry pulp blended kalakand

strawberry pulp blended kalakand was subjected to chemical analysis for fat, protein, total sugar, ash, moisture, total solids, titratable acidity and pH. The results obtained were furnished under the Table 1.

Table 1: Effect of different levels of strawberry pulp on Physico-chemical quality of Kalakand

Treatments (Part of Cow milk khoa: Straberry pulp: Sugar)	Mean values of five replications in per cent							
	Fat	Protein	Total Sugar	Ash	Moisture	Total Solids	Acidity (TA)	pH
T_1(70:00:30)	21.14	16.38	35.74	2.64	26.49	73.51	0.55	6.37
T_2(65:05:30)	20.11	15.69	33.13	2.75	28.92	71.08	0.60	6.34
T_3(60:10:30)	19.22	15.01	32.54	2.86	29.79	70.21	0.65	6.33
T_4(55:15:30)	18.04	14.31	30.29	2.95	30.44	69.56	0.70	6.30
T_5(50:20:30)	17.14	13.65	29.63	3.06	31.47	68.53	0.75	6.29
'F' Test	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
SE (m) +/-	0.043	0.101	0.422	0.018	0.332	0.328	0.009	0.010
CD at 5%	0.130	0.308	1.283	0.054	1.011	0.999	0.028	0.031

Fat content of kalakand

It was observed that treatment differences were statistically significant at 5 per cent level of significance. The fat content in treatment T_1 was significantly highest among all treatments also it was observed that incorporation of strawberry pulp in different treatment was increased with decreased the fat content in kalakand. This might be due to lowest fat content in strawberry pulp than cow milk khoa. These results are in agreement with the results reported by following research workers. Sawant *et al*. (2007) [15] studied utilization of mango pulp for kalakand preparation and reported that increased mango pulp blending with buffalo milk decreased the fat content in kalakand. Shalini *et al.* (2015) studied on development and quality assessment of papaya kalakand and reported that increased papaya pulp blending with whole milk decreases the fat from 21.47 (T_0) to 9.12 (T_3) content in kalakand. Verma *et al*. (2018) [17] reported that, the kalakand prepared by using buffalo milk blended with coconut milk and sapota and it was observed decreased the fat content in kalakand from 25.32 (T_1) to 22.41 (T_3) per cent.

Protein content of kalakand

It was observed that, the treatment differences were statistically significant at 5 per cent level of significance for protein content. The protein content in treatment T_1 was significantly highest over the rest of the treatment. The incorporation of strawberry pulp in different treatment was increased with decreases the protein content in kalakand. This might be due to lower protein content in strawberry pulp than cow milk khoa. These results were supported with the results of Patel and Roy (2015) [14] studied on protein content of different combination of papaya pulp kalakand decreased from 16.08 to 9.40 per cent. Shalini *et al.* (2015) reported the protein content of different combination of papaya pulp kalakand decreased from 18.66 to 13.44 per cent in kalakand. Kumar and Singh (2017) [11] studied on protein content of different combination of wood apple kalakand decreased from 17.45 to 15.09 per cent with increases the level of wood apple pulp. Verma *et al.* (2018) [17] noted on protein content was of different combination of coconut milk and sapota kalakand decreased from 16.91 to 14.47 per cent.

Total sugar content

The perusal of data from table 1 revealed that, addition of strawberry pulp was significantly affected the total sugar content of kalakand. It was observed that increased the level of strawberry pulp with decreased total sugar content in kalakand. There was significantly decreased in total sugar content of kalakand with increases the level of strawberry pulp in kalakand. This might be due to low sugar content in strawberry pulp as compare to cow milk khoa. Kumar and Singh (2017) [11] studied on total sugar content of different combination of wood apple kalakand and reported decreasing trend with increases the level of wood apple pulp.

Ash content of kalakand

It was observed that incorporation of strawberry pulp in different treatment was increased with increased ash content in kalakand. This might be due to higher ash content in strawberry pulp than cow milk khoa. These results are in agreement with the results reported by Sawant *et al.* (2007) [15] observed that, the ash content of different combinations of mango fruit pulp in kalakand increases from 2.67, 2.73 and 2.81 per cent. Thakur (2015) reported that the ash content in custard apple kalakand increased from 2.43 to 3.10 per cent

Moisture content of kalakand

It is revealed from Table 1 that, the average moisture content of strawberry pulp kalakand ranged from 26.49 to 31.47 per cent. The mean moisture content was as 26.49, 28.92, 29.79, 30.44 and 31.47 per cent under treatments T_1, T_2, T_3, T_4 and T_5respectively. The moisture content was lowest in T_1 (26.49 per cent) i.e. kalakand prepared from cow milk khoa (control) and highest moisture content in kalakand was observed in T_5 (31.47per cent). It was observed that, as incorporation of strawberry pulp in different treatments was increased the moisture content in kalakand increased the level of strawberry pulp. This results are in agreement with the results reported by various research workers like, Shalini *et al.* (2015) studied on development and quality assessment of papaya kalakand and observed addition of papaya pulp in kalakand increased moisture content range from T_0 (26.12) to T_3 (47.12) per cent. Bhutkar (2015) [3] observed that the moisture per cent by utilization of ash gourd pulp for kalakand preparation. The moisture content was increased in range T_1 (17.40) to T_4 (28.75) per cent by increases the level of ash gourd pulp. Verma *et al.* (2018) [17] studied on development and quality assessment of kalakand prepared by using buffalo milk blended with coconut milk and sapota and observed that Maximum moisture of 25.14 per cent was found in the treatment T_0 followed by treatments T_3 (23.32), T_2 (22.21) and T_1 (21.09).

Total solids content

Blending of strawberry pulp was significantly affected the total solids content of kalakand. It was observed that addition of strawberry pulp decreased the total solids content of kalakand. The above results are in agreement with the results reported by Patel and Roy (2015) [14] studied on total solids content of different combination of papaya pulp kalakand was decreased from 75.52 to 71.49 per cent. Shalini *et al.* (2015) studied on total solids content of different level of papaya pulp kalakand decreased from 72.31 to 52.92 per cent. Kumar and Singh (2017) [11] reported that, the total solids content of different level of wood apple in kalakand was decreased from 82.97 to 75.68percent.

Titratable acidity

Rate of addition of strawberry pulp was significantly affected the acidity content of kalakand., there was significantly increase in acidity content of kalakand due to increase the level of strawberry in kalakand preparation. This might be due to higher acidity content in strawberry pulp as compare to cow milk khoa. Verma *et al.* (2018) [17] reported that acidity of kalakand increase in T_3 (0.61) as compare to T_2 (0.57) when kalakand blended with coconut milk and sapota. Kumar and Singh (2017) [11] reported that acidity of kalakand increase due to addition of pineapple pulp (10 to 30%) from 0.45 to 0.67 per cent.

pH of kalakand

There was significantly decrease in pH of kalakand due to increased the level of strawberry in kalakand. This might be due to higher pH content in strawberry pulp compare to cow milk khoa. Ghule (2015) strawberry pulp decreases the pH in lassi with increased in strawberry pulp.

Conclusion

From the results obtained in present study it is concluded that fat, protein, total sugar, total solid and pH was decreased due to increasing in rate of addition of strawberry pulp, while the increasing trends was recorded for moisture, titrable acidity and ash content of kalakand.

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