



ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(12): 2174-2177
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www.thepharmajournal.com
Received: 09-10-2021
Accepted: 19-11-2021

Arsul Shriram Ramkisan
Department of Dairy
Technology, Warner College of
Dairy Technology, SHUATS,
Prayagraj, Uttar Pradesh, India

Dr. John David
Professor and Head of
Department, Department of
Dairy Technology, Warner
College of Dairy Technology,
SHUATS, Prayagraj, Uttar
Pradesh, India

Maske Sachin V
Ph.D., Scholar, Department of
Dairy Technology, Warner
College of Dairy Technology,
SHUATS, Prayagraj, Uttar
Pradesh, India

Corresponding Author:
Arsul Shriram Ramkisan
Department of Dairy
Technology, Warner College of
Dairy Technology, SHUATS,
Prayagraj, Uttar Pradesh, India

Process optimization of Kalakand by admixing Sapota and papaya pulp with Ashwagandha (*Withania somnifera* L.) Powder

Arsul Shriram Ramkisan, Dr. John David and Maske Sachin V

Abstract

Kalakand is one of the indigenous milk products obtained by heat desiccation or concentration of whole or standardized milk with subsequent addition of sugar and proper coagulant. Kalakand was prepared under standard procedure from standardized buffalo milk (6% fat and 9% SNF). Sapota and Papaya Pulp was incorporated in the Kalakand @ 5% 10% 15% and 20% in combination with constant incorporation of Ashwagandha powder @ 2%. Chemical properties of product were tested to find the total solids, moisture, fat, protein, ash, carbohydrate and ash. The sample (S₀P₀) incorporated with 0% sapota and 0% papaya showed promising results in the chemical properties Total Solids 74.14%, Fat 24.66%, Protein 15.62%, Carbohydrate 30.94% and Ash 2.92% which are consistent with previous studies. Nutritive value (energy value) - 408.18 Kcal/100gm was considered as best of sample (S₀P₀) among other samples.

Keywords: Sapota, papaya, Ashwagandha, Kalakand and chemical properties

Introduction

With an annual growth rate of 6%, India is quickly becoming the world's largest milk producer. India's current milk production is 198.40 MT with per capita availability of 407 gm per day (NDDDB Statistics, 2019-20) [14]. Milk-based sweets are an important feature of the Indian subcontinent's diet. These delicacies are traditionally served at weddings, festivals, and other special occasions. Traditional Indian dairy products, also known as Indian Indigenous milk products, are any milk products that are indigenous to India and have evolved over time using locally accessible fuels and cooking utensils. Of total milk production nearly 54 to 55% of is used to make traditional dairy products such as heat-desiccated milk products like Khoa, Basundi, fermented such as Dahi, Shrikhand, coagulated like Channa, Kalakand, Paneer and heat clarified products like butter, ghee, which are traditionally made from milk.

Kalakand is a traditional milk product manufactured by desiccation of heat and prepared from acidified milk with a caramelized flavor and gritty texture. Denaturation and coagulation of milk proteins are the major reactions in the preparation process. Due to the fact that it is a whole milk concentrate, kalakand is a rich source of protein, minerals, fat, and lactose. It is 4-6 times more nutrient-dense than milk in terms of calorific content and weight per serving.

Carica papaya L., member of the Caricaceae family, is a native to Tropical America. There is a good reason why papaya is renowned as "the wonder fruit of the tropics," and that is because of its remarkable nutritional and therapeutic properties. Papaya is available throughout the year in India. Area under papaya cultivation in India is 1, 42,000 ha with annual production of about 57, 80,000 MT (National Horticulture Board, 2019-20). Prabha *et al.*, (2018) [15] observed that, chemical composition of papaya moisture 92.69%, crude protein 0.71%, fat 0.12%, ash 0.45%, and acidity 0.27%.

Sapota (*Manikara achras* Mill.) popularly known as Chikoo is another famous tropical and subtropical fruit in line with mango, banana, jackfruit, etc. Sapota is made up of a soft, easily digested pulp that is rich in sugars like fructose and sucrose, which are easily absorbed. In India, Sapota is cultivated on more than 84,000 ha with an annual production of 9,06,000 MT (National Horticultural Board, 2019-20). The chemical composition of fresh sapota fruits is Moisture content 77 to 83%, protein 0.6 to 0.80, carbohydrate 14.3 to 28.31, fat 0.4 to 1.25, fiber content 0.42 to 28.31 (Jadhav *et al.*, 2018) [10].

India is home to a diverse range of natural flora and wildlife, including medicinal plants used for a variety of purposes. Ashwagandha (*Withania somnifera* L.), which is also known as Indian ginseng or winter cherry is a significant plant that has been long utilized to treat a

variety of clinical problems. Its overall pharmacological characteristics make it a promising therapeutic treatment for anxiety, cancer, microbial infection, and immune-modulation and neurological illnesses (A Dar *et al.*, 2016) [1].

Materials and Method

The present study was carried out in the research Lab of Department of Dairy Technology, Warner College of Dairy Technology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj- 211007, U.P. (India). All the raw materials were collected from the local market of Prayagraj. The product was prepared with potable water. It was made certain that the materials used were devoid of any illnesses.

Manufacturing of Kalakand

Kalakand was manufactured using standardized milk (6% fat and 9% SNF). It was made using a process specified by

Manohar *et al.*, (2018) [11], with minor changes. Standardized milk was placed in a jacketed jar and heated to a simmering temperature (85-90 °C) by stirring continuously in a circular motion with occasional scraping of the heating surface with a wooden spoon. 0.02 percent citric acid (in the form of a solution) was added to the milk after 10-15 minutes of boiling, resulting in partial coagulation of the milk. After 1-2 minutes of stirring Sapota pulp, Papaya pulp and Ashwagandha powder was added as per treatment combination. At this stage vigorous stirring was required to obtain a product of good quality. The intensity of heating was reduced when semi-solid state was reached after 10-15 min. Sugar was added @ 7% of amount of milk taken. The finished product was transferred to tray greased (single layer) with ghee for cooling and setting. After cooling and setting at room temperature the set product was cut into the square pieces of 1.5 cm³ size.

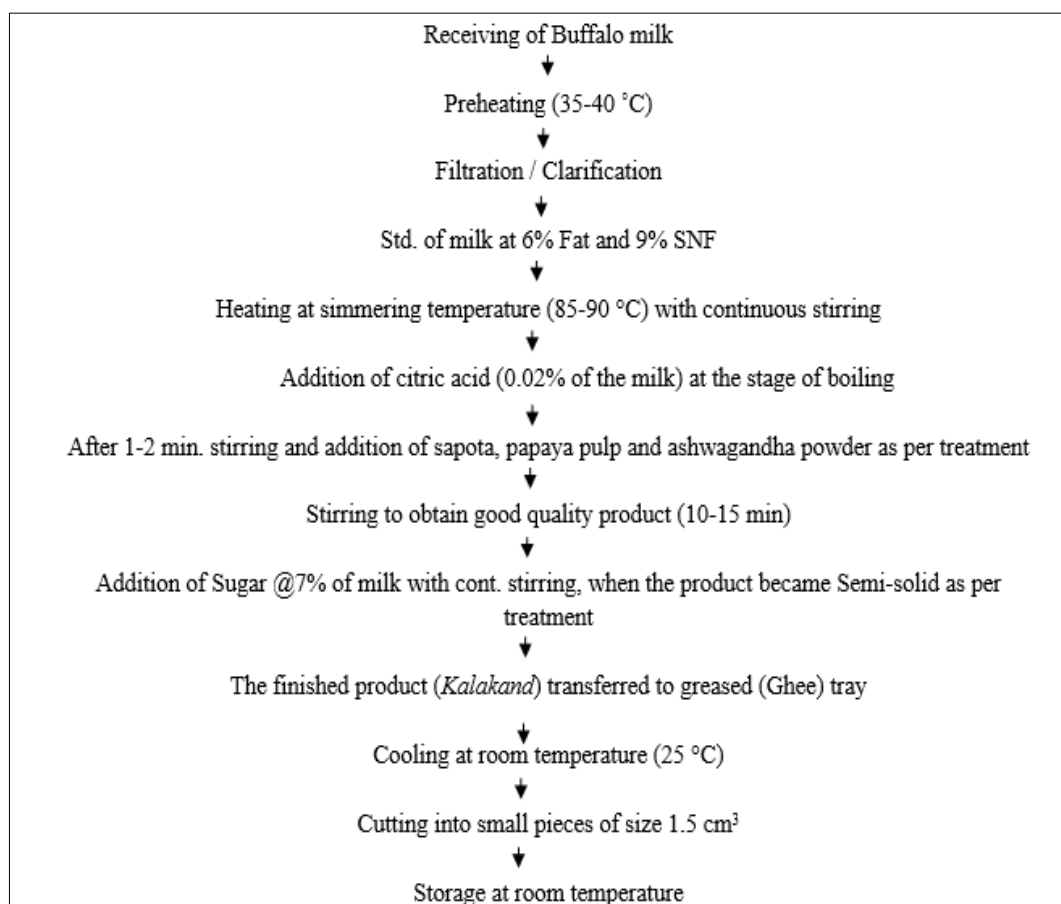


Fig 1: Preparation and manufacturing of *Kalakand*

Table 1: Recipe formulation for *Kalakand*

Sr. No.	Treatment	Khoa (%)	Sapota Pulp (%)	Papaya Pulp (%)	Ashwagandha Powder (%)
1	S ₀ P ₀	100	0	0	0
2	S ₁ P ₁	90	5	5	2
3	S ₁ P ₂	85	5	10	2
4	S ₁ P ₃	80	5	15	2
5	S ₁ P ₄	75	5	20	2
6	S ₂ P ₁	85	10	5	2
7	S ₂ P ₂	80	10	10	2
8	S ₂ P ₃	75	10	15	2
9	S ₂ P ₄	70	10	20	2
10	S ₃ P ₁	80	15	5	2
11	S ₃ P ₂	75	15	10	2
12	S ₃ P ₃	70	15	15	2

13	S ₃ P ₄	65	15	20	2
14	S ₄ P ₁	75	20	5	2
15	S ₄ P ₂	70	20	10	2
16	S ₄ P ₃	65	20	15	2
17	S ₄ P ₄	60	20	20	2
NOTE: Sugar use For all treatment: @ 7% of milk taken					
Papaya Pulp			Sapota Pulp		
P ₀ = 0%			S ₀ = 0%		
P ₁ = 5%			S ₁ = 5%		
P ₂ = 10%			S ₂ = 10%		
P ₃ = 15%			S ₃ = 15%		
P ₄ = 20%			S ₄ = 20%		

Result and Discussion

The result of chemical analysis found in the present study of Kalakand are elaborated and discussed in Table No. 2

Chemical analysis of Kalakand

Table 2: Preparation and manufacturing of *Kalakand*

Sr. No	Treatment	T.S. (%)	Moisture (%)	Fat (%)	Protein (%)	CHO (%)	Ash (%)	Acidity (%)
1	S ₀ P ₀	74.14	25.86	24.66	15.62	30.94	2.92	0.439
2	S ₁ P ₁	73.63	26.34	22.76	15.08	33.11	2.68	0.438
3	S ₁ P ₂	73.23	26.81	21.62	14.21	34.79	2.55	0.432
4	S ₁ P ₃	72.72	27.29	20.39	13.81	36.12	2.41	0.427
5	S ₁ P ₄	72.18	27.78	19.24	13.26	37.45	2.29	0.411
6	S ₂ P ₁	73.27	26.69	22.09	14.27	34.33	2.55	0.431
7	S ₂ P ₂	72.82	27.21	20.92	13.81	35.68	2.43	0.428
8	S ₂ P ₃	72.33	27.72	19.74	13.34	36.91	2.32	0.412
9	S ₂ P ₄	71.69	28.27	18.56	12.83	38.16	2.18	0.388
10	S ₃ P ₁	72.83	27.16	21.41	13.84	35.16	2.44	0.426
11	S ₃ P ₂	72.32	27.65	20.24	13.36	36.45	2.32	0.413
12	S ₃ P ₃	71.88	28.12	18.92	12.93	37.75	2.19	0.386
13	S ₃ P ₄	71.42	28.59	17.93	12.47	39.08	2.09	0.311
14	S ₄ P ₁	72.42	27.56	20.72	13.58	35.79	2.34	0.414
15	S ₄ P ₂	71.79	28.21	19.58	12.89	37.09	2.19	0.385
16	S ₄ P ₃	70.89	29.09	18.41	12.46	38.02	2.08	0.315
17	S ₄ P ₄	70.43	29.55	17.21	11.94	39.33	1.94	0.277

- Total Solids (%) in Kalakand:** The highest mean in total solids percentage of Kalakand was obtained in treatment S₀ P₀ (74.14) while S₄ P₄ recorded the minimum (70.43) revealed that variation in total solid content of different treatment combination is due to ratio of fruit pulp added.
- Moisture (%) in Kalakand:** The highest mean in moisture percentage of Kalakand was obtained in treatment S₄ P₄ (29.55) while S₀ P₀ recorded the minimum (25.86) revealed that variation in moisture content of different treatment combination is due to ratio of fruit pulp added.
- Fat (%) in Kalakand:** The highest mean in fat percentage of Kalakand was obtained in treatment S₀ P₀ (24.66) while S₄ P₄ recorded the minimum (17.21) revealed that variation in fat content of different treatment combination is due to ratio of fruit pulp added.
- Protein (%) in Kalakand:** The highest mean in protein percentage of Kalakand was obtained in treatment S₀ P₀ (15.62) while S₄ P₄ recorded the minimum (11.94) revealed that variation in protein content of different treatment combination is due to ratio of fruit pulp added.
- Carbohydrate (%) in Kalakand:** The highest mean total carbohydrate percentage of Kalakand was obtained in treatment S₄ P₄ (39.33) while S₀ P₀ recorded the minimum (30.94) revealed that variation in carbohydrate content of different treatment combination is due to ratio of fruit pulp added.
- Ash (%) in Kalakand:** The highest mean ash percentage of Kalakand was obtained in treatment S₀ P₀ (2.92) while S₄ P₄ recorded the minimum (1.94) revealed that variation in ash content of different treatment combination is due to ratio of fruit pulp added.
- Acidity (%) in Kalakand:** The highest mean in acidity percentage of Kalakand was obtained in treatment S₀ P₀ (0.439) while S₄ P₄ recorded the minimum (0.277) revealed that variation in acidity content of different treatment combination is due to ratio of fruit pulp added.
- Energy Value (Kcal) of Kalakand:** It can be observed from the Table-3 that the Energy Value (Kcal) of kalakand reveals that the sample of S₀ P₀, S₁ P₁, S₁ P₂, S₁ P₃, S₁ P₄, S₂ P₁, S₂ P₂, S₂ P₃, S₂ P₄, S₃ P₁, S₃ P₂, S₃ P₃, S₃ P₄, S₄ P₁, S₄ P₂, S₄ P₃ and S₄ P₄ were Rs. 408.18, 397.60, 390.58, 383.23, 376.00, 393.21, 386.24, 378.66, 371.00, 388.69, 381.40, 373.00, 367.57, 383.96, 376.14, 367.61, 359.97 respectively.

Table 3: Energy Value (Kcal) of Kalakand

Sr. No	Treatment	Fat content x 9	Protein content x 4	CHO content x 4	Total Energy Value Kcal
1	S ₀ P ₀	221.94	62.48	123.76	408.18
2	S ₁ P ₁	204.84	60.32	132.44	397.60
3	S ₁ P ₂	194.58	56.84	139.16	390.58
4	S ₁ P ₃	183.51	55.24	144.48	383.23
5	S ₁ P ₄	173.16	53.04	149.8	376.00
6	S ₂ P ₁	198.81	57.08	137.32	393.21
7	S ₂ P ₂	188.28	55.24	142.72	386.24
8	S ₂ P ₃	177.66	53.36	147.64	378.66
9	S ₂ P ₄	167.04	51.32	152.64	371.00
10	S ₃ P ₁	192.69	55.36	140.64	388.69
11	S ₃ P ₂	182.16	53.44	145.8	381.40
12	S ₃ P ₃	170.28	51.72	151.00	373.00
13	S ₃ P ₄	161.37	49.88	156.32	367.57
14	S ₄ P ₁	186.48	54.32	143.16	383.96
15	S ₄ P ₂	176.22	51.56	148.36	376.14
16	S ₄ P ₃	165.69	49.84	152.08	367.61
17	S ₄ P ₄	154.89	47.76	157.32	359.97

The maximum energy value obtained from formulation sapota 0%, papaya 0% (i.e., S₀P₀) is 408.18 Kcal from the control. The minimum energy value obtained from formulation sapota 20%, papaya 20% (i.e., S₄P₄) is 359.97 Kcal.

Conclusion

Kalakand is one of the traditional milk products which are made by desiccation of milk by direct heat with caramelized flavor and granular texture prepared from acidified milk. The main reaction in preparation is denaturation and coagulation of milk proteins. Kalakand has unique importance in market because it is liked by all classes of people. Kalakand is indisputable product having economic importance especially in rural part of India as it provides good means for converting surplus milk into value added products. From the investigation, it is evident that manufacturing of Kalakand in appropriate proportions with other ingredients like sapota pulp, papaya pulp and ashwagandha powder produced acceptable quality in the product.

Further, it is concluded treatments S₀P₀, S₁P₁, S₁P₂, S₁P₃, and S₁P₄, were better as compared with other treatments in chemical characteristics. Kalakand is the traditional milk product with good calorific value.

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