

Incorporation of Bael (*aegle marmelos* L.) Pulp and Stevia (*stevia rebaudiana*) Powder in Value Added Sweet Products

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Authors' contributions

This work was carried out by author AK during doctorate in Food and Nutrition under the guidance of Author A. Kochhar, RSB and MJ. All authors read and approved the final manuscript.

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ABSTRACT

Bael is a medicinal plant with known therapeutic properties. Stevia is a natural, zero calorie sweetener which is 300 times sweeter than sugar. Keeping in view, the properties of these two plants, value added milk based sweet products i.e., kheer and kulfi, were developed using different proportions of bael pulp and stevia. One gram of sugar was substituted by 5 mg of stevia powder in all the products. Organoleptic evaluation of the products was done by the semi-trained and diabetic panel. Incorporation of bael pulp in kheer and kulfi at 40 and 20 percent respectively was found highly acceptable and resulted in significant increase in their fibre, vitamin C, beta carotene and potassium content. Percentage of sugar reduced in kulfi and kheer using stevia powder was 75 and 67 percent, respectively, resulting in decrease in their energy content. Use of bael and stevia need to be encouraged in sweet products as they are natural, safe and possesses therapeutic benefits.

Keywords: Kheer; kulfi; milk; organoleptic evaluation; sugar; energy.

1. INTRODUCTION

Increase in chronic diseases in the whole world are a cause of concern for the nutritionists. It is related to increased consumption of sugar, salt and fat in our diets. Human nature's preference for sweet taste is a big issue to deal with [1]. We cannot survive on earth without plants. They not only provide us oxygen to breath in but also bless us with their therapeutic benefits. Two such plants are bael (*aegle marmelos*) and stevia (*stevia rebaudiana*) which if used in sweet products provides nutrition as well as sweetness. The use of bael and stevia in product development helped to satisfy the craving for sweetness of the obese, diabetics and other individuals.

Bael (*aegle marmelos*) is a fruit tree found in dry forest hill range of India, Southern and Central Asian countries. It is known by different names like bil, bilwa, shripal, vilvum, bengal quince etc. The fruit had a very hard rind. The pulp contains many seeds and is mucilaginous which makes the fruit difficult to handle as a dessert fruit. The pulp of this fruit contains terpenoids, steroids, flavonoids, lignin, phenolic compounds, fat and oil, carbohydrates, proteins, alkaloids, glycosides [2]. The curative value of bael fruit is improved because of presence of tannins, the evaporating material present in its outer covering i.e., rind which helps to treat diabetes. The tannin content of rind and pulp was reported to be 20 and 9 per cent respectively. Bael possesses many therapeutic properties including antidysentric, demulcent, astringent, antidiarrhoeal, anti-inflammatory and antipyretic activities. It has been proved that the constituents purified from this fruit are biologically active in fighting against several major diseases like diabetes, cancer and cardio vascular diseases [3]. Ready to serve drink prepared from bael fruit by adding equal amount of water to the pulp was heated up to 80°C for one minute and immediately cooled and sieved through 20 mesh stainless steel sieve. Sugar and citric acid was added to the extracted pulp to adjust the TSS and acidity of the prepared product [4].

Stevia (*stevia rebaudiana*) is a natural sweetest nutrient rich plant belonging to Asteraceae family that naturally grows in South America. More than two hundred species of stevia are found in the world but *stevia rebaudiana* is the only species that possesses the characteristic of sweetening. Stevia leaves contain certain constituents i.e., glycosides which impart a sweet taste but gives

no caloric value apart from containing protein, fibers, carbohydrates, phosphorus, iron, calcium, potassium, sodium, magnesium, zinc, rutein (flavonoid), vitamin C and vitamin A (Kim et al. 2002). The leaves contain rebaudiosides A-F, diterpene glycosides stevioside, steviolbioside and dulcoside responsible for the sweet taste and lend it a commercial value to be used all over the world as a sugar substitute in beverages, foods or medicines. Stevia possesses many therapeutic and pharmacological properties as suggested by different preclinical and clinical studies. It is nontoxic and holds antimicrobial, antioxidant, anti-carcinogenic and antifungal activity [5]. Abo Elnaga [6] reported non-caloric or low caloric sweeteners as tools for making healthier food choices introduced to satisfy consumer demand. The study aimed to evaluate the effect of stevia sweetener as a substitute of sucrose at different doses (25, 250, 500 and 1000 mg/kg b. wt/day) for twelve weeks on the weight management and on several hematological and biochemical parameters of female rats. The results showed significant improvement and ameliorated reduction in final bodyweight, body weights gain (%) and feed efficiency ratio in the stevia sweetener groups compared with the control.

1.1 Objective

The objective of present study was to develop value added sweet products viz. kheer and kulfi different proportions of bael pulp and stevia for people suffering from non-communicable diseases like diabetes and CHD, who have to keep a check on their calorie intake. The organoleptic and nutritional evaluation of the prepared products was further carried out, to select highest acceptable proportion of both bael pulp and stevia in kheer and kulfi.

2. MATERIALS AND METHODS

2.1 Procurement and Processing of Raw Material

The bael fruit (var. Kaghzi), was procured from Regional Research Station, Patiala, Punjab. Stevia powder was purchased from Ozzy Business Consulting Ltd, Patiala. Milk, khoa, rice, sugar etc. were purchased from the local market of Ludhiana. The bael fruit was procured and checked for any infestation or damage. The fruit was washed and then broken by hitting on floor or using a hammer. The pulp along with seeds

and fibre was scooped out of the fruit with help of a stainless steel spoon and the peel was discarded. The scooped out pulp was then weighed and equal amount of water was added to the pulp. It was then mixed in a mixer and sieved through a 20 mesh stainless steel to separate the seeds. The pulp thus obtained was used for the product development.

1. Kheer was standardized at two levels:

Standardization-I

Table 1. Kheer using different levels of bael pulp

Ingredients	Kheer				
	C	B1	B2	B3	B4
Milk (ml)	500	500	500	500	500
Rice (g)	50	40	35	30	25
Bael pulp (g)	--	10	15	20	25
Sugar (g)	30	30	30	30	30

*C – Control (100% rice)
B1- 20% bael pulp;
B2- 30% bael pulp;B3- 40% bael pulp;B4- 50% bael pulp*

Standardization-II

Table 2. Kheer using acceptable level of bael pulp and different levels of stevia powder

Ingredients	Kheer				
	C	BS1	BS2	BS3	BS4
Milk (ml)	500	500	500	500	500
Rice (g)	30	30	30	30	30
Bael pulp (g)	20	20	20	20	20
Sugar (g)	30	20	15	10	5
Stevia (mg)	--	50	75	100	125

*C – Control (60% rice+ 40% bael pulp)
BS1- 33% stevia + 67% sugar; BS2-50% stevia + 50% sugar; - 67 % stevia + 33% sugar; BS4- 84 % stevia + 16% sugar*

Development of Kheer- Ingredients: Milk-500 ml, rice -30 g, bael pulp-20 g, sugar-10 g, stevia powder-100 mg. Rice was soaked in water for 4-5 hours. Milk was boiled and soaked rice were added to the boiling milk and cooked. It was simmered until the kheer reduced to half of its original quantity. Sugar, bael pulp and stevia was added and simmered for 3 minutes.

2. Kulfi was standardized at two levels:

Standardization-I

Table 3. Kulfi using different levels of bael pulp

Ingredients	Kulfi				
	C	B1	B2	B3	B4
Milk (ml)	500	500	500	500	500
Khoa (g)	50	45	40	35	30
Bael pulp(g)	--	5	10	15	20
Sugar (g)	20	20	20	20	20

*C – Control (100% khoa)
B1- 10% bael pulp; B2- 20% bael pulp; B3- 30% bael pulp;B4- 40% bael pulp*

Standardization-II

Table 4. Kulfi using acceptable level of bael and different levels of stevia powder

Ingredients	Kulfi				
	C	BS1	BS2	BS3	BS4
Milk (ml)	500	500	500	500	500
Khoa (g)	40	40	40	40	40
Bael pulp (g)	10	10	10	10	10
Sugar (g)	20	15	10	5	00
Stevia (mg)	--	25	50	75	100

*C – Control (90% khoa+ 10% bael pulp)
BS1- 25% stevia + 75% sugar; BS2-50% stevia + 50% sugar; BS3-75% stevia + 25% sugar; BS4- 100%stevia*

Kulfi

Development of Kulfi- Ingredients: Milk-500 ml, khoa -40 g, bael pulp-10 g, sugar-5 g, stevia powder-75 mg. Milk was boiled in a pan and reduced to one third volume. Khoa and sugar were added and cooked for 2-3 minutes. Added bael pulp and stevia powder and stirred well. Cooled the mixture, put in kulfi moulds and set in freezer till the kulfi set. Removed from moulds and served chilled.

Organoleptic Evaluation: The organoleptic evaluation of the developed value added sweet products was carried out to select the most acceptable level of bael pulp from the first trial as well as the acceptable level of stevia powder in the development of products in the second trial. In the second trial, the acceptable product of first trial was used as the control sample [1]. The sensory evaluation of the developed products of first trial was carried out by ten semi-trained panelists including faculty of department of Food and Nutrition of Punjab Agricultural University while the second trial was evaluated by both the trained panel as well as diabetic panel. The

panel was provided with 9 point hedonic scale for attributes like appearance, colour, texture, flavour, taste and overall acceptability (Larmond 1970).

Nutritional Evaluation: The highly acceptable products from the second trial containing both bael and stevia with their corresponding control (with no bael and stevia) were weighed, homogenized and oven dried at 60°C. Dried samples were stored in air tight plastic bags for further proximate analysis by standard procedures [7] analysis.

Minerals namely calcium, phosphorus iron, zinc, potassium and sodium were estimated using atomic absorption spectrophotometer (AAS, Varian model) after wet digestion [8].

Estimation of Ascorbic Acid was done by using AOAC 2000 methods with principle that the blue colour produced by the reduction of 2, 6-dichlorophenolindophenol dye by ascorbic acid is estimated using a spectrophotometer.

Carotene was estimated by column chromatography [4].

2.2 Statistical Analysis

The data on organoleptic evaluation and chemical analysis was analyzed statistically. Kruskal Wallis test was used for selecting the best formulations through sensory evaluation. T-test was applied to compare the nutritional parameters between the control and the value added products.

3. RESULTS AND DISCUSSION

3.1 Kheer Incorporated with Bael Pulp

Five samples of kheer were prepared using rice as control and for test, samples were incorporated with bael pulp at 20, 30, 40 and 50 per cent levels. The mean scores of sensory evaluation of kheer by semi trained panel of judges using nine-point hedonic rating scale is presented in Table 5. The results showed that the highest scores for all the sensory parameters among the test samples were obtained by B3 treatment (40% bael pulp). The scores all the parameters of control i.e., 8.1-8.4 were found to be slightly higher than B3 treatment i.e., 8.0-8.2, followed by B2 ranged from 7.9-8.0. The overall acceptability mean scores for appearance, colour, texture, flavour and taste of B3 treatment was significantly lower i.e. 8.1 than that of control i.e. 8.2. Statistical results revealed that there was

a significant difference between the B3 treatment and control sample in context of appearance, colour, texture, flavour, taste and overall acceptability. Control (C) scored the highest scores for all the sensory parameters with a highest overall acceptability score of 8.2. The B3 treatment scored the highest score of 8.1 for taste among the samples incorporated with bael.

3.2 Kheer Incorporated with Bael Pulp and Stevia Powder by Semi-Trained Panel

Five samples were prepared using different levels of stevia powder including one as control taken from the first standardization. The amount of sugar was reduced and stevia powder was added to balance the sweetness of products and lower the calorie intake.

Control (C) sample was prepared using 60 per cent rice and 40 per cent bael pulp. The four levels at which the stevia powder was substituted for sugar were 33, 50, 77 and 84 per cent and coded as BS1, BS2, BS3 and BS4 respectively. The scores statistically revealed that all the treatments showed non-significant difference with regard to parameters like colour, texture, flavour, taste and overall acceptability. The mean scores of acceptability trials for kheer by semi-trained panel of judges using nine-point hedonic scale are presented in Table 6. The results revealed that the highest scores for all the sensory parameters among test samples were obtained by BS3 treatment (67% stevia + 33% sugar). The overall acceptability of BS3 treatment was found to be higher i.e. 7.68 as compared to control (7.61) followed by BS2 (50% stevia + 50% sugar) i.e. 7.43 and BS1 (33% stevia + 67% sugar) i.e. 7.38. The highest score of 7.6 for taste was obtained by BS3 which is higher than control (C) and other treatments. BS3 was taken as the final value added product for further analysis. Aggarwal and Kochhar (2009) prepared ghia kheer using different ratios of steviolal, and observed that the taste score was highest for 25mg steviolal recipe which was liked very much and lowest for 50mg steviolal recipe with an overall acceptability range of 6.9±0.24 to 7.7±0.26.

3.3 Kheer Incorporated with Bael Pulp and Stevia Powder by Diabetics

The mean sensory scores of acceptability trials of kheer by ten diabetics on nine-point hedonic

rating scale are presented in Table 7. The results revealed that the highest scores for all the sensory parameters among test samples were obtained by BS3 treatment (67% stevia and 33% sugar). The overall acceptability of BS3 treatment was found to be higher i.e. 7.78 than all other treatments. The overall acceptability of all the treatments i.e, BS1, BS2, BS3 and BS4 was found to be higher than the control sample. Statistical analysis revealed that the mean scores for all the parameters of sensory evaluation showed non-significant difference between BS3 treatment and control sample. The scores for taste was found to be higher in the BS3 (7.7) treatment followed by BS1 and BS2, C and BS4. The mean score for taste and colour for BS1 and BS2 were at par to each other. The mean score for overall acceptability obtained by BS3 is higher than the scores obtained by semi-trained panel i.e., 7.75 and 7.68 respectively. Aggarwal and Kochhar [9] reported that in ghia

kheer prepared by using different ratios of steviolcal, the taste score was highest for 25mg steviolcal recipe which was liked very much and lowest for 50 mg steviolcal recipe with taste scores ranged from 6.6±0.27 to 7.7±0.44 by the diabetics.

3.4 Kulfi Incorporated with Bael Pulp

Kulfi prepared from 100 percent khoa was taken as control (C). The bael pulp was added at 10, 20, 30 and 40 percent levels designated as B1, B2, B3 and B4 respectively in the first standardisation. It was then subjected to sensory evaluation by the semi trained panel. Table 8 shows that the B2 (80% khoa +20% bael pulp) scored the highest points for all the sensory parameters with an overall acceptability score of 7.81 while the control (C) attained an overall acceptability score of 7.46 followed by B1 (7.2), B3 (7.18) and B4 (6.88).

Table 5. Mean sensory scores for kheer incorporated with bael pulp by semi-trained panel

Samples	Parameters					
	Appearance	Colour	Texture	Flavour	Taste	Overall acceptability
C	8.4	8.24	8.1	8.2	8.4	8.2
B1	7.8	7.8	7.8	7.8	7.8	7.8
B2	7.9	7.96	8	8	7.9	8
B3	8.1	8.1	8.2	8	8.1	8.1
B4	6.9	6.9	6.9	6.9	6.8	6.9
χ^2	17.739**	17.531**	16.635**	14.369**	20.060**	14.369**

** Significant at 1% level of significance ($p<0.01$); NS - Non-significant

*Significant at 5% level of significance ($p<0.05$)

- C – Control (100% rice)
- B1- 20% bael pulp
- B2- 30% bael pulp
- B3- 40% bael pulp
- B4- 50% bael pulp

Table 6. Mean sensory scores for kheer incorporated with bael pulp and stevia powder by semi-trained panel

Samples	Parameters					
	Appearance	Colour	Texture	Flavour	Taste	Overall acceptability
C	7.7	7.7	7.7	7.6	7.35	7.61
BS1	7.4	7.3	7.3	7.4	7.5	7.38
BS2	7.6	7.6	7.5	7.3	7.15	7.43
BS3	7.8	7.7	7.9	7.4	7.6	7.68
BS4	7.3	7.3	7.3	7.4	7.2	7.3
χ^2	5.205 ^{NS}	3.694 ^{NS}	5.740 ^{NS}	1.132 ^{NS}	3.853 ^{NS}	4.655 ^{NS}

** Significant at 1% level of significance ($p<0.01$); NS - Non-significant

*Significant at 5% level of significance ($p<0.05$)

- C – Control (60% rice+ 40% bael pulp+100% sugar)
- BS1- 33% stevia + 67% sugar
- BS2-50% stevia + 50% sugar
- BS3- 67 % stevia + 33% sugar
- BS4- 84 % stevia + 16% sugar

The mean score decreased with the increased incorporation of bael pulp after B2 treatment as shown in table 4.4. The differences in scores were found to be statistically significant with regards to all the sensory parameters for all the treatments. The mean score for all parameters in acceptable level ranged from 7.5-8.1 which is higher than that of control i.e., 7.2-7.8. The minimum mean score was attained by B4 ranging 6.6-7.4 as compared to other treatments.

3.5 Kulfi Incorporated with Bael Pulp and Stevia Powder by Semi-Trained Panel

Five samples were prepared using khoa and bael pulp (80% + 20%) as control and test samples were prepared by reducing the sugar content and incorporating stevia powder at different levels i.e. 25, 50, 75 and 100 per cent. The mean scores of acceptability trials for kulfi by semi trained panel of judges on nine-point hedonic rating scale are presented in Table 9. The results revealed that the highest scores for all the sensory parameters among test samples were obtained by BS3 treatment (75% stevia +25% sugar). The overall acceptability of BS3 treatment was found to be higher i.e. 7.57 than BS2 i.e. 7.56, followed by C i.e. 7.44, BS1 i.e. 7.24 and minimum for the BS4 i.e., 6.68. The highest mean score for taste was scored by BS3 (7.55) while control and BS2 taste scores were at par to each other i.e., 7.3. Statistical analysis revealed that there was a significant difference between the BS3 treatment and control sample for all the sensory parameters except for colour. As the overall acceptability was found to be higher in the BS3 treatment, it was further used for chemical analysis. The most acceptable modified recipe for

kulfi according to the trained panel was recipe with 25mg steviocal with an overall acceptability score of 7.7 ± 0.17 as reported by Agarwal and Kochhar [10].

3.6 Kulfi Incorporated with Bael Pulp and Stevia Powder by Diabetics

The mean scores of acceptability trials for kulfi by diabetics on nine-point hedonic rating scale are presented in Table 10. The results revealed that the highest scores for all the sensory parameters among test samples were obtained by BS3 treatment (75% sugar replaced). The overall acceptability of BS3 treatment was found to be higher i.e. 7.68 than BS2 i.e. 7.65, followed by BS1 i.e. 7.6, C i.e., 7.4 and BS4 i.e. 6.8. As shown in the Table 10, the mean scores for all the sensory parameters of control are less as compared to that of BS3. Statistical results revealed that there was non-significant difference between the BS3 treatment and control sample for colour and flavour. A significant difference was observed in appearance, texture, taste and overall acceptability among control and treatments. The overall acceptability score given by diabetics for BS3 (7.68) was found to be higher as compared to the scores given by the semi trained panel i.e., 7.57. Agarwal and Kochhar [10] revealed that the overall acceptability was highest for the 25 mg steviocal recipe and lowest for the recipe with 50mg steviocal as judged by diabetic panel. The taste scores ranged from 7.3 ± 0.33 to 8.1 ± 0.13 , the highest for the recipe with 25mg steviocal. The overall acceptability was highest for the same recipe and lowest for the recipe with 50mg steviocal.

Table 7. Mean sensory scores for kheer incorporated with bael pulp and stevia powder by diabetics

Samples	Parameters					
	Appearance	Colour	Texture	Flavour	Taste	Overall acceptability
C	7.4	7.4	7.4	7.5	7.35	7.41
BS1	7.6	7.8	7.5	7.5	7.6	7.6
BS2	7.7	7.8	7.9	7.8	7.6	7.76
BS3	7.9	7.8	8	7.5	7.7	7.78
BS4	7.8	7.7	7.4	7.4	7.3	7.52
χ^2	4.414 ^{NS}	2.951 ^{NS}	7.758 ^{NS}	1.695 ^{NS}	4.966 ^{NS}	5.039 ^{NS}

** Significant at 1% level of significance ($p < 0.01$); NS - Non-significant

*Significant at 5% level of significance ($p < 0.05$)

- C – Control (60% rice+ 40% bael pulp+100% sugar)
 - BS1- 33% stevia + 67% sugar
 - BS2-50% stevia + 50% sugar
 - BS3- 67 % stevia + 33% sugar
 - BS4- 84 % stevia + 16% sugar

Table 8. Mean sensory scores for kulfi incorporated with bael pulp

Samples	Parameters					
	Appearance	Colour	Texture	Flavour	Taste	Overall acceptability
C	7.8	7.7	7.4	7.3	7.2	7.46
B1	7.8	7.5	7.1	6.8	6.8	7.2
B2	8.1	8.1	7.7	7.5	7.65	7.81
B3	7.3	7.1	7.2	7.1	6.8	7.18
B4	7.4	7	6.6	6.8	6.6	6.88
χ^2	12.469*	14.431**	14.502**	13.003*	19.601**	24.738**

** Significant at 1% level of significance ($p < 0.01$); NS - Non-significant

*Significant at 5% level of significance ($p < 0.05$)

- C – Control (100% khoa)
- B1- 10% bael pulp
- B2- 20% bael pulp
- B3- 30% bael pulp
- B4- 40% bael pulp

Table 9. Mean sensory scores for kulfi incorporated with bael pulp and stevia powder by semi-trained panel

Samples	Parameters					
	Appearance	Colour	Texture	Flavour	Taste	Overall acceptability
C	7.7	7.6	7.3	7.4	7.3	7.44
BS1	7.6	7.5	7.2	6.9	7	7.24
BS2	7.5	7.5	7.6	7.5	7.3	7.56
BS3	7.5	7.9	7.6	7.3	7.55	7.57
BS4	6.8	7	6.5	6.7	6.4	6.68
χ^2	9.583*	8.368NS	15.525**	12.749*	19.067**	22.597**

** Significant at 1% level of significance ($p < 0.01$); NS - Non-significant

*Significant at 5% level of significance ($p < 0.05$)

- C – Control (80% khoa+ 20% bael pulp +100% sugar)
- BS1- 25% stevia + 75% sugar
- BS2-50% stevia + 50% sugar
- BS3- 75% stevia +25 % sugar
- BS4- 100% stevia

3.7 Nutritional Evaluation

3.7.1 Kheer

The data for proximate composition of kheer is presented in Table 11. The moisture content of kheer ranged between 69.85 in control and 73.58 per cent for BS3 treatment with a significant difference ($p < 0.01$). The protein content of C was found to be non-significantly higher i.e., 5.66 per cent where as in BS3 it was 5.24. A non-significant decrease in crude fat and total ash content of BS3 was observed i.e., 5.74 and 0.96 per cent as compared to C i.e., 5.95 and 0.88 per cent respectively. There was a slight increase in crude fibre content of BS3 (0.15%) than C (0.02%) which is statistically significant ($p < 0.01$). A significant decrease in carbohydrate content of BS3 i.e., 14.33 per cent was observed as compared to C i.e., 17.63 per cent ($p < 0.05$). Addition of stevia powder resulted in a significant

decrease in energy content of BS3 i.e., 129.72 Kcal as compared to C i.e., 146.74 Kcal ($p < 0.01$). A significant difference in proximate composition was observed for parameters like moisture, crude fibre and carbohydrate and energy. For parameters like crude protein, crude fat and total ash, the difference was observed to be non-significant.

3.7.2 Kulfi

It was observed that the moisture content of control kulfi was 58.84 per cent which was significantly lower than the BS3 treatment (80% khoa, 20% bael pulp and 75% stevia) i.e., 66.72 per cent. Protein content and ash content of BS3 were found to be non-significantly lower i.e., 4.03 and 0.95 per cent than control i.e. 4.10 per cent and 0.98 per cent respectively (Table 11). Fat content of control sample (12.17%) was significantly higher than BS3 treatment (10.08%).

Table 10. Mean sensory scores for kulfi incorporated with bael pulp and stevia powder by diabetics

Samples	Parameters					
	Appearance	Colour	Texture	Flavour	Taste	Overall acceptability
C	7.6	7.7	7.4	7.1	7.2	7.4
BS1	7.9	7.7	7.5	7.5	7.5	7.6
BS2	7.6	8	7.6	7.4	7.65	7.65
BS3	7.8	7.4	7.7	7.6	7.6	7.68
BS4	6.9	7	6.7	6.9	6.5	6.8
χ^2	11.557*	8.633 ^{NS}	11.082*	8.065 ^{NS}	17.857**	18.790**

** Significant at 1% level of significance ($p < 0.01$), NS - Non-significant

*Significant at 5% level of significance ($p < 0.05$)

- C – Control (80% khoa+ 20% bael pulp+100%sugar)
 - BS1- 25% stevia + 75% sugar
 - BS2-50% stevia + 50% sugar
 - BS3- 75% stevia +25 % sugar
 - BS4- 100% stevia

Table 11. Proximate composition of the developed products (DW basis)

Products	Moisture (%)	Crude protein (%)	Crude fat (%)	Total ash (%)	Crude fiber (%)	Carbohydrate (%) (by differences)	Energy (Kcal/100g)
Kulfi (control)	58.84±0.46	4.10±0.03	12.17±0.08	0.98±0.01	0.00±0.00	23.90±0.48	221.59±1.66
Acceptable	66.72±0.19	4.03±0.02	10.08±0.12	0.95±0.00	0.08±0.02	18.14±0.13	179.37±1.40
t-value	15.92**	2.20 ^{NS}	14.60**	2.47 ^{NS}	4.85**	11.66**	19.45**
Kheer (control)	69.85±0.23	5.66±0.17	5.95±0.18	0.88±0.02	0.02±0.003	17.63±0.23	146.74±0.15
Acceptable	73.58±0.64	5.24±0.06	5.74±0.31	0.96±0.02	0.15±0.01	14.34±0.81	129.72±2.44
t-value	5.46**	2.28 ^{NS}	0.60 ^{NS}	2.33 ^{NS}	11.34**	3.94*	6.97**

Values are given as Mean±SE*Significant at 5% level of significance ($p < 0.05$)

**Significant at 1% level of significance ($p < 0.01$)NS- Non-significant

Incorporation of 20 per cent fresh bael pulp in place of khoa may have contributed to a low fat content in treatment BS3. Fiber content of BS3 (0.08%) treatment was found to be significantly higher than the control sample. Carbohydrate content of control sample was 23.90 g which was significantly higher than the BS3 treatment i.e. 18.14 g. Energy content was found to be high in control sample i.e. 221.59 Kcal followed by BS3 treatment i.e. 179.37 Kcal. Replacing 75 percent of sugar with stevia powder would have contributed to the low carbohydrate and energy content. Mohammad et al. [11] concluded that substitution of sucrose with Stevia can produce low caloric and GI ice creams but use of mixture of the two sweeteners i.e. sucrose and stevia improves sensory acceptance of the developed formulations.

3.7.3 Minerals

A statistically non-significant increase in calcium content of kulfi and kheer was observed as compared to test samples (Table 12). The statistical data revealed that the phosphorous content of control was significantly higher than test sample in Kulfi and kheer. Zinc content present in kheer was found to be of non-significant difference. A small but statistically significant increase in iron content of test samples i.e., kheer was observed in comparison to control ($p < 0.01$). A non-significant decrease in iron content of test sample and control was

observed in kulfi i.e. 0.60 and 0.65 mg/100 respectively. The potassium content of kulfi and kheer showed the significant increase as compared to control. Potassium content of kulfi, and kheer in test samples was observed to be 192.69 and 98.19 mg/100 gm which is significantly higher than their controls i.e. 171.76 and 86.18 mg/100 gm respectively ($p < 0.01$). Sodium content of burffor test sample showed a decrease in sodium content as compared to control. However, this decrease in sodium content was found to be of non-significant difference. Sodium content of kulfi control was found to be 60.63 mg/100 gm which was significantly higher than the test values for the same i.e. 58.32 mg/100 gm respectively and resulted in significant difference in sodium content of control and test sample ($p < 0.01$). The sodium content of kheer and test sample was observed to be 40.55 and 39.35 mg/100 gm respectively and presents a statistically significant difference ($p < 0.05$).

3.7.4 Vitamin C and Carotene content of developed products

Vitamin C content of kulfi and kheer showed a significant increase in values as compared to the control (Table 13). Carotene content increased in test samples of kulfi i.e., 47.36 $\mu\text{g}/100\text{ g}$ as compared to control i.e., 43.44. Increase in carotene content of kheer was found to be of non-significant difference.

Table 12. Mineral content of developed products

Products	Calcium (mg/100 g)	Phosphorus (mg/100 g)	Iron (mg/100 g)	Zinc (mg/100 g)	Potassium (mg/100 g)	Sodium (mg/100 g)
Kulfi (control)	449.22±0.42	98.30±0.37	0.65±0.02	-	171.76±0.23	60.63±0.21
Acceptable	443.20±3.20	94.44±0.45	0.60±0.01	-	192.69±0.50	58.32±0.45
t-value	1.87 ^{NS}	6.69**	2.56 ^{NS}	-	37.92**	5.24**
Kheer (control)	341.69±15.59	65.62±0.30	0.18±0.00	0.05±0.005	86.18±0.45	40.55±0.17
Acceptable	359.71±1.59	63.59±0.20	0.23±0.00	0.06±0.05	98.19±0.34	39.35±0.20
t-value	1.15 ^{NS}	5.66**	7.04**	2.8 ^{NS}	21.52**	4.45*

Values are given as Mean±SE*Significant at 5% level of significance ($p < 0.05$)

**Significant at 1% level of significance ($p < 0.01$) NS- Non-significant

Table 13. Vitamin C and Carotene content of developed products

Products	Vitamin C (mg)	Carotene (μg)
Kulfi (control)	1.20±0.07	43.44±0.55
Acceptable	1.96±0.01	47.36±0.28
t-value	11.18**	6.33**
Kheer (control)	1.13±0.01	110.84±2.10
Acceptable	1.91±0.04	213.45±0.48
t-value	19.78**	1.21 ^{NS}

Values are given as Mean±SE*Significant at 5% level of significance ($p < 0.05$)

**Significant at 1% level of significance ($p < 0.01$) NS- Non-significant

4. CONCLUSION

Based on the results obtained from the present study, it was concluded that incorporation of bael pulp in value added sweet products i.e., kulfi at 20 and kheer at 40 per cent, was found highly acceptable. The percentage of sugar reduced in kulfi was 75 and in kheer was 67 by using stevia powder in milk based bael products. Addition of bael pulp/powder resulted in significant increase in fibre content of these products. The potassium content increased significantly in the products as compared to the control and the sodium content decreased significantly. Addition of stevia resulted in a significant decrease in energy content of both the acceptable products. Hence, use of bael and stevia powder in sweet products as they are natural, safe and have many therapeutic benefits.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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