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Physico-chemical and microbiological characteristics of low calorie herbal Basundi

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Abstract

Basundi is a dessert that is consumed directly and contains sugar and all the milk solids in an approximate two-fold concentration that gives it a high nutritive value. Low calorie herbal basundi was developed under the current study using sucralose as low calorie sweetener, *Hemidesmus indicus* and *Bougainvillea glabra* as herbs with health beneficial properties and analyse it for physico-chemical and microbiological parameters. The developed product was analysed for chemical composition parameters like fat, protein, lactose, total solids and acidity, physical parameters like colour characteristics and microbiological parameters like standard plate count, coliform count and yeast and mold count alongside for traditional control basundi.

Keywords: Basundi, low calorie, herbal, physico-chemical analysis

Introduction

Dairy products provide an important food source for human health and nutrition in India as a major percentage of population being vegetarians. Indian dairy has witnessed an incredible growth in milk production. About 50-55 per cent of the milk produced in our country is transformed into various traditional dairy products like Khoa and Channa based, Ghee, Paneer, Dahi and concentrated milk products such as Rabri, Basundi and Malai etc. (Singh *et al.*, 2009)^[15].

Basundi which has a sweetish caramel aroma is a heat-desiccated, thickened milk dessert, having white to light caramel colour, creamy consistency with soft textured flakes that are uniformly suspended throughout the product matrix. It is a dessert that is consumed directly and contains sugar and all the milk solids in an approximate two-fold concentration that gives it a high nutritive value (Aneja *et al.*, 2002)^[2].

Low calorie sweeteners have been successfully used as a substitute to sucrose in a wide range of dairy products. Ministry of Health and Family Welfare under Government of India made Amendments to PFA Act, 1995 such that artificial sweeteners are used within prescribed limits and was permitted with proper label declaration. Various low-calorie sweeteners such as saccharin, acesulfame K, aspartame and sucralose have been permitted in the dairy products like khoa, burfi, and rasogolla (FSSR, 2012)^[4].

Use of high potency low calorie sweetener like sucralose by complete or partial replacement of calorie loaded sucrose in numerous food products has been attempted to reduce total calorie intake (Morlock and Prabha, 2007)^[12]. Management of lifestyle diseases such as obesity or diabetes mellitus has become much easier with such dietary options (Kroger *et al.*, 2006)^[9].

A considerable portion of today's functional food market consists of herbal supplemented functional foods. Dairy products, popular throughout the country, can be used effectively as carriers for herbs to satisfy the needs of health conscious consumers. Functional components present in the herbs aids in performing a wide range of biological functionalities. Among the herbs are *Hemidesmus indicus* and *Bougainvillea glabra* common in state of Kerala have been documented to have health benefits.

As stated by Khanna and Kannabiran (2007)^[8], *Hemidesmus indicus* is also known as Anantamul in Hindi, Nannari in Tamil whose root extracts are used as a coolant and a blood purifier. Various effects of *Hemidesmus indicus*, such as hypoglycemic, hypolipidemic, antioxidant, antiulcerogenic, hepatoprotective have been reported (Lakshmi and Rajendran, 2013)^[11].

Bougainvillea is a genus of bright flowering plants belonging to the Nyctaginaceae family and is also called as paper flower having shiny green and magenta or purple colored bracts (Kumar *et al.*, 2013) [10]. Among the Bougainvillea's varieties include *Bougainvillea glabra*, *Bougainvillea spectabilis*, and *Bougainvillea harrisi* (Adebayo *et al.*, 2009). *Bougainvillea spectabilis* is used in herbal combination for the treatment of diabetes (Simmonds and Howes, 2006) [14]. Information also exists about the use of *Bougainvillea glabra* in the cure of ulcer, diarrhoea and having anti-microbial activities (Edwin *et al.*, 2007) [3].

Keeping in view of the above facts the present study was undertaken with the objective of developing low calorie herbal basundi and analyse it for physico-chemical and microbiological characteristics.

Materials and Methods

Basundi was prepared by heat desiccation of cow milk as recommended by Aneja *et al.* (2002) [2]. Cow milk was thickened through evaporative heating with occasional stirring at the bottom. Thickening of the milk occurred by continuous boiling. For preparing low calorie herbal basundi, sucralose was added and stirred into milk until they were fully dissolved and then the milk was concentrated further to the consistency of the condensed milk. The pan was then removed from the fire, allowed to cool and the extracts of *Hemidesmus indicus* and *Bougainvillea glabra* were added and mixed well for uniform distribution.

For preparing traditional basundi, only sugar was added and

condensed to desired consistency. The product formulation was optimized by employing Response Surface Methodology. The final optimized formulation had sucralose of 70.98 ppm, *Hemidesmus indicus* and *Bougainvillea glabra* of 0.98 per cent and 0.20 per cent, respectively. The optimized product was taken for further analysis.

The chemical analysis was carried out as per IS: 1166 (1973) using analytical grade chemicals, the colour characteristics was measured by reflectance spectroscopy technique employing reflectance meter, colour flex (Hunter lab Miniscan XE plus Spectrocolourimeter, Virginia, USA) with geometry of diffuse/8° (sphere-8mm view) and an illuminant of D65/10° and the microbiological analysis was carried out as per IS: 1224: Part I and Part II (1981).

Results and Discussion

Low calorie herbal basundi was evaluated along with traditional basundi for its compositional profiles and the data generated was analyzed statistically using student's t-test and the results are summarized in Table 1.

No significant ($p \geq 0.05$) difference was observed in the proximate composition of low calorie herbal basundi and traditional basundi except in total solids content. The total solids content of low calorie herbal basundi (35.10 per cent) was significantly ($p < 0.01$) lower than traditional basundi (52.20 per cent). The significantly lower total solids content in low calorie herbal basundi is due to the complete replacement of sugar with sucralose. The results are in agreement with the findings of Neetha (2015) [13].

Table 1: Chemical composition of traditional basundi and low calorie herbal basundi

Parameter	Traditional basundi	Low calorie herbal basundi	t-value
Fat (%)	14.58±0.61	13.74±0.38	1.175 ^{ns}
Protein (%)	8.54±0.40	8.75±0.28	0.436 ^{ns}
Lactose (%)	10.33±0.34	10.36±0.43	0.058 ^{ns}
Total solids (%)	52.20±1.32	35.10±0.69	11.45 ^{**}
Acidity (% LA)	0.35±0.03	0.36±0.03	0.41 ^{ns}

Figures are the Mean ± Standard Error of three replications, ** - Significant at one per cent level ($p < 0.01$), ns - non-significant ($p \geq 0.05$)

Colour of food is the first quality parameter evaluated by consumers and is vital in acceptance of any product. The colour characteristics of product expressed in terms of L* (luminance or lightness component, which ranges from 0 to 100) and parameters a* (from green to red) and b* (from blue to yellow), which ranges from -120 to 120. Table 2 shows the colour characteristics of low calorie herbal basundi compared with traditional basundi and the data generated was statistically analysed using independent t-test.

The L* value of low calorie herbal basundi was 79.86 which was found to be significantly ($p < 0.05$) higher than traditional palada having L* value of 78.87. The a* value which is the

measure of redness also showed significant difference ($p < 0.01$) among the two samples. The traditional basundi had significantly lower a* value of -2.26 compared to 2.72 for low calorie herbal basundi. The b* value which measures yellowness was found to be 16.01 for low calorie herbal basundi which was significantly lower ($p < 0.01$) compared to a value of 18.99 for traditional basundi. The significant difference in L*, a* and b* values in low calorie herbal basundi may be due to the addition of herbal extracts affecting its colour characteristics. The results are in agreement with the findings of Adeola and Ohizua (2018) [1].

Table 2: Colour characteristics of low calorie herbal basundi

Parameter	Traditional basundi	Low calorie herbal basundi	t-value
L*	78.87±0.32	79.86±0.05	0.348*
a*	-2.26±0.99	2.72±0.12	31.759 ^{**}
b*	18.99±0.02	16.01±0.15	19.654 ^{**}

Figures are the average ± Standard Error of six replications, ** - Significant at one per cent level of significance ($p < 0.01$), * - Significant at five per cent level ($p < 0.05$)

The microbiological quality of basundi depends upon the microbial quality of ingredients used for manufacture as well as the equipment and personnel hygiene maintained during the manufacturing process. The standard plate count, coliform

count and yeast and mold count of low calorie herbal basundi samples were enumerated and compared with that of traditional basundi (Table 3).

The SPC and Yeast and Mould count was found to be log 10.62 and log 1.65 respectively. The microbial count obtained for traditional basundi was compared with that of low calorie herbal basundi and was found to be non-significant ($p>0.05$). The coliform was absent in both the samples. The hygienic

atmosphere during production might have been the reason for lower microbial load in the product. The results are in agreement with the findings of Gaikwad and Hembade (2011b)^[5] in Ujani basundi.

Table 3: Microbiological quality of low calorie herbal basundi

Microbial parameter	Traditional basundi (Log ₁₀ cfu/g)	Low calorie herbal basundi (Log ₁₀ cfu/g)	t-value
Standard plate count	10.65±0.02	10.62±0.01	1.021 ^{ns}
Coliform count	Absent	Absent	-
Yeast and mold count	2.33±0.50	1.65±0.53	0.934 ^{ns}

Figures are mean ± standard error of six replications, ns-non-significant ($p\geq 0.05$)

Conclusion

The developed product was analysed for its physico-chemical properties and microbiological characteristics. The product was found to contain 13.74 per cent fat, 8.75 per cent protein, 10.36 per cent lactose, 35.10 per cent total solids and 0.36 per cent lactic acid. The colour characteristics of basundi with L*, a* and b* were found to be 79.86, 2.72 and 16.01, respectively. Freshly prepared low calorie herbal basundi had a Standard Plate Count (SPC) of 10.62 log₁₀cfu/g and yeast and mould count of 1.65 log₁₀cfu/g. Coliform count was found to be absent in the samples.

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