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Nutrient enriched Sandesh the blend of buffalo milk, soya milk and mountain knot grass

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Abstract

The present study focuses on the development of nutrient-enriched Sandesh by incorporating buffalo milk, soymilk, and mountain knot grass (*Aerva lanata*) extract to enhance its nutritional and functional qualities. Sandesh, a traditional Bengali milk sweet, is valued for its protein, calcium, and energy content. However, conventional formulations are high in saturated fat and lack functional bioactive compounds. To address this, buffalo milk was partially substituted with soymilk at 10%, 20%, 30%, and 40% levels, along with the addition of 1-4% herbal extract. Soymilk contributes high-quality plant proteins, essential amino acids, and isoflavones, while reducing cholesterol and lactose content. *Aerva lanata* extract, rich in flavonoids, alkaloids, and antioxidants, adds medicinal value and improves the functional profile of the product. Five formulations, including a control, were prepared and evaluated through chemical and sensory analyses. Results showed that the enriched Sandesh contained 28.1% moisture, 2.7% ash, and 69% remaining nutrients. Sensory evaluation revealed that Sample T₂ (20% soymilk + 2% herbal extract) achieved the highest acceptability, offering superior flavour, texture, and overall quality. The study concludes that combining buffalo milk, soymilk, and mountain knot grass extract yields a healthier functional Sandesh without compromising traditional taste, making it suitable for modern consumers.

Keywords: *Aerva lanata*, bio active components, coagulation, isoflavones, sensory evaluation

Introduction

Sandesh is popular due to its palatability and aroma. It is a rich source of milk protein, fat, carbohydrate and vitamins like A and D (poonia, 2015) [13]. Sandesh is a well-known traditional Bengali milk sweet prepared from freshly curdled chenna and sweeteners such as sugar or jaggery. Sandesh is one of the heat-acid coagulated milk products available in India (Yadav., 1989; Patil, 2005) [7]. Sandesh continues to gain relevance not only as a traditional sweet but also as a promising base for modern product innovation in dairy and confectionery research and it is comparatively lighter than traditional syrup-based sweets like gulab jamun or rasgulla. The typical chemical composition of buffalo-milk Sandesh includes Moisture 27.14%, Fat 18.42%, Protein 18.71%, Sugar 33.83%, and Ash 1.90% (Parekh, 1994) [12]. Today, Sandesh continues to be a widely appreciated dessert available in both conventional sweet shops and modern confectioneries. The precipitation of milk involves the formation of large structural aggregates of whey protein such as α -lactalbumin (α -la), β -lactoglobulin (β -la), bovine serum albumin (BSA), immunoglobulins (Ig), and polypeptides proteose peptones (PP), in which milk fat, other colloidal and soluble solids such as carbohydrate, calcium, phosphate, vitamins (thiamine, riboflavin, niacin, ascorbic acid, vitamin B12, folic acid etc.), nitrogenous materials (ammonia amino acid, urea, creatine etc.), entrained with whey (Sahu., 2008) [15]. The preparation of Sandesh begins with fresh milk being boiled and curdled using lemon juice or vinegar to obtain soft chenna (cottage cheese). The chenna is strained through a muslin cloth and washed to remove excess acidity, after which it is kneaded thoroughly until smooth and lump-free. The mixture is then lightly cooked in a pan with sugar or jaggery, with continuous stirring to maintain its soft texture.

Once the mixture is thickened slightly, it is removed from heat, cooled, and shaped into small rounds or molded into decorative forms. Finally, Sandesh is garnished with saffron, cardamom, dry fruits, or silver leaf, resulting in a soft, mildly sweet delicacy. Several varieties of Sandesh are sold in the market and each variety of Sandesh differs in appearance, flavor, body and texture and composition (Aneja *et al.*, 2002)^[2].

Soybean is considered one of the most important plant-based protein sources used in human nutrition and food processing. Soybeans are an excellent and cheap source of calories and quality protein. They contain 35 - 40% protein and 18-20% fats and can therefore be useful in combating protein calorie malnutrition in the poorer starter of population. Regarding this soy milk (prepared from soybean) can be used as a replacement to milk to meet deficiency of whole milk. Incorporating soymilk with buffalo milk in Sandesh preparation improves both the nutritional profile and quality of the product. Soymilk, a plant-based alternative, provides high-quality proteins, essential amino acids, dietary fiber, is flavones, and contains little to no cholesterol. It contains more amount of protein content compared to cow milk. It is lactose free and easily digestible. It is also very economical to produce and a very good substitute for dairy and meat products (Arora *et al.*, 2018)^[3]. The water-holding capacity and texture of Sandesh are enhanced by the combination, giving it as softer body and smoother mouth feel. The lactose content of the sweet is reduced by partial substitution with soymilk, making it more tolerable for people with mild lactose intolerance. Soy protein products contain high concentration (up to 1 g/kg) of isoflavone that exerts protective properties against breast, prostate, colon and lung cancers (Giram *et al.*, 2022)^[6]. Soy proteins are highly digestible after proper heat treatment, and amino acid profile is almost well balanced except methionine to meet the requirements for human nutrition (Mazumder and Begum, 2016)^[10].

Mountain knot grass (*Aerva lanata*), widely used in Ayurveda and folk medicine, is rich in alkaloids, flavonoids, tannins, and phenolic compounds. The leaves contain phenolic compounds, alkaloids and steroids (Akanji *et al.*, 2018)^[1]. Ferulic acid, a phenolic derivative hydroxycinnamic acid, is regarded as a major active compound present in *A. lanata* (Rajasekaran and Gebrekidan, 2018)^[14]. Different parts of the plant are used across India for treating urinary disorders, headaches, skin ailments, digestive issues, kidney stones, wound healing, and general weakness. People in the Madhya Pradesh hamlet of Nagnular use the stem parts of this plant to tie around the necks of the livestock to get rid of worms in wounds (Nagaratna *et al.*, 2014; Gogte, 2000)^[11].

Aerva lanata leaves were found to have significant levels of crude protein (22.6 g/100 g), ash (31.2 g/100 g), and carbohydrates (26.6 g/100 g). *Aerva lanata* is extensively utilized by progressive scientific techniques which is reported to possess activities such as diuresis, urolithiasis, anti-inflammatory, antimicrobial, anti-diabetic, nephroprotective, hepatoprotective, anthelmintic and anti-diarrheal. Spices and herbs have risen to popularity as viable natural food preservatives in recent years because of growing interest in developing safe and efficacious natural food preservation methods (Martinez *et al.*, 2015)^[9]. The results could support the traditional use of *A. lanata* and provide essential data for the development of nutraceutical

products in order to use them as an alternative antioxidant treatment (Chewchinda *et al.*, 2019)^[4]. The protein and ash contents increase slightly in buffalo milk Sandesh. Sandesh made from buffalo milk using various suitable processing parameters gave a slightly better body and texture than that of cow milk Sandesh (Chaudhary *et al.*, 2013)^[5]. Blending buffalo milk with soymilk and incorporating mountain knot grass extract enriches Sandesh with functional qualities. The utilization of buffalo milk considering its probiotic effects as a functional food and natural remedy to various ailments, emphasizing the potential of innovation and the importance of milk-based products as health promoters (Vargas-Ramella *et al.*, 2021)^[8]. While mountain knot grass provides bioactive compounds with medicinal value. This results in a healthier, functional version of Sandesh without compromising taste. Thus, fortifying Sandesh with soy milk and mountain knot grass demonstrates that traditional sweets can be re-designed to enhance nutrition and offer added health benefits suitable for modern consumers.

Materials and method

Fresh buffalo milk, soybeans, sugar, lemon juice, condensed milk and mountain knot grass (*Aerva lanata*) were used for the preparation of Sandesh. All ingredients were procured from local markets and were of food-grade quality.

Method

All experimental procedures were undertaken in the Food Science Laboratory of Ideal College of Arts and Sciences, Kakinada. All the raw materials were collected from different local sources. Fresh buffalo milk was procured from a nearby dairy farm. The remaining ingredients were purchased from a local supermarket.

Mountain knot grass leaves were freshly handpicked from a nearby garden. Potable water was used throughout the process, and it was ensured that the materials were clean and free from any kind of infection and contamination.

Preparation of Soy Milk

Soy milk was prepared using cleaned and graded soybean seeds (50 g). The seeds were washed thoroughly and soaked overnight in potable water. After soaking, the hydrated beans were washed again to remove the outer husk. The dehulled beans were blended with water at a ratio of 1:4 (w/v) to obtain a uniform slurry. This slurry was filtered through fine muslin cloth to separate the liquid extract from the residue. The processed soy milk was stored under refrigeration until further use.

Preparation of mountain knot grass (*Aerva lanata*) extract

Aerva lanata leaves were used to obtain the functional herbal extract. Fresh leaves of mountain knot grass were soaked in water and boiled gently for 10-15 minutes to allow the bioactive compounds to dissolve. The mixture was filtered through muslin cloth, and the clear extract was collected. The extract was cooled to room temperature before being incorporated into the Sandesh mixture.

Preparation of chenna

Buffalo and soya milk was brought to a boil with continuous stirring to avoid scorching. Once boiling was reached,

lemon juice (20 ml) diluted with warm water was added gradually with gentle mixing until complete coagulation occurred. The formed curd (Chenna) was allowed to settle for a few minutes and then strained through clean muslin cloth. The whey was drained, and the chenna was washed with cold water to remove residual acidity. It was then pressed lightly to remove excess moisture and kneaded until a soft, smooth, and uniform texture was obtained.

Formulation of Soy-Milk-Enriched and Herbal Sandesh

Buffalo and soya milk chenna, soy milk, powdered sugar (30 gm), condensed milk (20 g) and the herbal extract were blended in different ratios to develop four formulations along with one control sample. All mixtures were cooked over low heat with constant stirring until a soft dough-like consistency was achieved. The final product was molded into uniform shapes and allowed to cool.

Composition of product variation

Table 1: Composition of ingredients used in preparation of nutrient enriched Sandesh

Sample	Buffalo milk (ml)	Soya milk (ml)	Mountain knot grass extract (ml)	Condensed milk (gm.)	Sugar (gm.)	Citric acid (gm.)
Control	100	00	0%	standard	standard	standard
T ₁ (9:1)	90	10	1%	standard	standard	standard
T ₂ (8:2)	80	20	2%	standard	standard	standard
T ₃ (7:3)	70	30	3%	standard	standard	standard
T ₄ (6:4)	60	40	4%	standard	standard	standard

Five different formulations were prepared, including one control and four treatments. The control sample consisted entirely of buffalo milk with no soymilk added. Buffalo milk was progressively replaced with soymilk at different levels. Along with the milk base, fixed amounts of mountain knot grass extract, condensed milk, sugar, and citric acid were added to all samples to maintain uniformity. The purpose of preparing these variations was to evaluate the effect of partial substitution of buffalo milk and soymilk with mountain knot grass extract on the quality characteristics of the final product.

Quality evaluation

Quality evaluation of the product was carried out by using instruments (objective analysis) as well as sensory evaluation (subjective analysis).

Ash content

The ash content of the prepared Nutrient enriched Sandesh was estimated at 2.7%, which reflects the total mineral composition of the product. A higher ash percentage is generally associated with the presence of essential minerals such as calcium, phosphorus, and iron, which contribute to the nutritional value of milk-based sweets. The incorporation of mountain knot grass may have further enriched the mineral profile, resulting in the observed value. An ash content of 2.7% not only indicates the product's enhanced nutritive quality but also highlights its potential as a functional dairy confection with added health benefits.

Remaining chemical composition

The remaining chemical composition of Nutrient enriched Sandesh, comprising carbohydrates, protein, and fat, was calculated to be 69.0%. This major fraction represents the primary nutrient load of the product, contributing to its energy density and overall nutritive value. Carbohydrates provide sweetness and bulk, proteins support body-building functions, and milk fat enhances flavor, richness, and mouth feel. The presence of this substantial nutrient portion, along with controlled moisture and appreciable ash content, confirms that the prepared Sandesh is not only texturally stable but also nutritionally balanced, offering both sensory appeal and health benefits.

Subjective analysis

Sensory evaluation

The sensory quality of the control and experimental nutrient enriched Sandesh was evaluated by a panel of judges on a 9 point hedonic scale. Where a score of 9 = like extremely, 8 = like very much, 7 = like moderately, 6 = like highly, 5 = Neither like nor dislike, 4 = Dislike slightly, 3 = Dislike moderately, 2 = Dislike very much, and 1 = Dislike extremely. The sample of Sandesh was analyzed for sensory parameters like color, appearance, flavour, texture, taste and overall acceptability. The studies of sensory scores of control and different treatments of nutrient enriched Sandesh prepared with buffalo milk and soymilk and mountain knot grass are shown in Table 2.

Table 2: Sensory evaluation scores of nutrient enriched Sandesh

Attributes	Control	T ₁	T ₂	T ₃	T ₄
Color	9	9	9	9	9
Taste	9	8	8	8.5	8
Texture / mouth feel	9	8	9	8.5	8
Flavor	9	9	8	8	8
Overall Acceptability	9	9	9	8.5	8

Results and Discussion

The incorporation of soy milk and mountain knot grass extract had a noticeable effect on both the nutritional value and sensory characteristics of Sandesh. Samples enriched with soy milk exhibited improved softness and a lighter texture due to the presence of plant proteins. *Aerva lanata* extract imparted a mild herbal flavour and improved functional properties without compromising acceptability.

Among all formulations, Sample T₂ (20% soy milk + 2% herbal extract) received the highest scores for flavour (8.0), taste (8.0), colour (9), texture (9), and overall acceptability (9.0). The results show that soy milk can successfully replace part of buffalo milk without negatively affecting product quality. The findings of the present study are supported by earlier reports, which indicates that Sandesh with 75% cow milk chhana and 25% Soy-milk Chhana was liked moderately. Addition of flavor substitutes will enhance the organoleptic properties of Soy-milk Chhana and it can be used as a replacement of Cow-milk Chhana in preparation of Sandesh. Thus, the fortified Sandesh is nutritionally superior, rich in plant protein, lower in fat, and

contains bioactive herbal compounds. This approach demonstrates the potential for developing functional dairy-based desserts that combine traditional taste with modern nutritional benefits.

Summary and Conclusion

The present study focused on the development of nutrient-enriched Sandesh by partially replacing buffalo milk with soy milk and adding mountain knot grass (*Aerva lanata*) extract. The results showed that the prepared Sandesh had improved nutritional quality without affecting its sensory properties.

Among all the formulations, Sample T₂ (20% soy milk + 2% herbal extract) showed the highest acceptability in terms of colour, taste, texture, flavour, and overall quality. The addition of soy milk increased the protein content and reduced lactose and cholesterol levels, while *Aerva lanata* extract contributed valuable bioactive compounds with health benefits.

Hence, nutrient-enriched Sandesh can be considered a healthier alternative to traditional Sandesh and has good potential as a functional dairy-based sweet for modern consumers.

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