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NUTRITIONAL COMPOSITION AND PHYTOCHEMICAL SCREENING OF VALUE-ADDED CANDY

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Abstract: Value-added candy is an expanding part of the confectionery market, defined by the inclusion of improved nutritional content, creative ingredients, and health-oriented benefits. This study investigated the creation of value-added candies, focusing on their formulation, production methods, and market trends. Key ingredients such as sea buckthorn berries, amla and superfoods like sesame seeds were incorporated in the developed candy. The main aim of this research was to create value-added candy which was prepared in three different variants (A, B and C) with different proportions. The most accepted variant of developed value-added candy was conducted for micronutrients analysis and phytochemical screening and compared with the standard. Our results indicated that micronutrients like vitamin C, calcium, iron and zinc were higher in the developed value-added candy and revealed significant difference ($p<0.05$) when compared with the standard. The developed candy, enriched with vitamins, minerals, and bioactive compounds, aims to satisfy the growing consumer demand for healthier choices without sacrificing flavor.

Keywords: Hippophae rhamnoides, sesame seeds, amla, flavonoids, micronutrients

1. Introduction

Sea buckthorn (Hippophae rhamnoides) is a perennial deciduous shrub from the Elaeagnaceae family, native to cold regions around the world, particularly in India, Mongolia, Tibet, China, Pakistan, Russia, Nepal and Canada (Singh. 2018). Sea buckthorn extracts are used in cosmetic products that are distributed worldwide. The products including skin cream, shampoo, moisturizers, hair lotions, bath soaks, mouthwash and facial masks, all formulated from sea buckthorn (Smida et al. 2019). Sea buckthorn berries have been well-known for their high nutritional value and medicinal properties for a long time. Sea buckthorn berries contain flavonoids, including leucoanthocyanidins, catechins, and flavonols. t is recognized as a rich source of essential minerals like potassium sodium, calcium, phosphorus and magnesium (Olas. 2016). Sea buckthorn is rich in vitamins, with vitamin C being the most abundant. It also contains small amounts of vitamins like B1, B2, B6, and K. (Chen et al. 2023). Having been used for centuries in Europe and Asia, sea buckthorn berries' nutritional and medicinal benefits have sparked a recent global surge in popularity. Sea buckthorn is used in around 200 industrial products, including traditional and herbal medicines for treating burns, neurological disorders, heart disease, liver issues, cancer, and ulcers (Ciesarová et al. 2020).

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Scientific Classification

Kingdom	Plantae
Division	Spermatophyta
Class	Dicotyledonae
Order	Elaeagnales
Family	Elaeagnaceae
Genus	Hippophae
Species	Hippophae rhamnoides

Amala (Phyllanthus emblica L.) a native fruit found in the tropical and subtropical regions of Southeast Asia, is a rich source of ascorbic acid, tannins, flavones, polyphenols, and other bioactive components (Poonam and Mahanta. 2014). Amla is one of the oldest fruits in India and is often referred to as the "Wonder fruit for health" due to its remarkable qualities. Amla, known as gooseberry in English, offers significant nutritional and therapeutic benefits. Due to its exceptional nutritional value and therapeutic benefits, it is transformed into various products. Various amla products, such as leather, murabba, chutney, juice, beverages, jam, powder, candy, and cheese are favored by consumers for their high content of vitamin C and antioxidants **(Yang et al. 2008).** So, present study is concerned with the effort to evaluate the phytochemicals and nutritional compositions and phytochemical screening of the value-added candy.

2. Materials and Methods

2.1 Collection of Raw Materials

Sea buckthorn (Hippophae rhamnoides) berries were sourced from Kyelang Valley, commonly called as Kyelong, a town situated in the central region of Lahul and Spiti, Himachal Pradesh, India. Himachal Pradesh, India. Amla and sesame seeds were procured from the local market of Banasthali Vidyapith, India.

2.2 Composition of Value-added Candy

The experiment comprised of treatments combination of amla, sea buckthorn juice and sesame seeds as follows (Table 1):

Table 1: Treatments in value-added candy

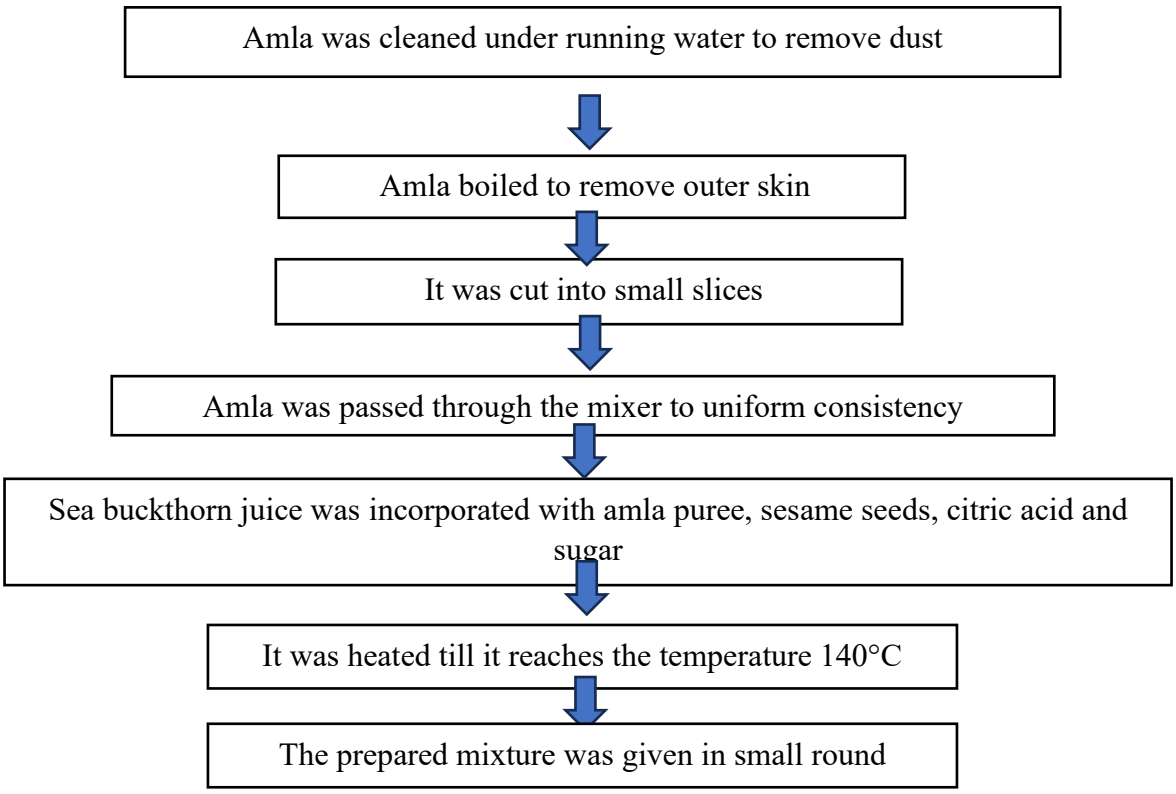
S. N	Composition	Variants
1.	100% Amla	Standard
2.	10% Sea buckthorn + 43% Amla +10% sesame seed	A
3.	20% Sea buckthorn + 38% Amla +10% sesame seed	B
4.	30% Sea buckthorn + 33% Amla + 5% sesame seed	C

2.3 Preparation of Value-added Candy

Amla was washed properly in running water to clean. Fruits were blanched in boiling water for 10 minutes. Then seeds were removed and segments were separated. For the extraction of juice,

sea buckthorn berries were washed and blended in an electric blender. After that berries mash was strained through sieve and stored in air tight glass containers.

Flow Chart of Preparation of Value-added Candy



2.4 Sensory Evaluation

Sensory evaluation is the common experimental structure evaluating the products for their acceptance. The overall acceptability of jam was based on mean scores obtained for all the sensory characteristics like appearance, color, texture, taste and flavor. The evaluation was carried out by numerical scoring method with the help of 20 semi trained panel members. The evaluation was done with 9-point hedonic scale. The scale ranged from “likely extremely” to “dislike extremely”, corresponding to the highest and lowest score of “9” and “1”, respectively.

2.5 Nutritional Analysis

To determine the calcium and iron levels, an ash solution was prepared. Using spectrophotometry, Wong's approach was used to assess iron (Raghuramulu and Madhavan. 2003). The Titrimetric Method was used to estimate the calcium content and standard potassium permanganate was used for titration (Sharma, 2007). Zinc was determined by flame Atomic Absorption Spectrophotometery (AOAC. 2012). Vitamin C was estimated by titration method (Sharma. 2007).

2.6 Phytochemical Screening

Flavonoids were determined by the Alkaline reagent test (Tiwari et al. 2011) and Alkaloids were estimated by Wanger's test (Tiwari et al. 2011). Steroids were determined by the

Salkowski test (Krishnaveni et al. 2016). Tannins were determined by the method given by (Van Buren and Robinson. 1969).

2.7 Data Analysis

The Student's t-distribution is typically employed to assess the significance of various findings derived from small sample sizes (De Winter. 2019).

Calculation:

$$t = \frac{\bar{x}1 - \bar{x}2}{S} X \sqrt{\frac{n1 - n2}{n1 - n2}}$$

$$t = \frac{\bar{x}1 - \bar{x}2}{S} X \sqrt{\frac{n1 - n2}{n1 - n2}}$$

$\bar{x}_1$ = First sample mean

$\bar{x}_2$ = Second sample mean

n_1/n_2 = Number of observation in first/second sample

S = Combined standard deviation

3. Results and Discussion

The sensory score of the value-added candy along with the standard are shown in figure 3 (a). In terms of texture, variant A and variant B of candy got the equal scores. However, the mean sensory score for all the attributes, variant A of candy was the most acceptable (8.2±0.3) and there was no significant difference ($p \geq 0.05$) when compared with the standard. It was followed by variant B (8.0±0.6) and variant C (7.8±0.7) of candy. Variant C of candy incorporated with 30% sea buckthorn juice was the least acceptable in terms of overall acceptability and exhibited significant difference ($p < 0.05$) when compared with the standard.

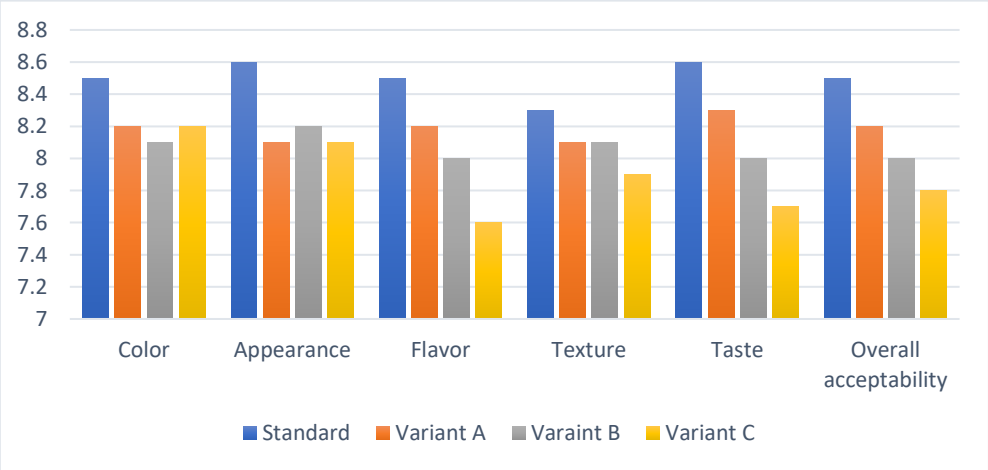


Figure 3 (a): Sensory evaluation of value-added candy

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The nutrient content of the most accepted variant of candy along with the standard is illustrated in figure 3 (b). The micronutrients of variant A showed significant difference ($p<0.05$) when compared with the standard. Variant A of candy incorporated with 10% sea buckthorn juice showed higher content of vitamin C (200.7±0.05 mg/100g), calcium (176.2±0.23 mg/100g), iron (2.7±0.01 mg/100g) and zinc (1.6±0.01 mg/100g) than standard.

For comparison, Katke et al. (2018) conducted micronutrient analysis on sugarless amla candy. The amla candy exhibited lower value of iron (0.60 mg/100g) but higher content of vitamin C (231 mg/100g) than present study. Another study was done by Ray et al. (2021), in which nutrient analysis was done on jackfruit caramel candy. In their study the value of zinc (3.64 mg/100g) was closer to the present study. Study performed by Shukla and Kandra (2015), conducted micronutrient analysis on candy made by white sesame seeds and dried dates. The developed candy exhibited lesser content of calcium (130±2.07 mg/100g) as compared to our study.

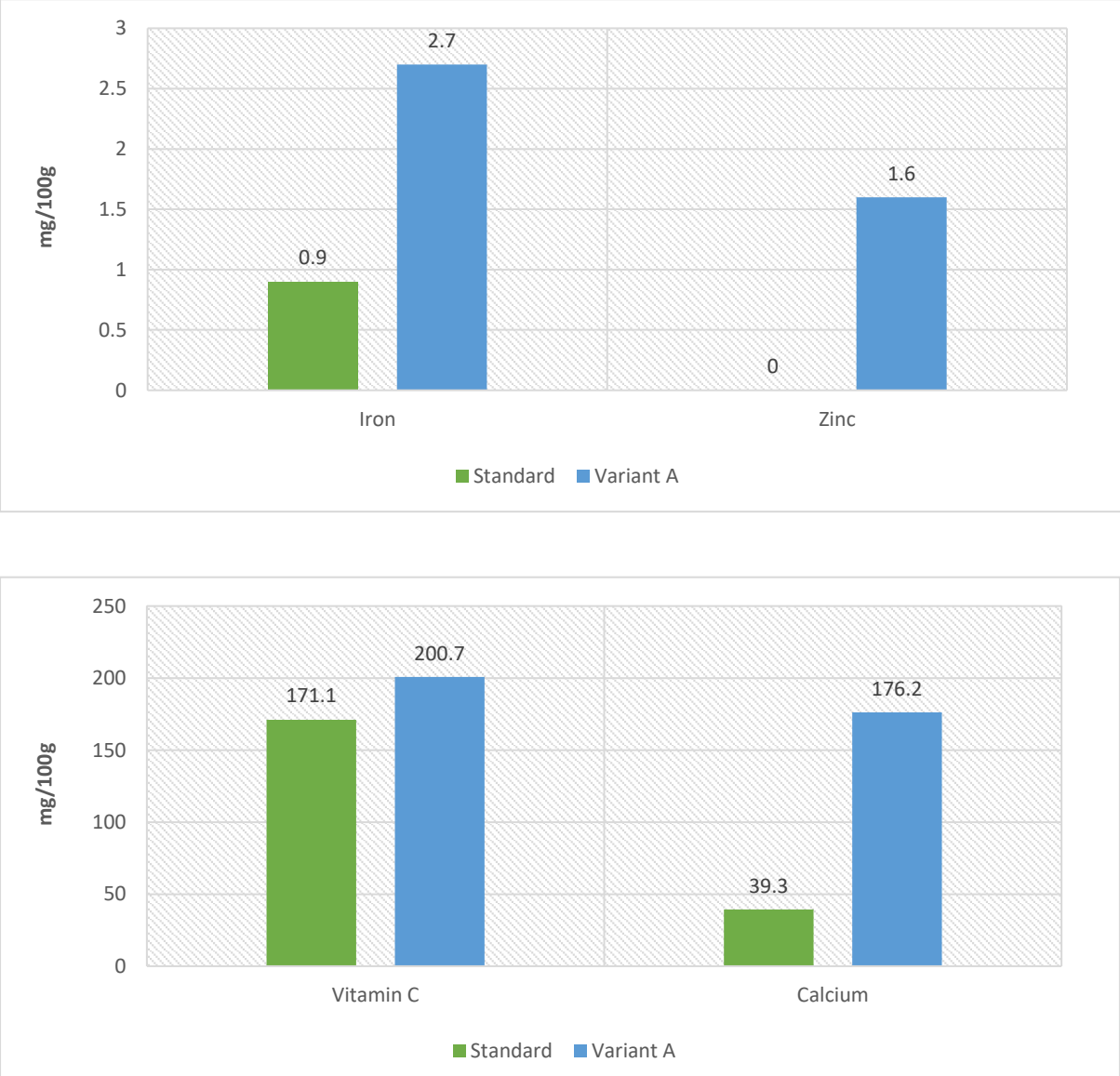

Figure 3 (b): Micronutrients analysis of the most accepted variant of value-added candy

Table 3 (c) showed the presence of qualitative phytochemical in aqueous extract of the most accepted variant of candy along with the standard. The results depicted the selected phytochemicals; flavonoids, tannins, alkaloids, saponins and steroids were found in both variant A as well as standard.

Phytochemical analysis was conducted on the most accepted variant of candy and compared with standard in aqueous extract. All phytochemicals; flavonoids, tannins, saponins, alkaloids and steroids were present in aqueous extract of developed candy as well as in the standard. Study conducted on herbal candy showed the presence of all alkaloids, flavonoids, tannins, and saponins and were similar to our study (Hooda. 2015).

Table 3: Phytochemical screening of the most accepted variant of value-added candy

Phytochemical	Standard	Variant A
Flavonoids	+	+
Tannins	+	+
Alkaloids	+	+
Saponins	+	+
Steroids	+	+

4. Conclusion

In conclusion, sea buckthorn berries and sesame seeds notably enhanced the nutritional profile of the developed candy. Vitamin C and minerals like iron, calcium and zinc were found to be higher in variant A of developed candy as compared to the standard. The qualitative evaluation of phytochemicals revealed flavonoids, tannins, alkaloids, saponins and steroids were present in both standard and variant A of candy. t can be concluded that sea buckthorn berries and sesame seeds are highly effective for value addition, as their functional properties make them advantageous in product development. Incorporating them into food products helps satisfy the increasing consumer demand for functional and nutrient-rich options, making them essential for innovation in the food industry.

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