



ISSN Print: 2664-844X
ISSN Online: 2664-8458
NAAS Rating: 4.97
IJAIFS 2025; 7(4): 124-127
www.agriculturaljournals.com
Received: 15-02-2025
Accepted: 17-03-2025

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Development and quality evaluation of Aonla (*Phyllanthus emblica L.*) candy using different Aonla fruit varieties

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DOI: <https://www.doi.org/10.33545/2664844X.2025.v7.i4b.346>

Abstract

Aonla (*Phyllanthus emblica L.*), Indian gooseberry is a fruit renowned for its high nutritional value, particularly its rich content of vitamin C, antioxidants, and phenolic compounds. Despite its numerous health benefits, the fruit's astringent and sour taste often limits its direct consumption, making it difficult to incorporate into regular diets. This study suggests that selection of appropriate Aonla variety plays a critical role in determining the quality of the final product. The present study was conducted to develop Aonla candy using different Aonla fruit varieties and to evaluate their effect on quality attributes. The research involved selecting four Aonla varieties Chakaiya, NA-7, Banarasi, and Krishna and processing them into candy using standardized osmotic dehydration techniques through a combination of blanching, osmotic dehydration in sugar syrup at varying concentrations (45°Bx, 50°Bx, and 70°Bx), followed by drying in a tray dryer at 60°C. The prepared candies were evaluated for a range of physicochemical properties, including moisture content (20.16%), Protein (0.43%), vitamin C (240mg/100g), Fiber Content (4.97%), Ash Content (0.23%) and Titrable Acidity (1.46%). Results revealed significant varietal differences in sensory acceptability and nutritional content with the NA-7 variety candy.

Keywords: Aonla, *Phyllanthus emblica*, Aonla variety, Aonla candy, value-added product, osmotic dehydration, sensory evaluation

Introduction

Indian gooseberry (*Phyllanthus emblica L.*), commonly known as Aonla, is widely regarded as a valuable gift of nature and is often referred to as a "wonder fruit for health" due to its exceptional medicinal and nutritional properties. Among the prominent cultivars of Aonla are Chakaiya, NA-7, Banarasi, Hathijhool, Bansi Red, Pink-tinged, and Krishna. In India, Aonla is cultivated over an area of approximately 50,000 hectares, yielding an estimated annual production of around 200,000 metric tonnes. The average yield per tree ranges from 100 to 300 kilograms per year (Goyal *et al.*, 2008) [4]. The fruit is highly nutritive, being one of the richest natural sources of vitamin C, and is extensively used in traditional and modern medicinal systems.

Due to its versatility and functional properties, Aonla serves as an ideal raw material for a wide range of value-added products. In the beverage segment, products such as Aonla juice, squash, and sherbet are popular for their refreshing flavor and health-promoting benefits. In the category of preserved foods, Aonla is processed into murabba, pickle, candy, and powder, valued for their extended shelf life and convenient consumption. Furthermore, Aonla is incorporated into various health and dietary supplements, including capsules, tablets, herbal teas, and chyawanprash, owing to its immune-boosting and general wellness-enhancing attributes. Aonla candy is a widely recognized value-added product, offering an optimal combination of nutritional benefits and sensory appeal. It falls under the category of candied fruits products derived by impregnating fruits with concentrated sugar syrup, followed by draining and drying processes. Such products are known for their extended shelf life, concentrated nutrient profile, reduced bulk, and high consumer acceptability. Aonla candy, in particular, has gained popularity due to its health-promoting properties, minimal thirst-inducing nature, and convenience as a ready-to-eat snack (Ranote and Singh, 2006) [2].

Different Aonla varieties differ significantly in physical, chemical, and sensory attributes, which can influence the quality of processed products. However, limited research has been done to compare the suitability of various Aonla cultivars for candy production. Therefore, this study aims to assess the impact of different Aonla varieties on the development and quality of Aonla candy.

Materials and Methods

Selection of Raw Materials

The different varieties of Aonla fruits required such as Chakaiya, NA-7, Banarasi, Krishna for preparation of candy and other materials such as sugar, alum solution were procured from the local market, Kolhapur, Maharashtra, India. Fruits were sorted for uniform size, color, and absence of defects.

Methods

The physical properties of different of Aonla fruits varieties size was evaluated using a digital gauge meter of about 0.01mm precision. The weight of 10 fruits randomly selected was measured by weighing balance (AOAC, 2000). The nutritional parameters of different varieties of Aonla fruits such as moisture, protein, fat, fibre, ash, carbohydrate, titrable Acidity, Vitamin C (mg/100gm) and Total Sugar were determined by using standard methods (AOAC, 2000). The energy value of food is typically calculated based on the macronutrient content: carbohydrates, proteins and fats. The formula for calculating the energy value is:

$$\text{Energy (kcal)} = (\text{carbohydrate} \times 4) + (\text{protein} \times 4) + (\text{fats} \times 9) \dots (1)$$

For the preparation of Aonla candy, only healthy, disease-free, pest-free, and bruise-free mature fruits were selected to ensure optimal product quality. Initially, the fruits were pricked and soaked in a 2% sodium chloride (NaCl) solution for 24 hours to reduce bitterness and enhance textural properties. After soaking, fruits were thoroughly washed under running tap water to remove residual salt. Subsequently, the fruits were blanched in boiling water for 10 minutes, as per the method described. The blanched fruits were then deseeded and segmented manually, following the procedure outlined by Kumar *et al.* (2001) [13]. These segments were further soaked in a 2% alum (aluminium potassium sulfate) solution for 24 hours to promote tissue firmness. The following day, segments were rinsed thoroughly to eliminate residual alum.

The osmotic dehydration process was carried out based on the protocol described by Tandon *et al.* (2006) [13]. The pretreated fruit segments were initially immersed in 45° Brix sugar syrup at room temperature for 24 hours. After soaking, the same syrup was concentrated by heating to 70° Brix, cooled to ambient temperature, and reused for further steeping. The fruit segments were again soaked in this 70° Brix syrup for an additional 72 hours to achieve osmotic equilibrium. This step ensured adequate sugar impregnation while preserving the structural and sensory qualities of the fruit. After osmotic treatment, the fruit segments were removed from the syrup, washed gently to remove residual surface sugar, and evenly distributed on aluminum trays. Drying was carried out in a cross-flow cabinet tray dryer at 60°C until the product attained a leathery texture and a final moisture content of approximately 15%. The dried Aonla

candy was then cooled to room temperature, packed in appropriate packaging materials, and sealed immediately to prevent moisture uptake and contamination.

Quality Evaluation of Prepared Aonla candy

The nutritional parameters of different varieties of Aonla Candies such as moisture, protein, fibre, ash, titrable Acidity and Vitamin C (mg/100gm) were determined by using standard methods (AOAC, 2000). The candy sample have been evaluated for different sensory attributes such as appearance, colour, texture, flavour, taste and overall acceptability by using 9-point Hedonic scale with the help of 20 member panel. The mean of observations has been considered for evaluating the quality of prepared candy.

Results and Discussions

Quality Evaluation of Fresh Aonla Fruits

The physical attributes assessed for the selected Aonla varieties included fruit length, diameter, and weight. Among the four varieties examined, Chakaiya exhibited the greatest fruit length at 3.54 cm, followed by Banarasi (3.41 cm), Krishna (3.30 cm), and NA-7 (3.21 cm), indicating slight varietal differences in longitudinal dimensions. In terms of fruit diameter, Chakaiya again recorded the highest mean value at 4.38 cm, whereas NA-7 had the lowest diameter (4.24 ± 0.04 cm). The Krishna and Banarasi varieties recorded intermediate values of 4.34 cm and 4.32 cm, respectively. Fruit weight across the varieties was relatively uniform, with only marginal differences observed. NA-7 exhibited the highest mean weight (43.90 g), while Banarasi had the lowest (43.20 g). Chakaiya and Krishna showed intermediate weights of 43.67 g and 43.32 g, respectively. These findings suggest that while all varieties share similar physical characteristics, minor differences in size and weight may influence their processing behavior and suitability for specific value-added applications, such as candy production.

The proximate composition and biochemical characteristics of four Aonla varieties Chakaiya, NA-7, Banarasi, and Krishna were analyzed to evaluate their nutritional potential and processing suitability. Among the varieties, Krishna exhibited the highest moisture content at 85.64%, whereas NA-7 recorded the lowest at 81.22%. Protein content was highest in NA-7 (2.14%) and lowest in Krishna (1.74%), indicating moderate variation across genotypes. Fat content varied among the cultivars, with Krishna exhibiting the highest value (1.2%), while Chakaiya and Banarasi both recorded the lowest (0.8%). The crude fiber content ranged from 2.71% in Krishna to 1.8% in NA-7, indicating a notable difference in dietary fiber concentration. Ash content, which reflects total mineral content, remained relatively stable across all varieties, ranging between 0.30% (Banarasi) and 0.33% (NA-7). In terms of carbohydrate content, Banarasi recorded the highest value (15.78%), while Krishna had the lowest (11.12%). Titrable acidity was found to be highest in Chakaiya (1.46%), followed by NA-7 and Krishna, with Banarasi recording the lowest value (1.24%). Vitamin C content, a key biochemical parameter, was highest in NA-7 (670.82 mg/100g) and lowest in Krishna (655.78 mg/100g), though the variation was relatively minor. Total sugar content remained consistent at 10.74% across all four varieties. These results indicate that while the Aonla varieties share many common nutritional traits, significant differences exist in moisture, protein, fat,

fiber, and biochemical parameters, which may influence their functionality and suitability for specific processing applications such as candy, juice, or nutraceutical products.

Quality Evaluation of Prepared Aonla candy

The key nutritional and biochemical parameters assessed in Aonla candies prepared from four different cultivars Chakaiya, NA-7, Banarasi, and Krishna included moisture content, protein, fiber, ash, titratable acidity, and vitamin C content. Moisture content exhibited slight variation across the varieties, ranging from 19.10% in Chakaiya to 21.24% in Banarasi, indicating differential water retention post-processing. Protein content was relatively low in all samples, with NA-7 recording the highest value (0.43%), and Banarasi the lowest (0.36%). Crude fiber content, indicative of dietary fiber levels, was found to be highest in NA-7 (4.97%) and lowest in Krishna (3.85%), suggesting variability in roughage content among the cultivars. Ash content, representing the total mineral matter, ranged from 0.20% in Chakaiya to 0.31% in Krishna. Titratable acidity, an important parameter related to sensory characteristics and preservation, was observed to be highest in Krishna (1.52%) and lowest in Chakaiya (1.38%), reflecting differences in organic acid concentrations. Regarding vitamin C content, which is a critical nutritional component in Aonla-based products, NA-7 exhibited the highest concentration (240 mg/100g), while Banarasi recorded the lowest (229.5

mg/100g). These findings align with earlier observations reported for similar Aonla varieties, confirming consistent varietal differences in nutritional composition.

Sensory Evaluation of Fresh Aonla Candy of Different Varieties.

Sensory evaluation of Aonla candy prepared from four different cultivars revealed distinct variations in consumer acceptability shown in Table 1. The cultivar NA-7 recorded the highest overall acceptability score (8.1), demonstrating superior performance in key sensory parameters such as appearance (8.45), color (8.2), and flavor (8.15). These attributes contributed to its classification as the most preferred variety among the panelists. The Krishna variety also exhibited favorable sensory attributes, with an overall acceptability score of 7.9, particularly excelling in taste (8.1) and color (8.0). Banarasi, with an overall score of 7.5, received moderate ratings, though it recorded the lowest score in flavor (6.45), which may have adversely impacted its overall preference. Chakaiya, while consistent across parameters, received the lowest overall score (7.37) and was ranked least preferred among the four varieties. Based on the combined results of chemical composition and sensory evaluation, Sample No. 2 (NA-7) was identified as the most suitable for further analysis. Consequently, this variety was selected for detailed storage studies to assess the effect of different packaging materials on quality retention over time.

Table 1: Sensory analysis of all prepared samples

Sample No.	Appearance	Colour	Texture	Flavour	Taste	Overall Acceptability
	Score					
Sample 1 (Chakaiya)	7.35	7.5	7.0	7.25	7.4	7.35
Sample 2 (NA-7)	8.45	8.2	8.15	8.15	8	8.1
Sample 3 (Banarasi)	7.45	7.35	7.35	6.45	7.35	7.5
Sample 4 (Krishna)	7.9	8	7.8	7.8	8.1	7.9

Conclusion

The study concludes that the choice of Aonla variety significantly affects the quality and acceptability of Aonla candy. Among the four varieties tested, NA-7 was the most suitable based on chemical composition and sensory evaluation. This finding underscores the importance of varietal selection in the development of value-added products, as it significantly influences nutritional quality, organoleptic properties, and overall consumer acceptability. Utilizing the appropriate variety, such as NA-7, can enhance product appeal and functionality, thereby supporting successful commercialization and wider consumer adoption.

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