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STUDIES ON PRE AND POST PROCESSING QUALITY CHANGES IN DIFFERENT RECIPES OF AONLA SHREDS

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ABSTRACT

Aonla (*Emblica officinalis*), nutrient-dense fruit rich in vitamin C and polyphenols, is often consumed in processed forms due to its sourness and astringency. This study investigates the effects of different spice combinations on the biochemical properties and sensory quality of aonla shreds during storage. Seven recipes (R1-R7) were formulated using a variety of spices including ginger, cardamom, fennel, and lime juice. The post processing biochemical analysis revealed significant variations in pH, total soluble solids (TSS), acidity, total sugar, and ascorbic acid content as compare to fresh aonla, across the recipes. Recipe 2 exhibited the highest ascorbic acid content. Sensory evaluation indicated that R1 and R2 were the most favoured recipes, particularly for appearance, taste, colour, aroma, texture and overall acceptability. The study suggests that the incorporation of spices enhances not only the sensory attributes but also the nutritional stability of aonla shreds, with R2 being the most promising recipe for processing due to its high ascorbic acid retention and balanced sensory profile. This research highlights the potential of spice-infused aonla shreds as a functional, nutritionally rich snack with market appeal.
Keywords **:** Aonla shred, sensory evaluation, spice combinations and vitamin C.

Introduction

Aonla (*Emblica officinalis*), commonly known as Indian gooseberry, is a highly nutritious tropical fruit recognized for its exceptional content of vitamin C, polyphenols, and dietary fibre. Owing to its strong antioxidant and therapeutic properties, it has long been revered in Ayurvedic medicine for treating various ailments including digestive disorders, skin conditions, and respiratory issues. However, its natural sourness and astringency pose sensory challenges that limit its direct consumption and market appeal. To overcome these challenges, various value-added products such as candies, preserves (murabba), juices, and dehydrated powders have been developed to make aonla more palatable and accessible. Among these processing methods, the use of spices is a traditional technique in Indian culinary practices that enhances flavour, masks its astringency, and contributes additional health benefits. Spices such as ginger, cardamom, fennel and lime are not only valued for their sensory appeal but also possess functional properties including antimicrobial, antioxidant, and digestive effects. The growing consumer demand for natural, minimally processed, and functional foods has created opportunities for developing spice-infused fruit snacks that retain their nutritional integrity. Recent studies have explored the integration of spices into fruit-based products to improve shelf life, flavour profile, and overall acceptability. However, limited research has focused on the effect of different spice combinations on the nutritional and sensory quality of aonla shreds during storage. Objective of the study is mainly to evaluate the effect of processing on retention of antioxidant components of value added aonla shreds by

assessing the pH, acidity, ascorbic acid, total sugar and sensory appeal of fresh aonla fruit and aonla shreds, thereby enhancing its market potential as a functional snack.

Materials and Methods

Fresh and uniform-sized mature aonla fruits were purchased from local markets. After thorough washing, the fruits were manually deseeded and shredded. To minimize enzymatic browning, the shredded aonla was blanched for five minutes. Seven recipes (R1 to R7) were formulated using different combinations of traditional Indian spices. The recipes were as follows:

R_1 consisted of aonla (800 g) blended with lime juice (15%), cardamom (5%), and salt (5%)

R_2 included aonla (800 g) with ginger juice (5%), cardamom (5%), and salt (5%)

R_3 contained aonla (800 g) with fennel (5%), cardamom (5%), and salt (5%)

R_4 was composed of aonla (800 g) lime juice (15%), ginger (5%), cardamom (5%), and salt (5%)

R_5 combined aonla (800 g) with lime juice (15%), fennel (5%), cardamom (5%), and salt (5%)

R_6 included aonla (800 g), fennel (5%), ginger (5%), cardamom (5%), and salt (5%)

R_7 comprised aonla (800 g), fennel (3%), ginger (3%), lime juice (15%), cardamom (5%), and salt (5%).

All spiced aonla shred samples were stored in sterilized containers and analysed for both biochemical and sensory properties. Biochemical parameters included total acidity, pH, ascorbic acid, total soluble solids (TSS), total sugar, reducing sugar, and non-reducing sugar, determined using standard procedures as outlined by AOAC (2005). Sensory evaluation was performed by a panel of five semi-trained judges using a five-point hedonic scale (1 = dislike extremely, 5 = like extremely), assessing characteristics such as colour, texture, taste, flavour, and aroma as described by (Ranganna, 2010).

Results and Discussion

The biochemical and sensory characteristics of fresh aonla and aonla shreds revealed significant differences, influenced by processing and incorporation of spice mixtures. Fresh aonla is characterized by low pH, high acidity, high ascorbic acid content, and moderate sugar levels. The transformation into aonla shreds, especially across recipes R1 to R7, introduced marked changes in these parameters.

pH and Acidity

Fresh aonla was pH analysed 2.5, reflecting its high natural acidity. Among the aonla shred recipes, the pH values ranged from minimum 2.61 in R5 to maximum 3.20 in R1. Lowest pH of R5 indicates enhanced preservation potential, while R1's higher pH suggests a milder acid profile due to its spice blend. Compared to fresh aonla, most shreds had a slightly elevated pH values likely due to dilution and buffering effects from added ingredients. The pH content of the aonla preserve was found out to be in the range as determined by Daisy and Gehlot (2006) is 2.67. Correspondingly, titratable acidity in fresh aonla was found naturally high (2.30%) and it reduces after processing to aonla shreds in all the recipes. Among the shred samples, R5 exhibited the highest acidity (1.21%), closely aligning with fresh fruit levels. R6 had the lowest acidity (1.00%), indicating some reduction during processing or from specific spice interactions.

Total Soluble Solids (TSS) and Sugars

TSS of fresh aonla was observed around 11.00 °Brix and shredding and recipe incorporation raised TSS in all the recipes, with the highest recorded in R1 (24.3 °Brix) followed by R3 (23.0 °Brix), which may be due to high sugar content in these recipes because of the infusion of lime juice and cardamom. Similarly, total sugar content was higher in all shreds compared to fresh aonla, with R1 (16.2%) showing the maximum, while R2 (14.68%) had the lowest total sugar content. Reducing sugars also increased in processed samples, with R1 having the highest (9.83%) versus the much lower levels in fresh aonla (6.20%), suggesting enhanced fermentable sugar content post-processing. According to (Shakir *et al*., 2008) increase in reducing sugars is due to hydrolysis of sucrose by low pH and heat treatment. Similar results were obtained in the work by (Damame *et al.,* 2002) who reported that a marked increase in reducing sugar content of aonla preserve. The increase in total sugar could be attributed to gradual inversion of non – reducing sugars (Jain *et al*., 2004).

Ascorbic Acid (Vitamin C):

Fresh aonla had shown high ascorbic acid content about 625.10 mg/100g. However, a substantial reduction was observed in all processed recipes due to thermal degradation and oxidation during preparation. The highest ascorbic acid content among aonla shred recipes was found in R2 (283.33 mg/100g), suggesting better retention possibly due to antioxidant properties of specific spices used. The lowest content was noted in R1 (225.92 mg/100g), emphasizing that recipe

composition significantly impacts nutrient preservation. This is mainly due to the fact that ascorbic acid being sensitive to oxygen, light and heat was easily oxidized in presence of oxygen in the formation of dehydroascorbic acid (Welch *et al.*, 2007).

Overall Assessment

The results underscore that processing and spice mixture incorporation led to noticeable changes in the quality profile of aonla. While certain recipes such as R2 retained better nutritional characteristics (ascorbic acid), others like R1 emphasized improved palatability (higher TSS and sugars). Compared to fresh aonla, the shreds had reduced vitamin C but enhanced sensory attributes due to increased sweetness and varied acidity, indicating a trade-off between taste enhancement and nutritional preservation.

An organoleptic evaluation was carried out to assess the sensory attributes of Aonla shreds prepared using different spice-based recipes (R1 to R7). The parameters examined included colour, appearance, taste, aroma, texture, and overall acceptability using a 5-point hedonic scale as described by (Ranganna, 2010). Among all recipes, R1 and R2 emerged as the most preferred, both receiving the highest overall acceptability score of 4.64. R1 showed particularly high scores in appearance (4.8), aroma (4.8), and texture (4.6), while R2 was rated best in taste (5.0) and colour (4.8), suggesting a balanced and appealing sensory profile in both formulations. R3 also performed well with a moderate overall acceptability of 4.20, supported by good scores in taste (4.4) and aroma (4.4). R5 had an overall acceptability of 4.04, with consistent but slightly lower ratings in appearance (3.8) and texture (3.8). Conversely, R6 (3.64) and R4 (3.76) showed reduced sensory appeal due to lower values in colour and aroma. The least preferred treatment was R7, which received the lowest scores in all parameters, particularly colour (2.6) taste (3.0), and overall acceptability (3.04), indicating an overpowering or unbalanced spice combination that negatively influenced the product's sensory quality. Vijayanand *et al.* (2007) have also reported browning and loss of natural colour and flavour in the production of aonla powder by hot air drying at 45 °C.

Overall, the results demonstrate that appropriate spice incorporation can not only preserve but also enhance the nutritional and sensory quality of Aonla shreds. Recipes that strike a balance between sweet, sour, and aromatic elements (like R_2 and R_1) offer the best results in terms of both quality and acceptability.

Table 1: Pre and Post Processing Quality changes in Aonla Shreds

Recipe	pH	TSS (°Brix)	Acidity (%)	Ascorbic Acid (mg/100g)	Total Sugar (%)	Reducing Sugar (%)	Non-Reducing Sugar (%)
Fresh Aonla	2.50	11.00	2.30	625.10	08.10	06.20	2.00
R1	3.20	24.30	1.03	225.92	16.20	9.83	6.37
R2	2.94	22.10	1.14	283.33	14.68	8.10	6.58
R3	3.03	23.00	1.12	278.70	15.75	9.15	6.60
R4	2.89	22.70	1.17	263.85	15.60	9.00	6.60
R5	2.61	22.00	1.21	257.60	15.90	9.60	6.30
R6	3.07	20.50	1.00	278.70	14.80	8.70	6.10
R7	3.13	21.40	1.08	263.00	15.00	8.50	6.50
CD	0.17	0.30	0.06	17.98	1.12	0.65	0.47
SE(m)	0.08	0.11	0.02	6.3	0.39	0.23	0.16
CV	3.56	2.97	4.75	4.25	5.13	6.27	5.82
SD	0.2	0.27	0.04	13.2	0.95	0.56	0.37

Table 2: Organoleptic Scores of Aonla Shreds

Recipe	Color	Appearance	Taste	Aroma	Texture	Overall Acceptability
R1	4.4	4.8	4.6	4.8	4.6	4.64
R2	4.8	4.4	5.0	4.4	4.6	4.64
R3	3.8	4.2	4.4	4.4	4.2	4.20
R4	3.6	3.4	4.2	3.8	3.8	3.76
R5	4.4	3.8	4.0	4.2	3.8	4.04
R6	3.4	3.2	4.2	3.8	3.6	3.64
R7	2.6	3.0	3.0	3.4	3.2	3.04
CS 5%	0.42	0.39	0.46	0.4	0.41	0.43
SE(m)	0.15	0.14	0.16	0.15	0.15	0.16
CV	3.48	3.65	3.12	3.25	3.47	3.27

Conclusion

The present study concludes that different spice blends significantly influence the pre- and post-processing quality attributes of aonla shreds when compared to fresh aonla. While fresh aonla is valued for its high nutritional content, particularly ascorbic acid, the spiced aonla shreds retained substantial nutrient levels and demonstrated enhanced sensory qualities such as improved taste, aroma, and texture. Among all formulations, R2 and R1 emerged as the most effective. R2 showed superior ascorbic acid retention, while R1 was higher in TSS and sugar content, leading to better flavour and overall acceptability. These improvements suggest that the addition of selected spices not only preserves but can also improve upon the qualities of fresh aonla. Furthermore, spice incorporation, when properly balanced, did not compromise shelf stability. The findings highlight the potential of optimized aonla shred formulations like R2 as commercially viable, functional fruit-based snacks that maintain the nutritional benefits of fresh aonla while enhancing consumer appeal.

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