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Physico-chemical changes in attributes of aonla preserve under ambient storage

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Abstract

A study titled "Physico-chemical Characterization of Aonla Preserve under Storage Conditions" has been conducted with the primary objective of identifying suitable aonla cultivars and sugar levels for high-quality preserve preparation and assessing the quality under storage conditions. The study provided a strong foundation for the development and standardization of aonla preserve, particularly focusing on cultivar selection and sugar concentration optimization, providing valuable insights into improving the quality, shelf life, and consumer acceptability.

The results were promising and projected "NA-7", significantly superior for processing purpose as compared to all other varieties. The maximum moisture content (87.7%) and ascorbic acid (725.65 mg/100 g) were recorded in NA-7, indicating its better nutritional profile. The highest TSS (10.81°Brix) was also recorded in NA-7, contributing to its superior sweetness and balanced flavour for value-added product development. Moreover, the results also showed that the optimum sugar composition is also a vital criterion for retaining the quality of the post-harvest produce. Higher total sugar content (64.34, 67.72 and 70.14%) was found in NA-7 + 75% Sugar content, followed by NA7+70% Sugar content (64.22, 66.84 and 69.39). Moreover, superior Ascorbic Acid score, (719.55, 561.25 and 402.08 mg/100 g) at 0, 45 and 90 DAS was noted in treatment NA7+65% Sugar content, followed by NA-7 + 75% Sugar content (716.47, 558.85 and 400.36 mg/100 g. Based on the experimental results, NA-7 + 75% sugar concentration was found to be the most suitable treatment for aonla preserve preparation, offering superior quality parameters. Therefore, NA-7 + 75% sugar concentrations can be recommended for commercial production due to its superior quality.

Keywords: Aonla, preserve TSS, ascorbic acid, total sugar & quality

Introduction

Aonla (*Emblica officinalis* L.), commonly referred to as Indian gooseberry, is a prominent indigenous fruit in India, long valued in traditional medicine and dietary practices. It is a member of the Euphorbiaceous family and the Phyllanthoideae sub-family. Known by various regional names, its cultural relevance is evident throughout the country (Shekhawat *et al.*, 2014) [13]. Due to their seasonal nature and perishable quality, these fruits require preservation to be utilized during the off-season. Preservations are highly effective and are a practicable method. Preservation methods help extends fruit shelf life with minimal impact on quality (Patel and Kushwaha, 2014) [9].

Despite its health-promoting properties, fresh aonla is not widely consumed owing to its intense acidity and astringent flavour, limiting its popularity as a table fruit. However, its potential for value-added processing has increased its commercial appeal. Aonla is particularly rich in bioactive compounds, especially vitamin C, ranging from 500 to 600 mg per 100 grams of pulp—much higher than most other fruits (Patel & Kushwaha, 2014) [9]. The fruit's vitamin C remains stable thanks to antioxidants like leucoanthocyanins and polyphenols, which slow down oxidation and help maintain nutritional value during storage (Dwivedi *et al.*, 2012) [5]. Converting aonla into stable products such as preserves, juice, squash, pickles, or powder is an effective strategy to overcome perishability issues. Among various processed forms, aonla preserve stands out due to its wide consumer acceptance, nutritional retention, and straightforward production method. The process involves repeated soaking of the fruit in sugar syrup, which reduces acidity and enhances sweetness. This approach not only makes the product more palatable but also helps retain essential nutrients

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like vitamin C and polyphenols, adding to its health benefits. Additionally, the method is accessible to small-scale producers and self-help groups, providing income opportunities in rural areas.

The sugar concentration as well as the cultivar used in preserve preparation also plays a vital role in determining the final product's taste, shelf stability, and appearance. A well balanced sugar level not only enhances flavor but also supports better preservation and aesthetic appeal. Moreover, sugar infusion helps stabilize vitamin C and polyphenol levels, which are prone to degradation during processing. Hence, a systematic study of how various cultivars respond to different sugar concentrations is essential for standardizing preserve making practices.

Thus, there is a strong rationale for scientific investigations into the development and standardization of aonla preserve, particularly focusing on cultivar selection and sugar concentration optimization, providing valuable insights into improving the quality, shelf life, and consumer acceptability.

In this context, a study has been formulated with the primary objective of identifying suitable aonla cultivars and sugar levels for high-quality preserve preparation and assessing the quality under storage conditions.

Materials and Methods

The study was carried out during 2024-25 at the Post Harvest and Value Addition Laboratory, Faculty of Agriculture and Veterinary Sciences, Mewar University, Gangrar, Chittorgarh (Rajasthan). Mature fruits of different aonla verities viz. Krishna, NA-7 and Kanchan were collected from the local orchard. The fruit was then subjected to different sugar syrup treatments viz. 65% sugar syrup, 70% sugar syrup and 75% sugar syrup for preserve preparation.

The aonla preserve of different varieties were prepared following standard protocols and were subjected to different sugar syrup combinations. The quality parameters under various storage period viz. 0, 45 and 60 DAS, were evaluated following standard protocols. Firstly, moisture content (%) was estimated by oven dry method (Akinmoladun & Akinmoladun, 2013) [1], TSS (^{0} Brix) was calculated using a digital refractometer following the method of A.O.A.C, 1970. The ascorbic acid content expressed as mg/100 gm of pulp, was measured using the 2, 6 dichlorophenol indophenols dye and titrating it with 4% oxalic acid (Ranganna, 1986) [10]. The titratable acidity was measured by titrating with sodium hydroxide using the phenolphthalein indicator and expressed in percentage (%) (Ranganna, 1986) [10]. Finally, total sugar (%) and reducing sugar (%) were calculated using the Anthrone and Fehling's method respectively (Hulme and Narain, 1931) [6]. The data obtained from set of observation for each character were subjected to "Analysis of variance" as advocated by Panse and Sukhatme (1985) [8].

Results and Discussion

It is evident from the data (table 2) that aonla variety "NA-7" was found significantly superior for processing purpose as compared to all other varieties. The maximum moisture content (87.7%) and ascorbic acid (725.65 mg/100 g) were recorded in NA-7, indicating its better nutritional profile. The highest TSS (10.81°Brix) was also recorded in NA-7, while Kanchan registered the maximum reducing sugar content (9.90%). The maximum acidity (1.87%) was also noted in NA-7, making it suitable for products requiring higher acid content. On the other hand, the highest total sugar (15.61%) was recorded in Kanchan, contributing to its superior sweetness and balanced flavour for value-added product development. These observations are supported by Sharma *et al.* (2018) [12], Singh *et al.* (2020) [14] and Patel *et al.* (2020), who emphasized the nutritional superiority of NA-7 and higher sweetness in Kanchan.

Result revealed that the higher moisture content (72.84, 60.46 and 36.28%) at 0, 45 and 90 days after storage was noted in treatment NA-7+65% sugar content and it was the best treatment for retaining moisture in aonla preserve as compared to other treatments (table 3). These findings are supported by Thakur *et al.* (2020) [14], who reported similar trends of moisture loss in fruit preserves during storage.

Secondly, the higher TSS (68.96, 69.52 and 70.29°Brix) at 0, 45 and 90 days after storage was noted in treatment Krishna + 75% sugar concentration and it was the best treatment for increasing TSS of aonla preserve. Increase in TSS might be due to breakdown of complex carbohydrates and conversion of polysaccharides to simple sugars (table 4). These findings are consistent with Rani and Jain (2020) [11], who reported increase in TSS in stored fruit candies.

The highest ascorbic acid score (719.55, 561.25 and 402.08 mg/100 g) at 0, 45 and 90 DAS (table 5) was noted in treatment NA-7+65% sugar content which are at par with the findings of Sharma *et al.* (2018) [12], Tripathi *et al.* (1988) [15] and Ashwini *et al.* (2017) [3].

Moreover, the maximum acidity (%) at 0, 45 and 90 DAS was found in Krishna +75% Sugar content (0.629, 0.459 and 0.346). The lowest acidity was recorded in NA-7+65% Sugar content (00.453, 0.282 and 0.172%) (table 6). The results agree with the findings of Mehta and Rathore (1976) and Tripathi *et al.* (1988) [15], who reported similar acidity reductions in processed fruit products.

Finally, the highest total sugar content (64.34, 67.72 and 70.14%) was found in NA-7 + 75% sugar content and the increase may be attributed to hydrolysis of polysaccharides during storage (table 7). Similar results were also observed by Ashbala *et al.* (2015) [2] and Chandel *et al.* (2018) [4].

Table 1: Treatment Details

S. No.	Treatments	Symbols
1	Krishna +65% Sugar content	T_1
2	Kanchan + 65% Sugar content	T_2
3	NA-7+65% Sugar content	T_3
4	Krishna +70% Sugar content	T_4
5	Kanchan + 70% Sugar content	T_5
6	NA-7+70% Sugar content	T_6
7	Krishna +75% Sugar content	T_7
8	Kanchan + 75% Sugar content	T_8
9	NA-7 + 75% Sugar content	T_9

Table 2: Bio-chemical characteristics of different aonla variety

Parameter	Krishna	NA-7	Kanchan	Methodology
Moisture (%)	86.41	87.7	86.85	Oven drymethod (Akinmoladun & Akinmoladun, 2013) [1]
TSS (Â°Brix)	10.29	10.81	9.21	Hand Refractometer
Ascorbic Acid (mg/100 g)	585.23	725.65	520.19	Ranganna (1986) [10]
Acidity (%)	1.54	1.87	1.25	Ranganna (1986) [10]
Total Sugar (%)	13.1	12.8	15.61	Hulme and Narain (1931) [6]
Reducing Sugar	8.54	9.45	9.90	Hulme and Narain (1931) [6]

Table 3: Effect of different treatments on the moisture content (%) of Aonla preserve at various storage intervals

Treatments	0 DAS	45 DAS	90 DAS
Krishna +65% Sugar content	71.28	59.16	35.50
Kanchan + 65% Sugar content	71.94	59.71	35.83
NA-7+65% Sugar content	72.84	60.46	36.28
Krishna +70% Sugar content	70.97	58.91	35.34
Kanchan + 70% Sugar content	71.79	59.58	35.75
NA-7+70% Sugar content	72.69	60.33	36.20
Krishna +75% Sugar content	70.52	58.53	35.12
Kanchan + 75% Sugar content	71.57	59.41	35.64
NA-7 + 75% Sugar content	72.29	60.00	36.00
S.Em.±	0.24	0.20	0.12
CD (5%)	0.92	0.76	0.46

Table 4: Effect of different treatments on the TSS (°Brix) of Aonla Preserve at various storage intervals

Treatments	0 DAS	45 DAS	90 DAS
Krishna +65% Sugar content	68.30	68.78	69.22
Kanchan + 65% Sugar content	67.58	68.15	68.58
NA-7+65% Sugar content	66.46	67.14	67.24
Krishna +70% Sugar content	68.42	68.90	69.34
Kanchan + 70% Sugar content	67.82	68.59	68.96
NA-7+70% Sugar content	66.82	67.24	67.60
Krishna +75% Sugar content	68.96	69.52	70.29
Kanchan + 75% Sugar content	67.90	68.71	69.15
NA-7 + 75% Sugar content	66.94	68.14	68.52
S.Em.±	0.04	0.18	0.07
CD (5%)	0.15	0.70	0.28

Table 5: Effect of different treatments on the ascorbic acid (mg/100 g) of aonla preserve at various storage intervals

Treatments	0 DAS	45 DAS	90 DAS
Krishna +65% Sugar content	530.17	413.54	296.26
Kanchan + 65% Sugar content	539.17	420.55	301.28
NA-7+65% Sugar content	719.55	561.25	402.08
Krishna +70% Sugar content	526.34	410.55	294.12
Kanchan + 70% Sugar content	535.77	417.90	299.39
NA-7+70% Sugar content	716.65	558.98	400.46
Krishna +75% Sugar content	521.70	406.92	291.52
Kanchan + 75% Sugar content	533.34	416.01	298.03
NA-7 + 75% Sugar content	716.47	558.85	400.36
S.Em.±	0.99	0.77	0.55
CD (5%)	3.80	2.96	2.12

Table 6: Effect of different treatments on the Titrable acidity (%) of aonla preserve at various storage intervals

Treatments	0 DAS	45 DAS	90 DAS
Krishna +65% Sugar content	0.572	0.402	0.308
Kanchan + 65% Sugar content	0.515	0.354	0.267
NA-7+65% Sugar content	0.453	0.282	0.172
Krishna +70% Sugar content	0.617	0.420	0.310
Kanchan + 70% Sugar content	0.549	0.371	0.271
NA-7+70% Sugar content	0.479	0.314	0.214
Krishna +75% Sugar content	0.629	0.459	0.346
Kanchan + 75% Sugar content	0.551	0.387	0.272
NA-7 + 75% Sugar content	0.500	0.350	0.234
S.Em.±	0.011	0.008	0.010
CD (5%)	0.044	0.031	0.039

Table 7: Effect of different treatments on the total sugar (%) of aonla preserve at various storage intervals

Treatments	0 DAS	45 DAS	90 DAS
Krishna +65% Sugar content	60.93	64.48	66.23
Kanchan + 65% Sugar content	61.78	65.76	67.96
NA-7+65% Sugar content	62.69	66.31	68.72
Krishna +70% Sugar content	61.38	64.55	67.35
Kanchan + 70% Sugar content	61.86	65.93	68.18
NA-7+70% Sugar content	64.22	66.84	69.39
Krishna +75% Sugar content	61.55	65.16	67.57
Kanchan + 75% Sugar content	62.56	65.94	68.52
NA-7 + 75% Sugar content	64.34	67.72	70.14
S.Em.±	0.21	0.13	0.16
CD (5%)	0.62	0.38	0.47

Conclusion

The study provided a strong foundation for the development and standardization of aonla preserve, particularly focusing on cultivar selection and sugar concentration optimization, providing valuable insights into improving the quality, shelf life, and consumer acceptability. Moreover, the results also showed that the optimum sugar composition is also a vital criterion for retaining the quality of the post-harvest produce. The results were promising and projected “NA-7”, significantly superior for processing purpose as compared to all other varieties. Therefore, NA-7 + 75% sugar concentration can be recommended for commercial production due to its superior quality even after storage.

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