



# Organoleptic Evaluation of Aonla (*Emblica officinalis* G.) Ready-To-Serve during Storage

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## Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

## Article Information

DOI: <https://doi.org/10.9734/jsrr/2024/v30i112527>

## Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here:

<https://www.sdiarticle5.com/review-history/125401>

**Original Research Article**

**Received: 17/08/2024**

**Accepted: 19/10/2024**

**Published: 22/10/2024**

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**Cite as:** Uikey, Ashwini, Bhavna, Pranali Gawade, Purvi Gupta, Pallavi Thakre, Mrinalini Uikey, P.K.S. Gurjar, and R.S. Gurjar. 2024. "Organoleptic Evaluation of Aonla (*Emblica Officinalis* G.) Ready-To-Serve During Storage". *Journal of Scientific Research and Reports* 30 (11):20-29. <https://doi.org/10.9734/jsrr/2024/v30i112527>.

## ABSTRACT

A research experiment was conducted during the year 2019-20 and 2020-21 in the Fruit and Vegetable Processing Unit Laboratory, Department of Horticulture, College of Agriculture, Gwalior with seven different varieties of aonla viz., NA-4, NA-5, NA-6, NA-7, NA-10, Laxmi and Chakaiya for preparation of aonla RTS. Hence an attempt was made to standardized non-alcoholic based products viz., ready-to-serve with different varieties. 9 hedonic scale, out of there. From the findings, Laxmi and Chakaiya varieties were found superior with respect to colour, appearance, taste and aroma as well as flavor. The overall acceptability of processed items has been found to be significantly higher with storage periods of 30, 60, 90, and 120 days. To overcome present national and international prohibitions on the use of chemical food additives in food processing and preservation, research into biological and plant-derived food additives has considerably increased. With respect to the sensory evaluation of different aonla products was concerned, the Laxmi and Chakaiya varieties are found to be superior for the purpose of the processing industry.

**Keywords:** Aonla; analyzing; aroma; flavor; ready-to-serve; processing; sensory evaluation; storage.

## 1. INTRODUCTION

Aonla, or Indian gooseberry (*Emblica officinalis*) is an indigenous fruit of the Indian subcontinent. It is one of the oldest Indian fruits and considered as “wonder fruit for health” because of its unique qualities (Shekhawat et al. 2014). It belongs to the family Euphorbiaceae. The fruit has high indigenous medicinal value such as an anti-ascorbic, laxative and antibiotic. Aonla is used in Ayurvedic systems of Indian medicines. Due to its perishable nature and glut after harvest, which lowers the market value of fruit, aonla experiences postharvest losses that range from 30 to 40%. Traditional procedures were time-consuming and unhygienic. Processed aonla finds use in various forms such as chutney, candy, preserves, sauce, dried chips, tablets, jellies, and pickles (Kumar 2013). Like many other fruits, Aonla is highly perishable and is responsible for postharvest losses in handling, transportation and storage, resulting in economic losses. Now-a-days, cultivation of aonla is gaining popularity due to its high market demand, less management cost coupled with wide adaptability in diverse agroclimatic condition (Ghosh et al. 2013). Aonla prices become very low during main season and sometimes farmers have to pay to throw away their produces because of higher perishable nature of the produce. Fresh Aonla has 92 to 94% moisture and it can be stored for 2 to 4 weeks at 0°C (Mudgal and Pandey 2007). Problem of food preservation has grown more complex task become today and because new products launched in market requiring longer shelf life and greater assurance of protection from microbial spoilage. The development of many functional compounds helpful to human health is

manufactured by processing of meat and meat products (Pathak and Ram 2007).

## 2. MATERIALS AND METHODS

Fully matured aonla fruits of different varieties such as NA-4, NA-5, NA-6, NA-7, NA-10, Laxmi and Chakaiya are harvested from the main experimental station of Department of Horticulture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior. All chemicals used in this investigation were of analytical grade. Cane sugar, skimmed milk powder, glucose, butter, citric acid, hot spices, vegetables and salt were obtained from a local market and used as ingredients for the preparation of different products such as aonla ready-to-serve beverage (Jegadeeswari et al. 2024).

**Extraction of Pulp:** Aonla fruits that were fully developed, had a firm texture, and were all the same size were blanched and utilized in the experiment. Using small-scale pulping equipment, the fruits were processed to extract pulp, yielding a fine pulp. The final pulp was prepared with an addition of 2% potassium bisulphite solution for 15-20 minutes.

**RTS:** Ready-to-serve beverages are those which contain at least 10 per cent fruit juice and 10 per cent total soluble solids. It can be made from a wide variety of fruits with an excellent quality of soft drink can also be prepared.

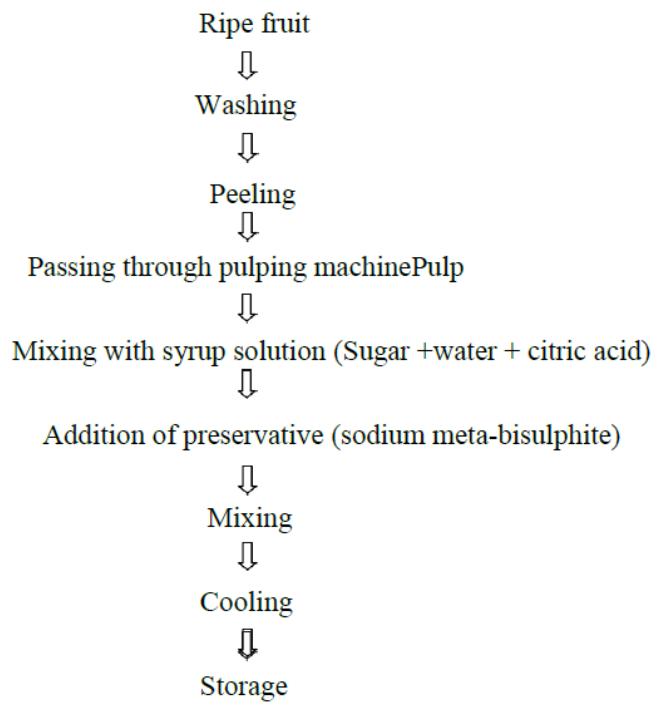
**Storage study:** The storage studies of prepared RTS was analysis by noting the changes in the bioactive components and sensory evaluation at regular intervals before and during storage (Sivakumar et al. 2024).

**Sensory evaluation (9-point hedonic scale):** Value-added aonla products such as RTS was conducted soon after preparation and after one, two, three, and four months of storage by a panel of ten judges following the 9-point hedonic scale (Ranganna 1986). These products were assessed for color and appearance, taste,

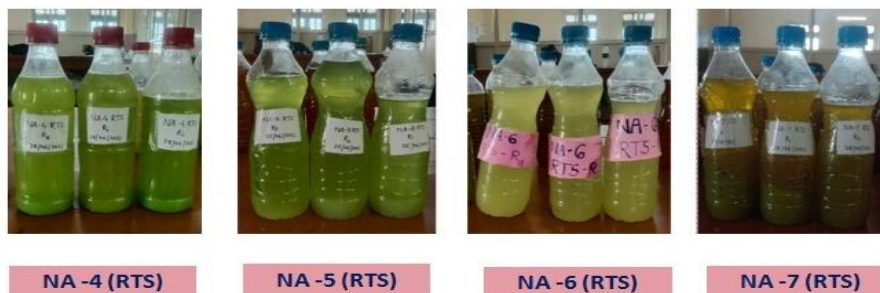
aroma, flavor, and overall acceptability. The overall acceptability of aonla RTS was based on the mean score obtained from all the sensory characteristics. The characteristics with mean scores of 6 and above out of 9 were considered acceptable.

**Recipe**

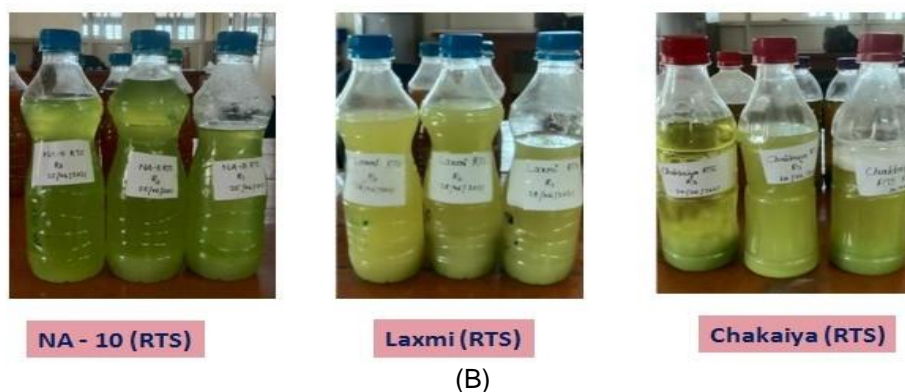
Aonla pulp	10 percent
Total soluble solids	12 per cent
Acidity	0.3 per cent
Sodium meta bisulphite (SO <sub>2</sub> )	70 ppm



**Fig. 1. Flow chart for preparation of Aonla RTS**



(A)



Picture 1(A-B). Varietal Photographs of Anola RTS

Statistically analyzing the data obtained during this investigation, the methods to determine the significance of the difference between means of scores were followed as suggested by Henry Garrett (Devi 2020).

**List 1. Organoleptic score and rating**

Organoleptic score	Rating
9	Like extremely (LE)
8	Like very much (LVM)
7	Like moderately (LM)
6	Like slightly (LS)
5	Neither liked or disliked (NLND)
4	Disliked slightly (DS)
3	Disliked moderately (DM)
2	Disliked very much (DVM)
1	Disliked extremely (DE)

Overall, the final rating was obtained by averaging the scores. A score of 7, rated as “Like moderately,” was considered the acceptable limit.

**3. RESULTS**

**3.1 Colour and Appearance**

Data on the color and appearance of aonla RTS are presented in Table 1. Among different varieties, significantly higher color and appearance were recorded with Chakaiya (8.00, 7.95, 7.90, 7.83, and 7.25) in the pooled data. It remained statistically at par with NA-10 and

Laxmi during both experimental years. NA-4 (6.94, 6.91, 6.89, 6.87, and 6.84) recorded the least values of color and appearance of aonla RTS.

**3.2 Taste**

Close examination of data presented in Table 2 revealed that the taste of aonla RTS varied significantly due to different aonla varieties and storage. Critical probing of pooled data revealed that decreasing noticeable taste was significant in the aonla RTS thereafter. Highest taste of aonla RTS (7.68, 7.60, 7.56, 7.54, and 7.53) was noted with Laxmi being at par with Chakaiya variety. Least taste values were recorded by NA-4 (6.23, 6.20, 6.19, 6.17, and 6.13) during the course of investigation.

**3.3 Aroma**

It is evident from data presented in Table 3 that the aroma of aonla RTS, based on organoleptic evaluation, was influenced by the different aonla varieties and storage up to 150 days after storage (DAS) during both years of experimentation. A close examination of data revealed that the aroma of aonla RTS decreased significantly due to the different aonla varieties and their storability up to 150 DAS. Highest values of aroma of aonla RTS (7.65, 7.62, 7.61, 7.60, and 7.57) were recorded in Chakaiya, being statistically at par with Laxmi and NA-10. Conversely, lower aroma of aonla RTS (6.54, 6.52, 6.51, 6.49, and 6.42) was achieved by the control during the course of investigation. The effect of different aonla varieties with respect to aroma of aonla RTS could attain levels of significance.

**Table 1. Effect of Different Varieties and Storage on the Aroma of Aonla RTS**

Cultivars	Storage Period (Days)														
	YearI					YearII					Pooled				
	30	60	90	120	150	30	60	90	120	150	30	60	90	120	150
NA-4	6.52	6.51	6.50	6.48	6.34	6.57	6.54	6.52	6.51	6.50	6.54	6.52	6.51	6.49	6.42
NA-5	6.49	6.48	6.47	6.47	6.46	6.48	6.47	6.45	6.44	6.41	6.49	6.48	6.46	6.45	6.43
NA-6	6.77	6.74	6.72	6.64	6.67	6.74	6.71	6.69	6.67	6.62	6.75	6.75	6.70	6.65	6.64
NA-7	6.99	6.98	6.95	6.94	6.92	6.89	6.85	6.83	6.82	6.81	6.94	6.91	6.89	6.88	6.86
NA-10	7.28	7.26	7.25	7.24	7.22	7.27	7.25	7.24	7.23	7.21	7.28	7.26	7.25	7.24	7.22
Laxmi	7.36	7.35	7.34	7.31	7.30	7.34	7.33	7.31	7.30	7.29	7.35	7.34	7.32	7.31	7.30
Chakaiya	7.65	7.64	7.62	7.60	7.57	7.68	7.65	7.61	7.65	7.58	7.65	7.62	7.61	7.60	7.57
SeM±	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
CD(p=0.05)	0.05	0.05	0.06	0.06	0.05	0.07	0.05	0.07	0.06	0.06	0.04	0.03	0.05	0.03	0.03

**Table 2. Effect of Different Varieties and Storage on the Flavor of Aonla RTS**

Cultivars	Storage Period (Days)														
	YearI					YearII					Pooled				
	30	60	90	120	150	30	60	90	120	150	30	60	90	120	150
NA-4	7.00	7.00	6.99	6.97	6.91	7.25	7.11	7.00	6.97	6.93	7.12	7.11	7.10	6.98	6.92
NA-5	7.78	7.62	7.59	7.33	7.21	7.62	7.56	7.47	7.36	7.25	7.71	7.59	7.53	7.34	7.23
NA-6	8.00	7.88	7.67	8.00	7.41	8.11	8.04	7.76	7.52	7.40	8.05	7.95	7.71	7.76	7.40
NA-7	7.92	7.61	7.53	7.49	7.25	8.00	7.67	7.56	7.52	7.30	7.96	7.64	7.56	7.50	7.27
NA-10	8.22	8.19	8.10	8.00	7.91	8.25	8.20	8.09	8.00	7.98	8.23	8.19	8.10	7.99	7.93
Laxmi	8.16	8.00	7.93	7.73	7.60	8.06	7.98	7.95	7.74	7.65	8.11	7.99	7.94	7.73	7.62
Chakaiya	8.10	7.85	7.73	7.56	7.41	8.05	7.88	7.76	7.54	7.45	8.07	7.86	7.74	7.55	7.43
SeM±	0.02	0.02	0.02	0.02	0.02	0.12	0.12	0.12	0.12	0.12	0.06	0.06	0.06	0.06	0.06
CD(p=0.05)	0.06	0.07	0.06	0.07	0.06	0.37	0.32	0.35	0.36	0.37	0.18	0.21	0.22	0.19	0.20

**Table 3. Effect of Different Varieties and Storage on the Color and Appearance of Aonla RTS**

Cultivars	Storage Period (Days)														
	YearI					YearII					Pooled				
	30	60	90	120	150	30	60	90	120	150	30	60	90	120	150
NA-4	6.93	6.91	6.90	6.89	6.88	6.95	6.90	6.87	6.85	6.80	6.94	6.91	6.89	6.87	6.84
NA-5	7.01	7.00	6.95	6.92	6.90	7.10	7.05	6.94	6.91	6.87	7.05	7.02	6.95	6.91	6.88
NA-6	7.42	7.41	7.41	7.40	7.38	7.40	7.38	7.37	7.36	7.33	7.41	7.39	7.39	7.38	7.35
NA-7	7.11	7.10	7.08	7.07	7.06	7.19	7.12	7.06	7.02	7.00	7.15	7.11	7.07	7.04	7.03
NA-10	7.67	7.59	7.54	7.48	7.41	7.69	7.63	7.58	7.52	7.49	7.68	7.61	7.56	7.50	7.45
Laxmi	7.61	7.59	7.58	7.54	7.52	7.60	7.57	7.54	7.52	7.49	7.61	7.58	7.56	7.53	7.50
Chakaiya	8.00	7.94	7.89	7.78	7.71	7.99	7.95	7.91	7.89	7.84	8.00	7.95	7.90	7.83	7.75
SeM±	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.05	0.05	0.05	0.05	0.05
CD( p=0.05)	0.24	0.23	0.21	0.23	0.24	0.23	0.23	0.25	0.25	0.24	0.16	0.13	0.11	0.15	0.16

**Table 4. Effect of different varieties and storage on taste of Aonla RTS**

Cultivars	Storage Period (Days)														
	YearI					YearII					Pooled				
	30	60	90	120	150	30	60	90	120	150	30	60	90	120	150
NA-4	6.21	6.19	6.18	6.18	6.16	6.26	6.21	6.20	6.15	6.11	6.23	6.20	6.19	6.17	6.13
NA-5	6.45	6.42	6.40	6.38	6.33	6.48	6.46	6.49	6.35	6.29	6.46	6.44	6.44	6.36	6.31
NA-6	6.76	6.73	6.71	6.70	6.67	6.79	6.75	6.70	6.68	6.60	6.77	6.74	6.70	6.69	6.68
NA-7	6.74	6.73	6.71	6.70	6.68	6.78	6.70	6.69	6.67	6.65	7.76	6.71	6.70	6.68	6.66
NA-10	7.49	7.45	7.43	7.38	7.33	7.85	7.60	7.53	7.40	7.30	7.67	7.52	7.48	7.39	7.31
Laxmi	7.65	7.61	7.60	7.58	7.57	7.71	7.59	7.53	7.50	7.50	7.68	7.60	7.56	7.54	7.53
Chakaiya	7.50	7.48	7.41	7.40	7.39	7.55	7.45	7.38	7.34	7.35	7.52	7.46	7.39	7.38	7.37
SeM±	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.05	0.05	0.05	0.05	0.05
CD(p=0.05)	0.24	0.23	0.21	0.23	0.24	0.23	0.23	0.25	0.25	0.24	0.16	0.13	0.11	0.15	0.16

**Table 5. Effect of different varieties and storage on overall acceptability of Aonla RTS**

Cultivars	Storage Period (Days)														
	YearI					YearII					Pooled				
	30	60	90	120	150	30	60	90	120	150	30	60	90	120	150
NA-4	7.14	7.06	7.91	6.83	6.67	7.21	7.11	7.00	6.90	6.71	7.17	7.08	6.95	6.86	6.69
NA-5	7.29	7.13	6.96	6.89	6.70	7.17	7.04	6.91	6.84	6.77	7.23	7.08	6.93	6.86	6.73
NA-6	7.55	7.32	7.24	7.05	6.83	7.50	7.40	7.31	7.10	6.91	7.52	7.36	7.27	7.07	6.87
NA-7	7.78	7.58	7.49	7.22	6.92	7.63	7.48	7.26	7.11	6.95	7.70	7.53	7.37	7.16	6.93
NA-10	7.95	7.64	7.42	7.25	7.10	8.00	7.84	7.62	7.40	7.16	7.97	7.74	7.52	7.32	7.13
Laxmi	8.08	7.83	7.65	7.43	7.25	8.18	7.89	7.66	7.40	7.29	8.13	7.86	7.65	7.41	7.27
Chakaiya	8.22	7.58	7.49	7.45	7.33	8.17	8.09	7.83	7.61	7.40	8.20	7.84	7.66	7.53	7.37
SeM±	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02
CD(p=0.05)	0.07	0.05	0.07	0.08	0.06	0.08	0.09	0.08	0.08	0.08	0.05	0.05	0.05	0.06	0.05

### 3.4 Flavour

It is evident from the data presented in Table 4 that the flavor of aonla varieties and storage conditions affects aonla RTS. A review of the pooled data clearly indicated that the higher flavor of aonla RTS decreased significantly due to the different aonla varieties and their storability up to 150 DAS, with the NA-10 variety showing the highest values. The highest values of flavor for aonla RTS (8.23, 8.19, 8.10, 7.99, and 7.93) were recorded for the NA-10 variety of aonla.

### 5.5 Overall Acceptability

A review of the results presented in Table 5 revealed that the overall acceptability of aonla RTS, based on organoleptic evaluation, was significantly affected by different aonla varieties and their storability up to 150 DAS, showing no significant changes during both experimental years.

Close examination of the data indicated that significantly higher values of overall acceptability for aonla RTS (8.22, 7.58, 7.49, 7.45, and 7.33) and (8.17, 8.09, 7.83, 7.61, and 7.40) were recorded under the Chakaiya variety during 2020 and 2021, respectively. This was followed by the Laxmi and NA-10 varieties.

The least values (7.14, 7.06, 7.91, 6.83, and 6.67) and (7.21, 7.11, 7.00, 6.90, and 6.71) were observed in the NA-4 variety during 2020 and 2021, respectively.

## 4. DISCUSSION

The data on colour, appearance, flavor, texture as well as overall acceptability was determined by sensory evaluation card. Sensory evaluation by judges observe colour,

The data on colour and appearance, flavor, texture of sample 1 and 3 are concerned, there was a significant difference between the mean of these parameters using 9 point Hedonic scale (Kumar 2019).

Based on organoleptic evaluation and chemical parameters, it can be concluded that the best quality aonla RTS can be prepared using the Laxmi variety, followed by NA-10, considering attributes like color,

appearance, taste, flavor, aroma, and overall acceptability. Color and appearance are affected by storage period (Devi 2020). As storage time increases, color and appearance decline slightly. Additionally, flavor and taste decrease gradually due to changes in volatile compounds of aonla RTS (Shekhawat et al. 2014).

Taste loss might be due to time, temperature and duration of storage.

Similar findings were observed in the confirmation of Kore et al.(2013), Balaji and Prasad et.al. (2014), Singh et al. (2014), Shashi Kumar et.al. (2015), Balaji and Sikarwar et al. (2017), Khushboo et al. (2018), Kumar et al. (2018) and Rajendra Kumar (2018) for the preparation of aonla RTS.

## 5. CONCLUSION

The data was analyzed using test analysis of variance (ANOVA) and sampled multiple times. To achieve the goal, multiple trials were conducted before selecting three samples. Sensory evaluation determines final product selection (Grishma et al. 2021). It can be concluded that aonla RTS is highly nutritious and medicinal properties, the shelf life of aonla RTS was found to be highly acceptable at ambient conditions.

## 6. FUTURE SCOPE

Food quality and quantity are major global concerns. Aonla is grown mainly on homestead farms and it produces multiple products for food, feed, and industry. Being nutritionally rich it can be good candidate to meet the nutritional deficiency. However, this fruit is underutilized on a commercial scale due to its high inedible portion, difficulty in eating as a table fruit and separating segments from the seeds, higher astringency, lack of knowledge on proper postharvest practices, and inadequate processing facilities in growing regions. Additional research is needed to improve the shelf life, commercialize, and promote this fruit.

The several investigations were made on nutraceuticals properties of aonla have to be retaining for curing of different diseases. There is a possibility that it will lead to the development of new food based drugs for control of disease



management for humans in the future (Sivakumar et al. 2024).

### DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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