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Assessment of different aonla (*Emblica officinalis L.*) fruits for their nutritional composition and biodiversity

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ABSTRACT

Aonla (*Emblica officinalis L.*) is a nutritive fruit crop indigenous to Indian sub-continent, which can be grown successfully in dry and neglected regions. The farmers are trying different varieties for growing as a commercial orchard without having knowledge about the performance of these varieties. The observations were recorded for physico-chemical characters of dropped aonla fruits in fresh condition. The experiment on varietal evaluation of the physic-chemical characteristics of various cultivars of aonla viz., NA-4, NA-5, NA-6, NA-7, NA-10, Laxmi and Chakaiya were taken up under the Gird regions of Madhya Pradesh at Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior during the year 2019-20 and 2020-21. Maximum fruit length (3.91cm) was recorded with the variety NA-10 followed by NA-4 and NA-7. These varieties have also higher productivity and fruits are free from necrosis or internal browning, hence, they are considered to be ideal varieties for biodiversity and their nutritive composition with advancement in the processing industry.

Keywords : Aonla, physico-chemical, Gird regions, evaluation, biodiversity, nutritional processing.

INTRODUCTION

Aonla is one of the oldest minor fruit and considered to be a wonder for human health. India ranks 1st in aonla area and production all over the world. It belongs to the family Euphorbiaceae and it is native of India. Mostly, it is popular in Uttar Pradesh but, nowadays its area is expanding rapidly in many states such as Maharashtra, Gujarat, Rajasthan, Andhra Pradesh, Karnataka, Tamil Nadu, Himachal Pradesh etc. It is one of the unique fruit which got great commercial importance because of its high antioxidant and medicinal properties and it is considered as "Wonder fruit for health" because of its unique qualities.

The main cultivated varieties are Banarasi, Bansi Red, Chakaiya, Desi, Krishna/NA-5, Kanchan /NA-4, Franchis (Hathijhool), NA-6, NA-7, NA-8, NA-9, NA-10 and Anand-7. The aonla ready for harvesting during mid-November to first week of January. However, the fruit may be allowed to remain on the tree till February without much fruit drops. The optimum stage of harvesting falls between the periods extending from the second week of December to the third week of January in Northern plains.

Determination of physico-chemical properties of the fruit may play a vital role in development of various food processing strategies. The data on various physic-chemical properties, sensory attributes of aonla fruits have been studied.

Material And Methods

The studies were carried out at main experimental station of Department of Horticulture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior during the year 2019-20 and 2020-21. The research work was undertaken as per details given below. The varieties studied are NA-4, NA-5, NA-6, NA-7, NA-10, Laxmi and Chakaiya. The samples were collected from 12 years old aonla orchard planted under sodic soil condition and it is located in typical saline-alkaline belt of indigenous plains and Gird regions of Madhya Pradesh.

Physical Character Analysis

Harvesting of 10 kg fruits per varieties with uniform size and age were selected at random for analysis. The fruit weight (g), fruit length (cm), fruit diameter (cm), flesh content (%) and seed content (%) were recorded. The size of the fruit was measured by the Vernier Callipers. Weight of fruit was recorded using an electronic balance.

Chemical characters of the fruits

Ten fruits were selected randomly among the dropped fruits and estimations were done in laboratory. T.S.S. was recorded using Hand Refractometer of each cultivar. The acidity content was determined by titrating the sample extracted in water against 0.1 N sodium hydroxide. The ascorbic acid content was estimated by 2, 6 dichlorophenol indophenols titration method by Ranganna (1986) and expressed in terms of milligrams per hundred grams of fruit. Ascorbic acid was calculated using the formula.

Titre value × dye factor × volume made up ascorbic acid (mg/100g) =

---------- × 100 aliquot of extract taken × Volume of sample

The fibre extracted is weighed on the electronic chemical balance and recorded. The colour of the fruits was observed visually on each date of the observation for all the cultivars. The content of total phenols was determined by the method of Amrorium (1977). Sugars were analyzed by the method of Hulme and Narain (1931).

Sensory Evaluation

Various aonla fruits were subjected to evaluation soon after preparation and after one, two, three and four months of storage by a panel of ten judges following 9-point hedonic scale (Ranganna, 2014). These products were assessed for colour and appearance, taste, aroma, flavour and overall acceptability. The overall acceptability of seven varieties viz. NA-4, NA-5, NA-6, NA-7, NA-10, Laxmi and Chakaiya was based on mean score obtained from all the sensory characters. The characters with mean scores of 6 and above out of 9 were considered acceptable.

Statistical analysis

The experimental values were analyzed statistically by using completely randomized block design (CRD) with three replications of each cultivar. Means were compared using WASP (Web Agri STAT Package ICAR Research Complex, Goa) test at 5 % level of significance.

Results and Discussion

Physical parameters variety

The perusal of the data presented in Table-1 indicated that the cultivars expressed their yield potentially at different magnitude in the present agro-climatic situation. In this study, seven different varieties were assessed for their physical characteristics. The fruit colour of all the varieties yellowish green except of Desi variety, which was green in colour (Table 1). Shape of the varieties was round to oblate. The maximum fruit weight was observed in variety NA-5 followed by NA-4 whereas the smallest fruit weight was of NA-10 followed by NA- 6. NA-10 variety was the fastest growing variety among all. Initial accelerated increase in fruit weight may be due to more natural occurring growth substances like auxins, gibberllins, cytokinin and others. The maximum fruit length (3.92 cm) was observed in variety NA-10 whereas the fruit smallest in length (3.44 cm) was observed in Laxmi variety. Fruit diameter increased with the growth of fruits (Table 2). The maximum fruit was observed in variety NA-5 was followed by NA-4. The smallest diameter was noted in NA-7.

Table 1 : Physical composition of different aonla cultivars

Cultivars	Fruit weight(g)	Fruit length(cm)	Fruit diameter(cm)	Flesh content(%)	Seed content (%)
NA -4	**43.56**	**3.84**	**4.21**	**34.86**	**0.17**
NA -5	**46.77**	**3.82**	**4.27**	**45.53**	**0.15**
NA -6	**38.03**	**3.74**	**4.01**	**30.27**	**0.16**
NA-7	**40.04**	**3.86**	**3.95**	**36.40**	**0.13**
NA -10	**37.85**	**3.92**	**4.15**	**34.03**	**0.11**
Laxmi	**42.58**	**3.44**	**4.09**	**38.75**	**0.10**
Chakaiya	**41.95**	**3.52**	**4.08**	**35.52**	**0.14**
SeM ±	**1.07**	**-**	**0.03**	**1.05**	**0.11**
CD(0.05)	**1.23**	**NS**	**0.15**	**1.27**	**0.31**

Considerable fruit flesh content was found in later stages of fruit growth (Table 1). The maximum flesh content (45.53 %) was observed in NA-5 variety. The minimum flesh content (34.03 %) was recorded in

NA-10 followed by NA-4 (34.86 %). Regarding the seed content, it was maximum in NA-4 (0.17%) followed by Laxmi (0.10 %). It was interesting to note that, poor performance of NA-10 may be due to prevailing climatic condition of area of study as this cultivar prefers Gird regions of Madhya Pradesh.

Table 2 : Chemical composition of different aonla cultivars

Cultivars	TSS (%)	Acidity(%)	TSS/ Acid ratio	Ascorbic acid(mg/100g)	Fibre (%)
NA -4	**12.17**	**1.85**	**6.58**	**618.59**	**1.47**
NA -5	**11.23**	**1.79**	**6.23**	**641.02**	**1.38**
NA -6	**11.12**	**1.80**	**6.17**	**638.29**	**0.86**
NA -7	**10.96**	**1.96**	**5.59**	**729.61**	**1.32**
NA -10	**10.14**	**1.83**	**5.54**	**627.72**	**1.30**
Laxmi	**12.67**	**1.98**	**6.39**	**653.18**	**1.41**
Chakaiya	**9.44**	**2.23**	**4.23**	**651.64**	**1.40**
SeM±	**0.068**	**0.007**	**-**	**0.087**	**0.070**
CD. (P=0.05)	**0.159**	**0.016**	**-**	**0.203**	**0.162**

Chemical parameters

It was observed that the total soluble solid content in different cultivars of aonla has been presented in Table 2. It was maximum in Laxmi (12.67 %) followed by NA-4 (12.17 %) and lowest in Chakaiya (9.44 %). Similar findings were found in the confirmation of Ghosh *et al*. (2013), Mandal *et al*. (2013), Priya *et al*. (2013), Balaji and Prasad *et al*. (2014), Nalage *et al*. (2014), Bharad *et al*. (2016) and Chiranjeevi *et al*. (2018). The acidity content in fruits of different cultivars (Table 2) was recorded maximum in Chakaiya variety (2.23 %) and minimum in NA-6 variety (1.80 %). Similarly, it was found that, the maximum TSS/ acid ratio was recorded in NA-4 variety (6.58) whereas the minimum was recorded in Chakaiya variety (4.23).The ascorbic acid content was maximum in NA- 7 variety (729.61 mg 100^{-1} g). The fibre content of the fruit was found in later stages of fruit growth. Initially there was no or very trace amount of fibre content was observed. The most fibrous variety was NA- 4 (1.41 %) followed by Laxmi. The least fibrous fruits were of NA-6 (0.86 %). This is in conformity with the findings of *Singh et al.*, (2004).

Table 2 : Chemical composition of different aonla cultivars

Cultivars	Phenol (%)	Reducing Sugar (%)	Non-reducing Sugar(%)	Total Sugar(%)
NA -4	179.28	2.35	1.17	3.52
NA -5	189.15	2.40	1.22	3.62
NA -6	189.10	2.26	1.14	3.40
NA -7	188.10	2.31	1.23	3.46
NA -10	188.72	2.46	1.16	3.61
Laxmi	175.97	2.51	1.39	3.81
Chakaiya	179.14	2.68	1.98	4.30
SeM±	0.24	0.01	0.02	0.01
CD. (P=0.05)	0.41	0.01	0.08	0.04

It was observed that the total soluble solid content in different cultivars of aonla has been presented in Table 2. In the present study, the highest phenol content were recorded in NA-5 (180.02 %) and (189.27 %). However, the minimum phenol content was recorded with Laxmi (175.09 %) and (176.85 %) during both the year. For fresh aonla fruits, the highest reducing sugar content was recorded in Chakaiya (2.68 %) which was statistically at par with Laxmi (2.51 %). However, the minimum reducing sugar was recorded with NA-6 (2.26 %) during the experimental year. The highest non-reducing sugar content was observed in Chakaiya (1.98 %), which was statistically at par with Laxmi (1.30 %) variety. While, lowest non-reducing sugar content was recorded in NA-6 (1.14 %) variety, which war at ar with NA-10 (1.16%) and NA-4 (1.17 %), respectively. The present findings are in confirmation with the findings of Patel *et al*. (2014) and Vinod Singh *et al*. (2016) in the aonla. Also, the highest total sugar content was observed in Chakaiya (4.30 %), which was statistically at par with Laxmi (3.81 %) variety. Similar findings were found in the confirmation of Priyanka *et al*. (2012), Patel *et al*. (2014), Jagmohan Singh *et al*. (2015), Praveen *et al*. (2015) and Vishen *et al*. (2017) in the fruits of aonla.

Conclusion

From the data, it is conclude that the TSS, acidity and reducing sugar contents increased and ascorbic acid content was decreased. These changes in refrigerated storage condition (7±1°C) were found suitable during 15 days of storage. The processed products can be stored at refrigeration temperature with minor amount of chemical preservative along with the desirable acceptability up to 90 days. There was a marginal increase in microbial load of value added products of aonla during storage period but did not affect the wholesomeness of the product during six months of storage. These products proved not only a nutritionally but also organoleptically desirable toffee, nectar, RTS, sauce and squash with agreeable taste, colour.

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