The Pharma Innovation Journal 2023; 12(5): 2208-2212

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(5): 2208-2212

www.thepharmajournal.com
Received: 18-02-2023
Accepted: 26-04-2023

Gayatri Pawar
Department of Food Technology and Nutrition, Lovely Professional University, Phagwara, Punjab, India

Corresponding Author:
Gayatri Pawar
Department of Food Technology and Nutrition, Lovely Professional University, Phagwara, Punjab, India

Physiochemical and nutritional composition of aonla (*Emblica officinalis*): A potential functional food for health benefits

Gayatri Pawar

DOI: https://doi.org/10.22271/tpi.2023.v12.i5aa.20194

Abstract
Aonla, also known as Indian gooseberry, a traditional fruit that has become increasingly popular due to its high nutritional and therapeutic value. Aonla is a member of the Euphorbeaceae family and is indigenous to China, India, Ceylon, and Malaya. Aonla is known for its high content of polyphenols and vitamin C, and is used in Ayurvedic and Unani medical systems to treat cough and jaundice. The fruit is available from October to January and has a short shelf life. It is typically consumed raw, boiled, or in pickle form, and is also used to make various products, including murrabas, juice, jam, cheese, candy, powder, and chutney. The paper highlights the various physicochemical parameters of Aonla that play a critical role in the processing and preservation of this valuable fruit.

Keywords: Aonla, physical characteristics, chemical characteristics

Introduction
Fruits have long been a cornerstone of the human diet, whether they are fresh or dried. This is because they are packed with nutrients and include many vital vitamins and minerals. In addition, fruits have been shown to be effective in treating a variety of illnesses. Likewise, Aonla (*Emblica officinalis*) is one of India's native traditional fruits, Indian gooseberry is referred to as a "wonder fruit for health" (Ganachari *et al*., 2010) [5]. The oldest minor fruit in India is the Indian gooseberry, or aonla (*Emblica officinalis* Gaertn. Syn. *Phyllanthus emblica* L.). It is a member of the Euphorbeaceae family and is indigenous to China, Malaysia, Sri Lanka, and India. Aonla is grown in about 30 different types in Banarasi, Chakaiya, NA-6, NA-10, L.S.-1, L.S.-6, Anand Aonla II, Kanchan, Krishna, Narendra 4, etc. are examples of different aonla cultivars. (Athawale and akbari, 2017) [2]. Aonla is produced yearly in 1131 MT on an area of 96000 hectares that is cultivated across the nation (NHB, 2018) [13].

Aonla is a plant that is indigenous to China, India, Ceylon, and Malaya that belongs to the family Euphorbiaceae and subfamily Phyllanthiodae. Even without any care, Aonla is remarkably resilient, a prolific bearer, and quite lucrative. It can easily thrive on calcareous soil that is also slightly salinized. Alkaline soils are inhospitable to common fruit crops (Pareek and Kitinoja, 2011) [14]. Currently, 150.5 thousand metric tonnes of aonla fruit are produced on 49.60 thousand hectares of land. Aonla has become one of the most sought-after crops among farmers in the dry land region due to its low water requirement, lack of crop protection methods, and high market demand. Due to its strong processing potential and therapeutic qualities, industry is in high demand (Raut *et al*., 2016) [17].

The aonla is available from October to January and is quite perishable by nature. Furthermore, customers dislike this fruit in its fresh form because to its extreme acidity and astringency. According to Priya and Khatkar (2013) [15], India is the world leader in the acreage and output of the aonla crop. The only other cultivated fruit with a higher vitamin C content is the Barbados cherry. Fresh fruit pulp provides 200–900 mg of vitamin C per 100 grammes, whereas dehydrated aonla pulp maintains up to 1,699.09 mg of vitamin C per 100 grammes of dry weight. The fruit has a short shelf life and is only available from October to January (Ghorai and Sethi, 1996) [7]. The antiscorbulic, diuretic, laxative, and alternative antibacterial characteristics of aonla fruit are used to treat cough and jaundice. Aonla is one of the richest sources of polyphenols, which are thought to have a high therapeutic value. It is also one of the greatest sources of vitamin C. The fruit now plays a significant therapeutic role in the Ayurvedic and Unani medical systems as a result. Aonla fruit is typically used raw, boiled, or in pickle form. It has a sour and astringent taste.

Due to their abundance in vitamin C and antioxidants, aonla products come in a variety of forms and are popular with consumers, including murrabas, juice, jam, cheese, candy, powder, and chutney (Goyal *et al*., 2008) [8]. Determination of physico-chemical properties of the fruit may play an important role in design and development of various food processing equipment.

Materials and Methods

Freshly harvested Aonla fruits of cultivar kanchan were procured from Mahatma Phule Agriculture University, Rahuri. Different equipments required for physio-chemical analysis characterization such as Digital pH meter, digital refractometer, Hot air oven etc. were made available from the Department lab store of Food Technology and Nutrition of Lovely professional university, Phagwara. Aonla fruits were analyzed for various quality attributes including physical attributes and proximate chemical composition. Physio-chemical qualities will be estimated using recommended standard of Association of Official Analytical Chemists (AOAC) methods (2000) as mentioned below

Physical characteristics

The fresh aonla fruit of Chakaiya variety was analysed for different physical characteristics like fruit shape, breadth, length, weight, edible portion, pulp weight, seed weight, pulp percentage, seed percentage and juice percentage etc.

Colour and Shape

Colour and Shape of the fruits were recorded by visual observation.

Length and Breadth

The length and breadth of the randomly selected fresh fruits were measured using Vernier Calliper and average length and breadth were expressed in terms of centimeters.

Weight

Fresh aonla fruits of Chakaiya variety were weighed on electronic weighinng balance. Average weight of ten fresh fruits were calculated and expressed in grams.

Chemical analysis

Chemical constituents like TSS, pH, moisture content, ascorbic acid content, reducing sugar, non-reducing sugar, total sugar, crude fiber, fat, TPC, TFC and antioxidants of fresh aonla fruit and aonla candy were determined.

Total soluble solids (T.S.S.)

The fruit pulp/product was uniformly mashed with a mortar and pestle. A drop of mashed pulp was placed on the prism of Digital refractometer and total soluble solids was recorded as °Brix.

pH

The pH was determined by using a digital pH meter after standardizing it with buffers of pH 4.0 and 9.0.

Titratable acidity

Measurement of titratable acidity was carried out by using the method given by (AOAC, 2000). 10g of sample was macerated and homogenized in a pestle and mortar with little amount of distilled water and transferred to a 100 ml volumetric flask and volume was made. The sample was filtered and 10ml of aliquot was titrated against standard 0.1 N NaOH using 1 percent phenolphthalein indicator till faint pink colour persists for 15 seconds. The percent titratable acidity was expressed in terms of anhydrous citric acid by using following formula.

$$\text{Acidity (\%)} = \frac{\text{Titre value x N of alkali x Eq.wt.of acid x volume made up}}{\text{weight of sample x aliquote taken for estimation x 1000}} \text{X } 100$$

(As citric acid content)

Estimation of moisture content

2 g of sample subjected to oven drying at 105 °C for 4-5 hours. It was again weighed after cooling and repeated until a constant weight was obtained. The resultant loss in weight was calculated as moisture content (AOAC, 2000).

$$\text{\% Moisture} = \frac{\text{loss in weight of sample after drying}}{\text{Weight of sample taken}} \times 100$$

Estimation of Crude Fibre

About 3 to 5 g of moisture and fat free samples were weighted into 500 ml beaker and 200 ml boiling 0.25N (1.25 W/V) H_2SO_4 was added. The mix was boiled for 30 minutes keeping the volume constant by addition of water at frequent intervals. At the end of this period, the mixture was filtered through a filter paper and the residue washed with hot water till free from acid. The material then transferred to the same beaker and 200 ml of boiling 0.313N NaOH solution added. After boiling for 30 minute, the mix residue was washed with hot water till free from alkali followed with same alcohol. It was then transferred to a crucible, dried over night at 80- 100 °C for 2-3 hours. Then cooled and weighted again. The difference in the weights represented the weight of crude fibre (AOAC 2000).

Estimation of Total Sugars

The estimation was earned out by taking 50 ml clear filtrate in 100 ml beaker. To this 5 ml of concentrated HCl was added and kept in hot water bath for half an hour for hydrolysis. After hydrolysis, excess HCl was neutralized with sodium carbonate. The mixture was transferred to 250 ml volumetric flask and the volume was made up to the mark. It was then titrated with 5 ml each of Fehling A and Fehling B using methylene blue as an indicator and the total sugars percentage was calculated (AOAC, 2000).

Estimation of Reducing Sugar

The reducing sugar in the sample was estimated by the volumetric method of Lane and Eynon reported by AOAC (2000). Freshly prepared 25 g of sample was taken in 250 ml volumetric flask. To it, 10 ml of lead acetate (2%) was added for clarification. The excess of lead acetate was precipitated with potassium oxalate solution and the volume was made to 250 ml with distilled water. The mixture was stirred well and allowed to stand for some time and then filtered. The clear filtrate was titrated with 5 ml each of Fehling A and Fehling B solutions to brick red precipitation using methylene blue as an indicator and the sugars calculated were presented on percent basis.

Estimation of Non-reducing sugars

The amount of non-reducing sugar of the product was

obtained by subtracting reducing sugar from total sugars and multiplying the same with the factor 0.95.

Ascorbic acid (vitamin C)

Ascorbic acid content was determined by titration of a known weight of sample with 2, 6-dichlorophenol indophenol dye using oxalic acid (AOAC, 2000). The 2, 6-dichlorophenol dye which is blue in alkaline solution and red in acid solution reduces ascorbic acid to a colorless form. Ascorbic acid was expressed as mg/100g by using given formula

Dye Factor = 0.5/ Titre

$$\text{Ascorbic acid (mg/100g)} = \frac{\text{Titre x Dye factor x Volume made up x 100}}{\text{Aliquot of extract taken for estimation} \times \text{Wt. or volume of sample taken for estimation}}$$

Antioxidant activity

Antioxidant activity (free radical scavenging activity) was measured as per the method of Brand-Williams *et al*. (1995) [21], DPPH (2, 2-diphenyl-1-picrylhydrazyl) was used as a source of free radical. A quantity of 3.9 ml of 6x10 mol/L DPPH in methanol was put into a cuvette with 0.1 ml of sample extract and the absorbance was measured at 515 nm after 30 minutes. Methanol was used as blank. Antioxidant activity was calculated using the following equation.

$$\text{Antioxidant activity (\%)} = \frac{\text{Absobance of blank} - \text{Absorbance of sample}}{\text{Absorbance of sample}} \times 100$$

Total phenol content

Total phenols were estimated by Folin-Ciocalteu procedure given by (AOAC, 2000) in which absorbance was measured at 765 nm in a colorimeter against water blank. One gram of sample was taken and ground with 10ml of 80% ethanol in pestle and mortar and centrifuged for 20 minutes at 10000 rpm and filtered. The filtrate was evaporated in an oven up to the dryness and dried extract was dissolved in 5 ml distilled water. 2 ml aliquot was taken in separate test tubes and volume was made up to 3 ml. Then 0.5 ml Folin-Ciocalteu reagent was added. Phenols with phosphomolybdic acid in Folin-Ciocalteu reagent and alkaline medium produce a highly dark blue colored complex (molybdenum blue). After 3 minutes 2 ml of Na:CO3 (20%) was added and mixed. Test tubes were placed in a boiling water bath for one minute and then cooled. The optical density of these prepared sample solutions was recorded at 765 nm. The concentration was determined as per the standard procedure from the standard curve. A standard calibration curve of gallic acid using its different concentrations was prepared. The stock solution was prepared by dissolving 0.5 g of dry gallic acid in water to make the final volume 100 ml in a volumetric flask. Aliquot 0. 1. 2. 3. 5 and 10 ml of gallic acid were taken in separate volumetric flasks and then the final volume was raised up to 100 ml with distilled water. Pipette 1 ml of each from these in a separate 100 ml volumetric flask. Water (60 ml) and Folin-Ciocalteu (5 ml) reagent were added to the respective flasks and mixed well. Then, 15 ml Na:CO3 (20%) solution was added. The contents were mixed properly, and final volume was made to 100 ml with distilled water. After 2 hours, absorbance was recorded at 765 nm. Absorbance was then plotted against concentration and the concentration of total phenols in the given sample was calculated and expressed as mg/100 g of sample (AOAC, 2000)

Total Flavonoid content

Preparation of Standard Quercetin for Calibration Curve: Total flavonoid contents in the extracts were determined by aluminum chloride colorimetric assay. Stock solution (4 mg/mL) of quercetin was prepared by dissolving 4 mg of quercetin in 1 ml of methanol. This standard solution was diluted serially to make various concentrations of 0.25 mg/mL, 0.5 mg/ml, 0.75 mg/ml, and 1 mg/ml solutions. 1 ml quercetin of each concentration was added to the test tube containing 4 mL of distilled water. At the same time, 0.3 mL of 5% NaNO2 was added to the test tube and 0.3 mL of 10% AlCl3 after 5 min. Then, 2 mL of 1 M NaOH was added to the mixture after 6 min. The volume of the mixture was made 10 ml by immediately adding 4.4 mL of distilled water. total flavonoids content was expressed as quercetin equivalents using the linear equation based on the calibration curve. Preparation of Samples for Total Flavonoid Content. Stock solutions of 4 mg/ml concentration in methanol of the extracts were prepared, and they were diluted serially to make different concentrations (0.25 mg/ml, 0.5 mg/ml, 0.75 mg/ml, and 1 mg/ml) solutions. Similar procedure as described for quercetin was followed for the extracts also, and the absorbance was measured by spectrophotometer at 510 nm. Readings were taken in triplicate, and the average value of absorbance was used to calculate the total flavonoid content. Total flavonoid content was expressed as quercetin equivalent (mg QE/g) using the linear equation based on the standard calibration curve (AOAC, 2000).

Tannin: Tannin content was determined by volumetric method as described by (AOAC, 2000). Aliquot of the filtered juice prepared from samples containing indigo carmine and distilled water was titrated against 0.1 N Potassium permanganate solution until color changes to bright yellow. Aliquots were titrated to get total tannin and non-tannin like material in the sample. The percent tannin as gallotannic acid was calculated as under

Result and Discussion

Physical characteristics of aonla fruit

Physical characteristics including colour of the fruit, fruit weight, fruit length, fruit breadth, seed weight, juice percentage, pulp percentage and edible portion are evaluated during the analysis of aonla fruit are mentioned in table.1. Colour of the fruit is observed yellow to light green. Fruit weight is observed 46.26 gm and the results are similar to the Bakshi *et al., (*2015) [3] and Singh *et al*., (2006) [20]. Fruit length observed is 16.20 mm and the results are similar to the findings of Bakshi *et al.,* (2015) [3]. Fruit breadth observed is14.18 mm and the results are similar to the findings of Singh *et al*., (2019) [18]. Seed weight observed is1.8gm our results were in agreement with Singh (2022) [19]. Juice percentage is observed 48.06 and the results are similar with data observed by Mishra *et al*., (2009) [11]. Pulp percentage of 20.06 is observed in the results and its similar to the data observed by Gantait. (2021) [6]. Edible portion is observed 90.16% and these results are similar with the data observed by Singh *et al*., (2019) [18].

Table 1: Physical characteristics of aonla fruit

Sr. No	Parameters	Mean±SD
1	Fruit colour	Yellow to light green
1	Fruit weight (gm)	46.26±0.22
2	Fruit length (mm)	16.20±0.10
3	Fruit breadth (mm)	14.18±0.12
4	Seed weight (gm)	1.8±0.04
5	Juice percentage (%)	48.06±0.26
6	Pulp percentage (%)	20.06±0.12
7	Edible portion (%)	90.16±0.04

Chemical and nutritional characteristics of aonla fruit

Different chemical characteristics of aonla TSS, pH, titrable acidity, moisture content, ascorbic acid, ash, protein, reducing sugar, non-reducing sugar, total sugar, antioxidant activity, total phenol content, total flavonoid content and tannin content are mentioned in the table.2. TSS content in aonla is observed is 11.5°B. pH of aonla is observed 2.4 and Similar results were observed by Singh *et al*. (2022) [19]. Titrable acidity of aonla is observed 2.24 is quite Similar findings were found by Bakshi *et al*. (2015) [3]. Moisture content in aonla fruits observed 90.6%. As aonla is rich source of vitamin-C. Ascorbic acid observed in aonla fruit is 460 mg/100g the results are kind of similar to the results observed by Mishra *et al*. (2009) [11]. Ash content in aonla fruit is observed 2.25 and kind of similar results are given by Kshirsagar *et al*., (2003). Protein content in aonla fruit is observed 2.24%, Reducing sugar in aonla is observed 14.12%, Non reducing sugar in aonla is observed 12.22%, Total sugar observed in aonla is 26.32% and the results are similar to the data observed by Bakshi *et al*., (2015) [3]. Antioxidant activity in aonla is observed 80.64% and the results are quite similar to the data observed by Bhattacherjee *et al*., (2020) [4]. Aonla contains different polyphenols like gallic acid, ellagic acid, caffeic acid, chlorogenic acid, chebulic acid, chebulagic acid and citric acid. TPC content in aonla is calculated is equivalent to gallic acid that is 102.12 mg GAE/g and the results are similar to the data observed by Nambiar *et al*., (2015) [12]. The flavonoids present in aonla are calculated equivalent to quercetin is observed 10.88 mg quercetin/g and the data is similar to the findings of Khopde *et al*., (2001) [9]. Aonla contains high amount of tannins due to which it is high in astringency. Tannin content in aonla is observed 45.24 mg/g and results are kind of similar to the data observed by Raghu *et al*., (2007) [16].

Table 2: Chemical and Nutritional characteristics of aonla fruit

Sr. No.	Parameters	Mean ±SD
1	TSS °B	11.5±0.1
2	pH	2.4±0.2
3	Titrable acidity (%)	2.24±0.1
4	Moisture content (%)	90.6±0.2
5	Ascorbic acid (mg/100gm)	460±0.18
6	Ash (%)	2.25±0.10
7	Protein (%)	2.14±0.06
8	Reducing sugar (%)	14.12±0.02
9	Non-reducing sugar (%)	12.22±0.02
10	Total sugar (%)	26.32±0.02
11	Antioxidant activity (%)	80.64±0.22
12	Total phenol content (mg GAE/g)	102.12±0.20
13	Total flavonoid content (mg quercetin/g)	10.88±0.12
14	Tannin (Tannic acid mg /g)	45.24±0.06

Conclusion

In conclusion, aonla fruit is a rich source of various nutrients and bioactive compounds. The physical characteristics of aonla such as fruit weight, length, breadth, seed weight, juice percentage, pulp percentage and edible portion have been reported in this study. The chemical composition of aonla fruit including TSS, pH, titrable acidity, moisture content, ascorbic acid, ash, protein, reducing sugar, non-reducing sugar, total sugar, antioxidant activity, total phenol content, total flavonoid content and tannin content have also been discussed. The results of this study are similar to the findings of previous studies on aonla fruit. Aonla is a good source of vitamin C, antioxidants, and polyphenols. The high tannin content in aonla makes it highly astringent. Overall, the study highlights the importance of aonla fruit as a potential functional food with various health benefits**.**

References

1. AOAC. Official Methods of Analysis of A.O.A.C International. 18th Edition; c2005.
2. Athawale GH, Akbari SH. Aonla and its processing – A review. International Journal of Green and Herbal Chemistry. 2017;6(3):62-73.
3. Bakshi P, Wali VK, Jasrotia A. Evaluation of different aonla (*Emblica officinalis*) cultivars under rainfed conditions of lower shivalik foothills of Himalayas. In Article in Indian Journal of Agricultural Sciences; c2015. https://www.researchgate.net/publication/286469946
4. Bhattacherjee AK, Dikshit A, Pandey D, Singh A. Characterization of ascorbic acid and phenolic compounds for identification of nutritionally rich cultivars and accessions of Indian gooseberry. Fruits. 2020;75(2):71-77. https://doi.org/10.17660/TH2020/75.2.2
5. Ganachari A, Thangavel K, Mazara Ali S, Nidoni U, Ananthacharya. Physical properties of Aonla fruit relevant to the design of processing equipments. International Journal of Engineering Science and Technology. 2010;2(12):7562-7566.
6. Gantait S, Mahanta M, Bera S, Verma SK. Advances in biotechnology of *Emblica officinalis* Gaertn. syn. *Phyllanthus emblica* L.: a nutraceuticals-rich fruit tree with multifaceted ethnomedicinal uses. In 3 Biotech Springer Science and Business Media. 2021, 11(2). Deutschland GmbH. https://doi.org/10.1007/s13205-020-02615-5
7. Ghorai K, Sethi V. Varietal suitability of amla (Desi and Banarsi) fruits for storage and preservation. Indian Food Packer. 1996;50(1):11-15.
8. Goyal RK, Patil RT, Kingsly ARP, Walia H, Kumar P. Status of post-harvest technology of aonla in India-a review. American Journal of Food Technology. 2008;3(1):13-23.
9. Khopde SM, Priyadarsini KI, Mohan H, Gawandi VB, Satav JG, Yakhmi JV, *et al*. Current Science Association Characterizing the antioxidant activity of amla (*Phyllanthus emblica*) extract. In Source: Current Science. 2001, 81(2). https://about.jstor.org/terms
10. Kshirsagar P, Gavankar M, Chavan V, Pujari K, Deshpande S, Shingre B, *et al*. Evaluation of bold aonla genotypes in Konkan with unique two harvests in a year. In J Appl. Hort. 2003, 5(2).

11. Mishra P, Chauhan OP, Rai GK, Srivastava V, Verma D, Chauhan OP, *et al*. Physico-chemical properties of Chakaiya variety of Amla (*Emblica officinalis*) and effect of different dehydration. African Journal of Food Science. 2009;3(10):303-306. http://www.academicjournals.org/ajfs.
12. Nambiar SS, Paramesha M, Shetty NP. Comparative analysis of phytochemical profile, antioxidant activities and foam prevention abilities of whole fruit, pulp and seeds of *Emblica officinalis*. Journal of Food Science and Technology. 2015;52(11):7254-7262. https://doi.org/10.1007/s13197-015-1844-x
13. NHB. Area and Production of Horticulture Crops: All India; c2018.
14. Pareek S, Kitinoja L. Aonla (*Emblica officinalis* Gaertn.). Food Science, Technology and Nutrition. 2011; 5:65-95.
15. Priya MD, Khatkar BS. Effect of processing methods on keeping quality of aonla (*Emblica officinalis* Gaertn.) preserve. International Food Research Journal. 2013;20(2):617-622.
16. Raghu V, Platel K, Srinivasan K. Comparison of ascorbic acid content of *Emblica officinalis* fruits determined by different analytical methods. Journal of Food Composition and Analysis. 2007;20(6):529-533. https://doi.org/10.1016/j.jfca.2007.02.006
17. Raut AA, Kadu RV, More HG. Studies on engineering properties of aonla fruits (*Phyllanthus emblica* L.) for design and development of aonla pricking machine. International Journal of Tropical Agriculture. 2016;34(2):355-360
18. Singh AK, Singh S, Saroj PL, Mishra DS, Singh PP, Singh RK. Aonla (*Emblica officinalis*) in India: A review of its improvement, production and diversified uses. Indian Journal of Agricultural Sciences. 2019;89(11):1773-1781. https://doi.org/10.56093/ijas.v89i11.95288
19. Singh N, Kumar M. Characterization of aonla (*Phyllanthus emblica* Linn.) germplasm under semi-arid condition of Haryana; c2022. http://www.thepharmajournal.com
20. Singh S, Singh AK, Joshi HK. ization of maturity indices in Indian gooseberry (*Emblica afficitlalis*) under semi-arid conditions of Gujarat; c2006.
21. Brand-Williams W, Cuvelier ME, Berset CL. Use of a free radical method to evaluate antioxidant activity. LWT-Food science and Technology. 1995 Jan 1;28(1):25-30.