



## Proximate, Phytochemical and Antioxidant Activity of Amla Powder and Amla Candy

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### Abstract

Amla is sour and astringent taste fruit, making the fruit less palatable to eat directly as fresh fruit; hence it can be consumed in processed form. Preparing powder and candy from amla fruit can increase its acceptability, the market value of it and be utilized to develop new value-added products. Considering this, the present study was designed to evaluate the nutritional compositions, vitamin C content, beta-carotene content, and antioxidant activity of fresh amla and two amla products such as amla powder and amla candy. Between the two products, amla powder contained a significantly ( $P < 0.05$ ) high amount of dietary fiber (17.67%), protein (4.98%), and ash (9.82%) contents than fresh amla and amla candy. Between two products, vitamin C (298.3 mg/100gm) and beta-carotene (113.55 mg/100gm) contents were significantly ( $P < 0.05$ ) high in amla powder. But amla candy showed high antioxidant activity (77.75%) than amla powder (59.2%). Results of this study suggested that amla and amla products are a good source of nutrients like vitamin C and different bioactive components. Amla can be utilized in diets as candy and dehydrated powder or flour which is easily included in food formulations due to its excellent nutritional qualities. Optimization of its use is beneficial in terms of nutritional and economical points of view.

**Key words:** Amla, Amla products, Candy, Powder, Proximate composition

### Introduction

Amla (*Embllica Officinalis*), also known as Indian gooseberry, is a small-sized subtropical fruit that belongs to the family Euphorbiaceae (Dubois *et al.*, 1956). It is eaten as a raw fruit or in an ingredient of a different processed food product like candy, jam, jelly, etc. Amla is considered a primary component in several ayurvedic medicine formulations and treatments such as chyvanprash (Rajeshkumar *et al.*, 2001; Shankar, 1969). Amla is known as a good source of vitamin C, coming in second only to the Barbados cherry, which has the highest vitamin C content (Rajeshkumar *et al.*, 2001; Soni *et al.*, 2009; Paul and Shaha, 2004; Mishra *et al.*, 2011). It's found 200-900 mg of vitamin C per 100 gm edible portion (Jain and Akhurdiya, 2000). The Anti-aging, expectorant, antibacterial, antioxidant, purgative, and hypoglycemic properties of amla have been studied before (Jayshri and Jolly, 1993; Deka *et al.*, 2001). Hemorrhage, dysentery, diarrhea, stomach problems, constipation, headache, jaundice, and liver enlargement can be treated with amla fruit (Goyal *et al.*, 2007). Amla has been used to make a variety of goods, including candies, jam, powder (Mishra *et al.*, 2010), and amla bars (Rastogi and Mehrotra, 1993). Amla berries may be used to make an herbal fermented beverage. The Indian gooseberry is indigenous to India, however, it may also be found in tropical and subtropical countries (Jamwal *et al.*, 1959). Because of its strong acidity and divested taste, the Amla fruit is mostly consumed after processing or as a processed product (Jamwal *et al.*, 1959; Rastogi and Mehrotra, 1993). Fresh Amla powder is frequently utilized in numerous formulations in the Unani and Ayurvedic medical systems. Fruit candies are also becoming increasingly popular due to their high

acceptance, small size, increased nutritional content, and longer shelf life (Ranote and Singh, 2006). So, the objective of the present study is to develop two amla products named amla powder and amla candy and to evaluate the proximate, vitamin C, beta-carotene, and antioxidant activity of value-added amla products and comparison with fresh amla.

### Materials and Methods

#### Collection of raw materials

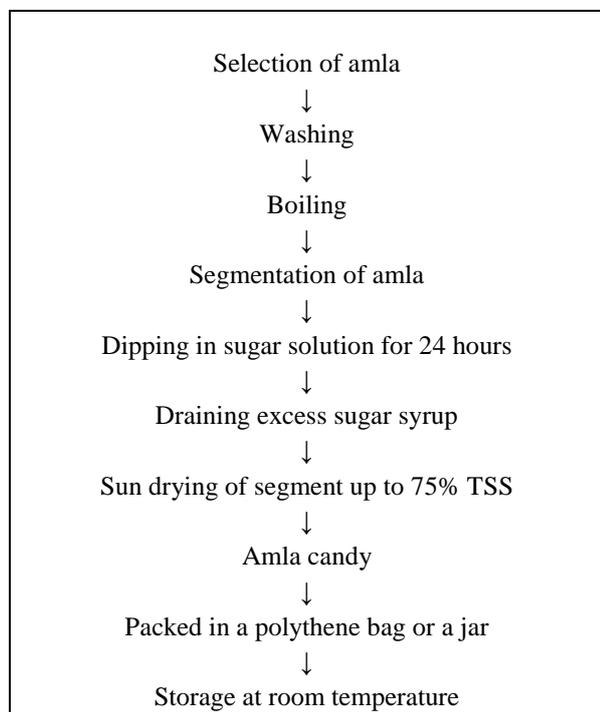
For the development of amla candy and powder, amla was collected from the local market at Tangail Sadar, and chemicals for the tests were collected from the food processing and analysis laboratory of the department of FTNS (Food Technology and Nutritional Science) of Mawlana Bhashani Science and Technology University (MBSTU), Tangail-1902, Bangladesh.

#### Processing of amla

Raw amla fruits were firstly sorted, then weighed, and washed with distilled water before preparing products. Shreds of amla were prepared from whole and fresh fruit by a hand grater. The shreds were blanched for 7-10 minutes at 83°C to prepare pulp. After that, the shreds were destined. The sample was then crushed using a blender. The pulp was dried for 6 hours in a cabinet dryer at 50°C. The dried samples were ground in a grinder and then passed through a 200 µm size mesh. The powder or flour was stored in airtight polythene bags for the next analysis.

**Preparation of amla candy**

The selected amla was weighed and taken into a bowl. Then amla was washed thoroughly with clean water and boiled at 500-600°C for 5 minutes. Each segment was separated uniquely. Dipping the segments of the amla in a measured amount of sugar syrup for 24 hours until it was fully absorbed; the segments of the amla were removed from the sugar syrup up to 75% TSS. The amla segments were sun-dried for 2 days and candy was packed in a polythene bag and/or a jar. After that, the prepared products were stored in a cool and dry place.



**Fig. 1.** Flow-chart for processing of amla candy

**Proximate analysis**

Moisture is always present in foodstuffs. The sample was heated at 105°C for 3-4 hours in the oven and then chilled in desiccators to absorb moisture to estimate moisture content. The technique was repeated until the sample shows the same weight each time.

$$\text{Percentage (\%)} \text{ of moisture} = \frac{W_1 - W_2}{W_1 - W} \times 100$$

Where W = Weight of empty crucible; W<sub>1</sub> = Weight of crucible with the sample; W<sub>2</sub> = Weight of crucible with the dried sample.

Ash was measured by taking 5-10 gm of the fresh amla sample and weighed accurately into a previously weighed crucible. The sample was burned at 600°C so that all the ingredients should burn except the minerals present in the foodstuff.

$$\text{Percentage (\%)} \text{ of Ash} = \frac{\text{Mass of Ash}}{\text{Mass of sample}}$$

The Kjeldahl technique (Parveen and Khatkar, 2015) was used to estimate protein levels. Digestion, distillation, and titration of a sample are all steps in the process. Digestion mix and conc. sulphuric acid was used to break down fresh amla. After dilution, 10 ml NaOH (Sodium hydroxide) was added, followed by distillation. The distillate was then collected in a conical flask (volume 50 ml) containing 5 ml boric acid and 2 drops of indicator mixed until the solution changed color. The distillate was then titrated against standard hydrochloric acid to get the value.

$$\begin{aligned} \text{Percentage (\%)} \text{ of Protein} \\ = \frac{(c - b) \times 14 \times d \times 6.25 \times 100}{a \times 100} \end{aligned}$$

Where, a = sample weight (gm); b = volume of NaOH required for titration for sample; c = volume of NaOH required for titration for blank; d = normality of NaOH used for titration; the conversion factor is 6.25; the atomic weight of nitrogen is 14.

The soxhlet extraction method was used to examine crude fat. Five grams fruit sample was taken in pre-weighed thimbles. Extraction was performed for 2 hours using petroleum ether.

$$\text{Crude Fat (\%)} = \frac{W_2 - W_1}{\text{Weight of the sample}} \times 100$$

Where, W<sub>1</sub> = Weight of beaker; W<sub>2</sub> = Weight of beaker with fat

Fibra plus was used to determine crude fiber content (Parveen and Khatkar, 2015). Sulphuric acid (0.255N) and sodium hydroxide (0.313N) solvents were used for acid and base digestion, respectively. After boiling the extract, it was placed in a muffle furnace to eliminate carbonaceous materials for 30 minutes and the loss of weight was estimated as crude fiber.

$$\text{Percentage (\%)} \text{ of fiber} = \frac{\text{Mass of fiber}}{\text{Mass of sample}} \times 100$$

For the determination of carbohydrate, this formula was used: Total carbohydrate (Per 100 gm of sample) = { 100 - (ash + moisture + fat + protein + crude fiber)}. Energy (in Kcal) is determined by 4 × (Proteins and carbohydrates mass in grams) + 9 × mass of fat in grams.

**Determination of vitamin C content**

At first, standard Vitamin C solution (10 ml) was taken in a conical flask and then titrated with the dye solution. Four to six grams of sample were taken and added with 3% meta-phosphoric acids then homogenized well and filtered through a double layer of muslin cloth. The filter was centrifuged for 10 minutes at 3000 rpm and was titrated the supernatant with 2, 6 - Dichlorophenol indophenol solution.

$$\text{Vitamin C content} \left( \frac{\text{mg}}{100 \text{ gm of sample}} \right) = \frac{\text{mg of vitamin C obtained from the sample}}{\text{Weight of sample}}$$

**Determination of  $\beta$ -carotene content**

20 ml n-hexane and 5 gm samples were taken in a test tube and shaking sometimes for mixing. For good mixing, the mixture was vortex for 5 minutes. The mixture is then swindled gently to obtain a homogenous mixture. Then the mixture was allowed to stand until two separate layers were obtained. The top layer collects in a 25 ml volumetric flask and adds 5 ml n-hexane in the bottom layer. The procedure was repeated until the extract becomes relatively yellow. The absorbance of extracts was measured using a spectrophotometer at a wavelength of 480 nm using n-hexane as blank.

$$\text{Concentration of pigment} = \frac{A}{E \times L}$$

Where, C = Concentration of pigments; A= Absorbance; E = Extinction coefficient; L = Thickness of cuvettes

**Determination of antioxidant activity**

Spectrophotometric techniques were used to measure the extracts' DPPH free radical scavenging activity. Using 80 percent methanol (4 mg of DPPH in 100 mL methanol to generate a 100 M solution), several dilutions of the extracts was prepared. The extract was then combined with 2 mL of 0.1 mM DPPH solution to yield 1 ml. After 30 minutes of incubation in the dark, the absorbance was measured at 517 nm. Finally, the proportion of scavenging activity was calculated using the equation:

$$\text{Scavenging activity, \%} = (A_c - A_s) / A_c$$

Where,  $A_c$  = the absorbance of the control sample;  $A_s$  = the absorbance of the test sample.

**Statistical analysis**

The data were analyzed using SPSS for windows V.20 and presented as Mean  $\pm$  SD (standard deviation). The statistical significance was determined using the One-way Analysis of Variance (ANOVA) followed by the Dunnett Multiple Comparisons Test. Each value was derived from the average of three observations and the mean value was reported.

**Results and Discussion**

**Proximate analysis**

Table 1 showed the results obtained for the proximate analysis of fresh and processed amla products (Amla powder, Amla Candy). The amount of moisture, carbohydrate, fat, and ash in the fresh amla sample was almost similar to what was mentioned in those works of literature by Rajpreet and Usha (2015), Yadav *et al.*

(2020), and Nayak *et al.* (2012). The moisture content of fresh amla was significantly high (84.92%) than amla powder (6.69%) and amla candy (17.39%). The moisture content of the fresh amala was found lower than in the study of Rajpreet and Usha (2015). Yadav *et al.* (2020) found slightly lower moisture content (82.76%) than the findings of the present study. The average value of moisture contents of amla varieties ranged from 81.26 to 84.65% (Parveen and Khatka, 2015). The reduced moisture content in powder was due to the drying effect. A higher amount of sugar might have caused dehydration effecting resulting in the moisture reduction in the amla candy (Chen *et al.*, 2002). However, the ash content of amla powder (9.82%) samples was significantly increased due to their high dry matter content. It was probably due to the freshness of Amla and the high minerals content of our sample. There was no significant difference observed in the ash content of fresh amla (1.97%) and amla candy (2.26%). Generally ash content of fresh amla ranges from 2.24 to 3.08% was observed in different varieties (Parveen and Khatka, 2015). Rajpreet and Usha (2015) found that raw amla, amla powder, and amla candy contained 1.54%, 9.31%, and 1.75% ash content accordingly. This finding is similar to the findings of the present study. No significant changes were observed in fat content. But fat content was slightly high in amla powder. This is due to fruits containing less fat. Fat content in fresh amla and amla candy was found high than the result found in the earlier study (Rajpreet and Usha, 2015). Parveen and Khatka (2015) reported that fat content in fresh amla of different varieties ranges from 0.36 to 0.48%. There was a significant difference has examined in the result of carbohydrate content among fresh amla, amla powder, and amla candy. Amla candy contained a high amount of carbohydrates (71.97%) than fresh amla (9.01%) and amla powder (60.32%). Fruits and vegetables are known as good sources of dietary fibers. Crude fiber usually includes hemicelluloses, cellulose, polysaccharides, and lignin. Crude fiber content was observed at a minimum in fresh amla (2.94%) and a maximum in amla powder (17.67%). A significant difference was observed in the crude fiber content of fresh amla, amla powder, and amla candy. Parveen and Khatka (2015) reported that fiber content in fresh amla of different varieties ranges from 7.18 to 22.35%. Another study reported the range of fiber in fresh fruit from 2.38 to 3.4% (Karla, 1988). Rajpreet and Usha (2015) reported that fiber content is high in amla powder than the fresh and amla candy. This result is similar to the results of the present study. No significant difference in protein content of fresh amla and amla candy was observed. But protein content was significantly increased in amla powder. Protein contents among different varieties of fresh amla varied from 2.05 to 3.17% (Parveen and Khatka, 2015). Rajpreet and Usha (2015) reported that fresh amla and amla candy contain less amount of protein (0.70% and 0.90%) than amla powder (5.60%). Similar trends in protein content were found in our study. The energy value of amla candy was found significantly higher than fresh amla and amla powder might be due to the contribution of a higher amount of sugar and carbohydrate. The variation

in proximate composition is contributed by soil profile, variation of variety, climate, geography, cultivation methods, etc. The overall results indicated that there

were significant differences among the fresh amla, amla powder, and amla candy in terms of proximate characteristics.

**Table 1.** Proximate Analysis of fresh amla, amla powder and amla candy

Parameters	Fresh Amla	Amla Powder	Amla Candy
Moisture (%)	84.92 ± 0.02 <sup>a</sup>	6.69 ± 0.08 <sup>b</sup>	17.39 ± 0.38 <sup>c</sup>
Ash (%)	1.97 ± 0.13 <sup>a</sup>	9.82 ± 0.13 <sup>b</sup>	2.26 ± 0.03 <sup>a</sup>
Fat (%)	0.21 ± 0.02 <sup>a</sup>	0.52 ± 0.03 <sup>a</sup>	0.12 ± 0.02 <sup>a</sup>
Fiber (%)	2.94 ± 0.04 <sup>a</sup>	17.67 ± 0.07 <sup>b</sup>	7.38 ± 0.06 <sup>c</sup>
Protein (%)	0.95 ± 0.01 <sup>a</sup>	4.98 ± 0.56 <sup>b</sup>	0.88 ± 0.06 <sup>a</sup>
Carbohydrate (%)	9.01 ± 0.2 <sup>a</sup>	60.32 ± 0.87 <sup>b</sup>	71.97 ± 0.55 <sup>b</sup>
Energy (Kcal/100gm)	41.73 ± 1.02 <sup>a</sup>	265.9 ± 6.0 <sup>b</sup>	292.5 ± 2.62 <sup>b</sup>

Values are means of triplicate ± standard deviations. Values in the rows bearing the different superscripts are significantly different (P<0.05)

**Phytochemical characteristics**

Vitamin C and beta-carotene content of fresh amla, amla powder, and amla candy are shown in Table 2. Vitamin C content in fresh amla was 533 mg/100gm which was lower than that observed by Hasan *et al.* (2016) and higher than Rajpreet and Usha (2015). Amla powder and amla candy contain 298.3 mg/100gm and 27.25 mg/100gm which were slightly higher than the amount of vitamin C reported by Rajpreet and Usha (2015). The variation of the results might be the reason for the variation of the extraction solvents. Vitamin C content

of amla candy was too lower than fresh amla because vitamin C is a water-soluble and temperature-sensitive vitamin, so is easily degraded during cooking (Igwegmar *et al.*, 2013). On the other hand, Cooking reduces carotenoid loss to a minimum, and in many circumstances, cooking makes carotenoids more accessible, owing to the liberation of carotenoids from the cell matrix by heat (Beverly *et al.*, 2000). Hence, there were no significant losses of Beta carotene found in amla candy. Beta carotene was found maximum in amla powder in the present study.

**Table 2.** Phytochemical and antioxidant activity of fresh amla, amla powder and amla candy

Parameters	Fresh Amla	Amla Powder	Amla Candy
Vitamin C(mg/100gm)	533 ± 1.5 <sup>a</sup>	298.3 ± 0.15 <sup>b</sup>	27.25 ± 0.25 <sup>c</sup>
β-Carotene (mcg/100gm)	87 ± 2.5 <sup>a</sup>	113.55 ± 2.15 <sup>b</sup>	98.38 ± 4.9 <sup>a</sup>
Antioxidant Activity (%)	81.42 ± 6.75 <sup>a</sup>	59.2 ± 0.6 <sup>b</sup>	77.75 ± 1.30 <sup>a</sup>

Values are means of triplicate ± standard deviations. Values in the rows bearing the different superscripts are significantly different (P<0.05)

**Antioxidant activity**

DPPH is normally used to evaluate antioxidant activity. The reduction capability of the DPPH radical is measured by the reduction in its absorbance at 515 nm, induced by antioxidants. The decrease in absorbance of DPPH radical is affected by antioxidants, because the reaction between antioxidant molecules and radicals, progresses, which results in the scavenging of the radical by hydrogen donation. Amla is a rich source of antioxidants. There were some changes between fresh amla and processed amla in antioxidant activity (Table 2). Fresh amla shows 81.42% antioxidant activity, whereas amla powder and amla candy have 59.2% and 77.75% antioxidant activity respectively. Rajpreet and Usha (2015) were also found almost similar trends in antioxidant activity in fresh amla, amla powder, and amla candy. Antioxidant activity was high in amla candy followed by fresh amla.

**Conclusions**

Two amla products were prepared in this study named amla powder and amla candy from amla fruit to increase their acceptability, and market value of it and utilize to develop new value-added products. Nutritional compositions, vitamin C content, beta-carotene content, and antioxidant activity of fresh amla and two amla products were studied. Between the two products, amla powder contained a significantly high amount of dietary fiber (17.67%), protein (4.98%), and ash (9.82%) contents than amla candy. Vitamin C (298.3 mg/100gm) and beta-carotene (113.55 mg/100gm) contents were significantly high in amla powder. But amla candy showed high antioxidant activity (77.75%) than amla powder (59.2%). Results of this study suggested that amla and amla products are a good source of nutrients like vitamin C and different bioactive components. So, Amla can be utilized in diets as candy and dehydrated

powder or flour which is easily included in food formulations due to its excellent nutritional qualities.

### References

- Beverly, C., Inke, P., and Smith, J.C.Jr. 2000. Bio-availability of Carotenoids from Vegetables. *American Society for Horticultural Science*, 35(4): 585-588.
- Chen, W., Liu, D., and Chen, M. 2002. Effects of high level of sucrose on the moisture content, water activity, protein denaturation and sensory properties in Chinese-style pork jerky. *Asian-australasian Journal of Animal Sciences*, 15(4): 585-90.
- Deka, B.C., Sethi, V., Prasad, R., and Batra, P.K. 2001. Application of mixtures methodology for beverages from mixed fruit juice/pulp. *Food Science and Technology*, 38(6): 615-618.
- Dubois, M., Gilles, K.A., Hamilton, J.K., Rebers, P.A., and Smith, F. 1956. Colorimetric methods for determination of sugars and related substances. *Analytical Chemistry*, 28(3): 350-356.
- Goyal, R.K., Kingsly, A.R.P., Kumar, P. and Walia, H. 2007. Physical and mechanical properties of Aonla fruits. *Journal of Food Engineering*, 82(4): 595-599.
- Hasan, M.R., Islam, M.N., and Islam, M.R. 2016. Phytochemistry, pharmacological activities and traditional uses of *Emblca officinalis*: A review. *International Current Pharmaceutical Journal*, 5(2): 14-21.
- Igwemmar, N.C., Kolawole, S.A., and Imran I.A. 2013. Effect of Heating on Vitamin C Content of Some Selected Vegetables. *International journal of scientific & technology research*, 2(1): 209-212.
- Jain, S.K., and Akhurdiya, D.S. 2000. Aonla: potential fruit for processing. *Delhi Garden Mega*. 38(1): 50-51.
- Jamwal, K.S., Sharma, I.P., and Chopra, L. 1959. Pharmacological investigation on the fruits of *Emblca officinalis* Gaertn. *Journal of Scientific and Industrial Research*, 18c: 180-181.
- Jayshri, S., and Jolly, C.I. 1993. Phytochemical anti-bacterial and pharmacological investigations on *Monordicachiranlia* and *Emblca officinalis*. *Indian Journal of Pharmaceutical Sciences*, 55(1): 6-13.
- Kalra, C.L., 1988. The chemistry and technology of amla (*Phyllanthus emblica*)- a resume. *Indian Food Packer*, 38(4): 67-83.
- Mishra, P., Verma, M., Mishra, V., Mishra, S., and Rai, G.K. 2011. Studies on development of ready to eat amla (*Emblca officinalis*) chutney and its preservation by using class one preservatives. *American Journal of Food Technology*, 6(3): 244-252.
- Mishra, V., Mishra, P., Rai, G.K. 2010. Process and product standardization for the development of amla bar. *Beverage Food World*, 37: 58-60.
- Nayak, P., Tandon, D.K., and Bhatt, D.K. 2012. Study on changes of nutritional and organoleptic quality of flavored candy prepared from aonla (*Emblca officinalis* G.) during storage. *International Journal of Nutrition and Metabolism*, 4(7): 100-106.
- Parveen, K. and Khatkar, B.S. 2015. Physico-chemical properties and nutritional composition of aonla (*Emblca officinalis*) varieties. *International Food Research Journal*, 22(6): 2358-2363.
- Paul, D.K., and Shaha, R.K. 2004. Nutrients, vitamins and minerals content in common citrus fruits in the northern region of Bangladesh. *Pakistan Journal of Biological Science*, 7(2): 238-242.
- Rajeshkumar, N.V., Therese, M., and Kuttan, R. 2001. *Emblca officinalis* fruit afford protection against experimental gastric ulcers in rats. *Pharmaceutical Biology*, 39(5): 375-380.
- Rajpreet, K.G., and Usha, B. 2015. Enhancing the functional properties and nutritional quality of ice cream with processed amla (Indian gooseberry). *Journal of Food Science and Technology*, 52(12): 7861-7871.
- Ranote, P.S., and Singh, S. 2006. Value added aonla products. The Schumacher Centre for Technology and Development Bourton-on-Dunsmore Rugby, Warwickshire, CV23 9QZ United Kingdom.
- Rastogi, R.P., and Mehrotra, B.N. 1993. Compendium of Indian Medicinal Plants. Central Drug Research Institute. Publication Information Directorate India.
- Shankar, G. 1969. Aonla for your daily requirement of vitamin C. *Indian Horticulture journal*, 13: 9-15.
- Soni, S.K., Bansal, N., and Soni, R. 2009. Standardization of conditions for fermentation and maturation of wine from Amla (*Emblca officinalis* Gaertn.). *Natural Product Radiance*, 8(4): 436-444.
- Yadav, K.C., Samikshya, R., Anish, D., and Lila, D.S. 2020. Phytochemical, Nutritional, Antioxidant Activity and Sensorial Characteristics of Amala (*Phyllanthus emblica*L.) Chutney. *Asian Food Science Journal*, 18(1): 43-52.