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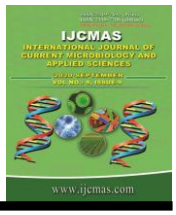

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Studies on Supplementation of Natural Ascorbic Acid in Dried Aonla (*Emblica officinalis* Gaertn) Powder

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A B S T R A C T

Fruit and fruit products both are an important supplement to the human diet as they provide almost all the vital components required for normal growth and development of the human body leading to the healthy physique and mind. Aonla is a very rich source of ascorbic acid. Its ascorbic acid lost during the process of drying. Therefore, supplementation with fresh aonla juice in aonla powder is one of the essential treatments to make its more nutritive and enriched. Aonla powder were taken into four cleaned petri dishes and marked as A (control), B, C and D further, it was supplemented with ascorbic acid 5, 10 and 15 times to samples of petri dish B, C and D, respectively. The present research revealed that marginal differences in ascorbic acid contents were observed in various treatments. The maximum retention of ascorbic acid with petri dish B samples and decreasing with increasing of treatments that means the minimum retention in sample of petri dish D. Treated samples had higher ascorbic acid content with respect to the control samples (petri dish A).

Introduction

Aonla (*Emblica officinalis* Gaertn), the king of arid fruits, popularly known as Indian gooseberry, is an important fruit crop of tropical and subtropical region of India. India ranks first in the world in aonla area and production volume. It is considered to be a "wonder fruit for health". Aonla is highly nutritious and important dietary sources of vitamin C (Ascorbic acid), minerals and amino acids. It also contains tannins, phyllembelic acid, phyllemblin, rutin, curcuminoides, emblicol and phenolic compounds (Zhang *et al.,* 2000). Nutritional losses of aonla fruits is major problem due to plucking, transportation, pre-processing treatment during conversion of aonla fruits into different food products. There are reports that 25-93% losses occur in vitamin C and other nutrients during processing of aonla into preserve (Sethi and Anand, 1983; Kalra *et al.*, 1988; Tandon *et al.*, 2003). Raw aonla fruits, being highly acidic and astringent in taste, are unacceptable to consumers. Therefore, they are generally processed to sugar-rich products

such as preserves, candies, etc (Kalra, 1988). Aonla fruits are commonly used for processing like Aonla pulp, Jam, Syrups, Morrabba, Squash, Chutney, Candy, Toffee, Pickles, Aonla sweet, Dehydrated aonla and aonla Powder. Preservation of foodstuffs through dehydration is an ancient practice. Aonla powder is one of the dried forms of aonla fruits, but its nutritional quality (Ascorbic acid) is not retained as in fresh aonla fruits due to processing (Pareek and Kaushik, 2012). The fruit contains a chemical substance called leucanthocyanin which retards the oxidation of Ascorbic acid (Balaji and Prasad, 2014). The fresh fruit of aonla are very rich source of Ascorbic acid (500-1500 mg/100g) and used as a strong rejuvenator in Indian pharmacopoeia (Pathak and Ram, 2007). It is also appreciable source of total sugar (7.53mg/100g), calcium (14.91 mg/100g), iron (0.62 mg/100g) and phosphorus (11.81mg/100g) and also has great potential for processing (Dachiya and Dhawan, 2001). Supplementation with fresh aonla juice in aonla powder is one of the essential treatments to make its more nutritive and enriched.

Materials and Methods

The procurement of aonla fruits were done in the first week of February. These aonla fruits were obtained from local garden of C.S.A University, Kanpur (U.P).

Grading, cleaning and washing

The aonla fruits were graded on the basis of their maturity and size. These aonla fruits were initially washed by plenty of tap water to remove adherent undesirable extraneous matter. The ascorbic acid was determined by 2, 6-dichlorophenol-indophenol visual-titration method as suggested by Palmer (1993).

Pre-processing treatments

Aonla fruits are highly acidic in nature and bitter in taste, so these are consumed after some pre-processing treatments. Blanching and drying are most important pre-processing treatments in the production of aonla powder.

Blanching of aonla fruits

The special heat treatment to inactivate enzymes is known as blanching. It is one of the essential treatments in the preparation of aonla fruit for dehydration. The treatment of blanching commonly involves by means of some heat, usually either steam or boiling water. The combination of time and temperature used depend on the final processing to be employed as well as on the nature of materials to be processed. The treatment of blanching is advantageous in the removal of tissue gas, shrinking and heating of materials, inactivation of enzyme particularly catlase and peroxidase present in the tissue. Enzyme inactivation in the material to be dehydrated is important because again no further cooking previous to storage is involved in the process.

5 kg of aonla fruit were taken separately in two equal lots and these lots were blanched in boiling water for 10 minutes. The blanched aonla fruits were cut into small pieces with the help of sharp edge stainless steel blade and seeds were removed from the fruits. Weight of blanched aonla flakes and seeds were taken by weighing machine.

Drying of flaked aonla fruits

Aonla fruits are highly perishable in nature as its storage in atmospheric conditions after harvesting is very limited (Kumar and Nath, 1993). Storage facilities such as cold storage, controlled/modified atmospheric storage, being very expensive are not direct reach of

poor farmers. Preservation of food stuffs through dehydration is an ancient practice. The modern method of dehydration i.e. drying fruits and vegetables under controlled conditions of temperature and humidity assumed importance as major industry on account their concentrated form, low cost, convenience and easy transportability with increase shelf life, dried fruits and vegetables product and also other dehydrated fruits have become more popular (Lal *et al.,* 1986). Pretreated (blanched) flakes of aonla fruit were dried in digital oven at 65°C till the weight was constant as suggested by Pareek and Kaushik (2012).

Grinding of dried aonla flakes

Dried aonla flakes were converted into aonla powder by grinding with the help of grinder. This aonla powder was stored in cleaned glass jar and determined ascorbic acid content. Further, 20 gm of aonla powder were taken into each four cleaned petri dishes and marked as A, B, C and D. Petri dish A was considered as a control (untreated) sample, which was kept in desiccators.

Supplementation of aonla powder with ascorbic acid

Aonla juice was extracted by juice extractor. This aonla juice was filtered through muslin cloth and transferred into glass jar. Further, determined ascorbic acid content of aonla juice and stored at refrigerated temperature (2°C). Further, aonla juice was taken into pipette and sprinkled over the aonla powder of petri dish B, C, and D for supplementation of ascorbic acid until the stage of saturation was reached. These ascorbic acid treated aonla powder petri dishes were kept in digital oven for drying at 40°C for 8 hours. After drying, large and hard granules were formed in aonla powder. These aonla powder were grinded to make again small granules powder. Similarly, this process was repeated 5 times for petri dish B, 10 times for petri dish C, and 15 times for petri dish D. After supplementation and drying, ascorbic acid content of enriched aonla powder in petri dish B, C, and D were determined.

Results and Discussion

The present investigation has been under taken to know exactly how much ascorbic acid increased and retained in the dried aonla powder. The data of Table 1 show that the blanching does not significantly affect the ascorbic acid content of dried aonla product. The ascorbic acid content of 280 mg/100 g was recorded in dried aonla product. Similar findings were observed by Shrivastava and Kumar (2007) and Singh et al (2006). It may be due to inactivation of oxidase enzyme (Prajapati *et al.,* 2011).

Table 2 illustrated the effect of supplementation treatments of ascorbic acid on dried aonla powder. It is clearly shown in Table 2 that after 5 treatments of supplementation in samples of petri dish B followed by drying; capability of absorption of juice by powder was found to be decreased from 7 ml to 5.5 ml. The supplementation of ascorbic acid was found maximum (85.95 ± 0.04 mg) in first two treatments as compared to later treatments. The overall supplementation of ascorbic acid in petri dish B was 666.76 mg against initial value of 280 mg per 100 gm powder. Further, drying of the sample only 500 ± 0.10 mg ascorbic acid was retained in aonla powder while 166.76 mg ascorbic acid was lost during drying process.

It is also shown in Table 2 that on further supplementation of powder by aonla juice up to 10 times in petri dish C, the absorption capability of powder sample was further decreased to 4.5 ml.

Table.1 Enrichment of dried aonla powder with fresh aonla juice

Characteristics	Petri dish A	Petri dish B	Petri dish C	Petri dish D
No. of Treatment (times)	Control (no treatment)	5	10	15
Initial weight of aonla powder (gm)	20	20	20	20
Final weight of aonla powder (gm) (after supplementation)	20	24.5±0.12	27.8±0.14	29.8±0.16
Initial ascorbic acid content (mg) (per 100 gm of aonla powder)	280±0.08	280±0.08	280±0.08	280±0.08
Total supplemented ascorbic content (mg)	280	666.76	967.56	1207
Retention of ascorbic acid content (mg) (per 100 gm of aonla powder)	280±0.08	500±0.10	600±0.09	630±0.12
Losses of ascorbic acid (mg) (per 100 gm of aonla powder)	0	166.76	367.57	577.00

Values are of mean ± SD of three replicates
Aonla juice contains 1227.8mg/100gm of Ascorbic acid used for treatments

Table.2 Effect of supplementation treatment on dried aonla powder with natural ascorbic acid (aonla juice)

Characteristics	No. of Treatment															Total value
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	
Petridish A (Control)																
Petridish B																
Aonla juice (ml)	7	7	6	6	5.5											31.5
Ascorbic acid (mg) (per 100gm)	85.95±0.04	85.95±0.03	73.67±0.03	73.67 ±0.02	67.53 ±0.04											666.76
Petridish C																
Aonla juice (ml)	7	7	6	6	5.5	5	5	5	5	4.5						56
Ascorbic acid (mg) (per 100gm)	85.95±0.04	85.95±0.03	73.67±0.03	73.67 ±0.02	67.53 ±0.04	61.39 ±0.05	61.39 ±0.04	61.39 ±0.03	61.39 ±0.04	55.25±0.05						967.56
Petridish D																
Aonla juice (ml)	7	7	6	6	5.5	5	5	5	5	4.5	4.5	4.5	4	3.5	3	75.5
Ascorbic acid (mg) (per 100gm)	85.95±0.04	85.95±0.03	73.67±0.03	73.67 ±0.02	67.53 ±0.04	61.39 ±0.05	61.39 ±0.04	61.39 ±0.03	61.39 ±0.04	55.25±0.05	55.25 ±0.05	55.25± 0.03	49.12 ±0.04	42.97 ±0.03	36.83±0.01	1207

Values of ascorbic acid are mean ± SD of three replicates
Aonla juice contains 1227.8mg/100gm of Ascorbic acid used for treatments

Table.3 Yield of aonla powder

Total weight of aonla fruit (kg)	**5.0**
Weight after blanching (kg)	4.54
Weight of edible flesh (kg)	4.22
Weight of stones (kg)	0.32
Weight of aonla powder (kg)	0.68
Dehydration Ratio	6.2:1
Yield of powder (%)	13.60

The supplementation of ascorbic acid was found maximum (61.39 ± 0.05 mg) in 6^{th} to 9^{th} treatments but decreased in 10^{th} treatment (55.25 ± 0.05 mg). The overall supplementation of ascorbic acid in petri dish C was 967.56 mg while retains only 600 ± 0.09 mg of ascorbic acid. The samples of petri dish C gained only 100 mg ascorbic acid in comparison to samples of petri dish B (Table 1). Similarly, the absorption capability of samples of petri dish D was further decreased to 3 ml (Table 2). The overall supplementation of ascorbic acid in petri dish D was 1207 mg (total 75.5 ml of aonla juice) while retains only 630 ± 0.12 mg of ascorbic acid. The increase in ascorbic acid content in sample D was insignificant (30 mg) with respect to ascorbic acid gained in sample C (Table 1).

It is clearly shown in Table 1 that the maximum and minimum absorption and retention of ascorbic acid was found in sample of petri dish B and petri dish D, respectively. However, the ascorbic acid retention in petri dish A was 500 ± 0.10 mg after supplementation of 666.76 mg ascorbic acid but in case of petri dish C and D the value was 600 ± 0.09 and 630 ± 0.12 after supplementation of 967.56 and 1207 mg ascorbic acid, respectively. This may be due to the repeatedly heating of product which affects the retention capacity of ascorbic acid. Pareek and Kaushik (2012) and Prajapati *et al*., (2011) also reported that drying method and degree of heating affects the retention of ascorbic acid in dried aonla products. The final product (aonla powder) was obtained 0.68 kg made from 5.0 kg of fresh Aonla fruit. The yield of aonla powder was 13.60% with dehydration ratio is about 6.2:1 (Table 3).

In conclusions the present research revealed that marginal differences in ascorbic acid contents were observed in various treatments. The result of the first treatment of aonla powder supplementation with fresh juice followed by drying is much encouraging. But, further supplementation of powder with aonla juice to 10 and 15 times, the absorption capability was decreased to 4.5 and 3 ml, respectively and ascorbic acid losses also increased with increasing number of treatments. Therefore, it can be concluded that the vital value of powder is much more enhanced in initial treatments as compared to later treatments. All treated samples had higher ascorbic acid content with respect to the control samples.

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