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Effect of Different Drying Methods on the Nutritional Composition of Aonla Fruit *(Emblica Officinalis* Garten)

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Abstract

Aonla *(Em blica Officinalis* Garten) var. Chakaiya was taken to evaluate the changes in nutritional quality of fruits dried by using four different methods of dehydration viz., solar drying (direct), solar drying (indirect), hot air oven drying and osmo-air drying. Ripe aonla fruits were blanched in boiling water for 10 minutes and then soaked in 0.1 per cent potassium metabisulphite solution for 10 minutes. After removing the pits, the pieces were dried in direct and indirect heating models, hot-air oven and by osmo-air drying method till no further moisture loss occurred. The drying was accomplished in 3 days each in hot-air oven drying and osmo-air drying method whereas it took 6 and 11 days respectively in direct and indirect heating models. The recovery of fruit was maximum in osmo-air drying method. The total ascorbic acid, total sugar and reducing sugar content of osmo-air dried aonla were maximum and the tannin content and browning were lowest. Indirect solar drying method was found to be comparatively better than direct solar drying method for dehydration of aonla fruit.

1 Introduction

Aonla as Indian Gooseberry *(Emblica Officina/is* Garten) is a native of India, Malaya and China. It is essentially a subtropical fruit but can be successfully grown in tropical as well as dry conditions. It is quite hardy, prolific bearer and is highly remunerative even without much care. The embolic blooms late in spring and the fruits ripen during winters (SINGH, 1980). The optimum stage of harvesting falls between the period extending from the second week of December to the third week of January in Northern plains (KALRA, 1988).

The fruits are attractive, round, deeply ribbed and pale green in colour. The surface of fruit is shiny and the size varies from small marble to a large plum. Aonla fruit is probably the richest known source of ascorbic acid (MANNY AND SHADAKSHARASWAMY, 1997). Its vitamin C content has been reported to be about 300-1000 mg/100 g (GHORAI

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AND SETHI, 1996). The presence of high level of ascorbic acid makes it of good medicinal value as antisorbutic, diuretic, laxative and antibiotic (MEHTA, 1995). The aonla fruits taste extremely acidic and bitter. It is sour, astringent, occasionally eaten raw and is generally consumed after processing in the form of jams, jellies, pickles, preserves, candies and in dried form. Unlike other fruits/vegetables, the vitamin C content of aonla fruit is not destroyed much on dehydration due to the protection of the vitamin by tannins containing gallic acid -ellagic acid and/or glucose present in it. Dehydration of aonla is an important technique which can be applied efficiently to make the fruits available round the year and also to avoid market glut in the peak harvest. The process of drying can be carried out in different ways, like solar drying, mechanical drying, osmotic drying etc. Keeping these facts in mind, the present study was undertaken to evaluate the changes in the nutritional quality of fruits dried using different methods of dehydration.

2 Material and Methods

Mature aonla fruits, variety 'Chakaiya' were obtained from the orchards of CCS Haryana Agricultural University, Hisar during the months of November to December, 1997. The fruits were washed and blanched in boiling water (90+2°C) for 10 minutes. The blanched fruits were then sulphited by dipping them in a solution of 0.1 per cent potassium metasulphite for 10 minutes. Pits were removed manually and fruits were subjected to different drying treatments viz., solar drying (direct), solar drying (indirect), hot-air oven drying and osmo-air drying. In the case of solar drying (direct), solar drying (indirect) and hot-air oven drying, the fruit pieces were placed in the respective cabinets and dried till no further weight loss occurred. In case of osmo-air dehydration, the fruit pieces after removal of pits were dipped in 70°C Brix sugar solution for 17 h at 50°C, drained, washed to remove adhering sugar, air dried and kept in hot air oven at 65°C till no further moisture loss occurred. The dried fruit pieces were ground and used for the estimation of various nutrients. The proximate composition was estimated using methods of AOAC (1990). Total and reducing sugars were estimated by the method of Hulme and Narain (1931). Ascorbic acid and total tannins were estimated by the method of AOAC (1990). Browning and titrable acidity were assessed by the method of Rangana (1986).

3 Results and Discussion

The nutritional evaluation revealed that the moisture content of fresh and blanched fruit was 80.74 and 82.82 g/100 g. The crude protein, crude fat, crude fibre and ash content of the fresh and blanched fruit were 0.58, 0.21, 3.17, 0.52 and 0.43, 0.15, 2.75 and 0.40 g/100 g respectively (Table 1).

Table 2 shows the comparison between the chemical composition of the dehydrated aonla dried using four different methods and the fresh fruit. The minimum moisture content was observed in osmo-air dried fruit (4.53%), followed by direct solar dried (5.73%) and indirect solar dried aonla (6.28%). The maximum moisture content was observed in hot-air oven dried aonla (7.07%). In the cases of osmo-air drying and hot-air oven drying, the dehydration process was completed in three days each whereas the drying was achieved in 6 days when directly solar dried. The drying of fruit using indirect solar drying cabinet took a longer period i.e. 11 days as the fruit pieces were not directly exposed to sunlight. The recovery of fruit after drying was maximum in osmo-air drying (28.69%).

The total ascorbic acid content of fresh fruit was found to be 454.40 mg/100 g on fresh weight basis. The retention of total ascorbic acid was maximum in osmo-air dried aonla (243.74 mg/100 g), followed by oven dried aonla (189.10 mg/100 g), direct solar dried aonla (170.17 mg/100 g) and lastly indirect solar dried aonla (159.08 mg/100 g). Singh (1992) also reported that the ascorbic acid content of ber fruit dried by osmo-air drying was significantly higher than oven dried and sun dried ber.

Table 1: Proximate composition of fresh and blanched aonla fruits (g/100 g, fresh weight basis)

Parameters	Fresh fruit	Blanched fruit
Moisture	80.74	82.82
Crude protein	0.58	0.43
Crudefat	0.21	0.15
Crudefibre	3.17	2.75
Ash	0.52	0.40

Table 2: Drying characteristics and chemical composition of aonla fruits dried by different methods (DWB)

Parameters	Fresh fruit	Solar dried (direct)	Solar dried (indirect)	Hot-air oven dried	Osmo-air dried
Moisture (%)	80.74	5.73	6.28	7.07	4.53
Recovery (%)	-	10.53	10.34	11.01	28.69
Dryingtime(days)	-	6.0	11.0	3.0	3.0
Total ascorbic acid (mg/100 g)	454.40	170.17	159.08	189.10	243.74
Tannins(g/100g)	3.05	15.00	13.60	14.60	4.80
Titrableacidity(g/100g)	1.82	5.98	6.24	6.08	5.33
Sugar (g/100 g)					
Reducing	5.51	14.96	20.47	19.05	37.28
Total	7.43	21.46	26.53	24.84	43.60
Browning (OD at 440 nm)	0.002	0.069	0027	0.030	0.026

FWB Fresh weight basis DWB = Dry weight basis

The lowest value of tannins was observed in osmo-air dried aonla (4.80 g/100g) on dry weight basis as compared to 3.05 g/100 g tannins in fresh fruit on fresh weight basis. Indirect solar dried aonla had 13.60 per cent, oven dried 14.60 per cent and direct solar dried aonla had 15.0 per cent tannins. The decrease in tannin content in case of osmo-air dried fruit might be because of leaching out of tannins during osmosis.

The titrable acidity was found to be highest in direct solar dried aonla (6.24 g/100 g), followed closely by oven dried aonla (6.08g /100g), direct solar dried aonla (5.98 g/ 100g) and lastly osmo-air dried aonla (5.33%). The reduction in acidity in osmo-air dried fruits which might be due to leaching of acids during osmosis has been reported by several workers (MEHTA AND TOMER, 1980; TOMER AND GAWAR, 1985; KUMAR, 1989). However, Khurdiya and Roy (1986) reported higher percentage of acidity in direct solar dried ber than in direct solar dried her

It was found that the total sugar content of osmo-air dried aonla increased significantly after dehydration (43.60 g/100 g). Singh (1992) and Kim and Toledo (1987) also observed higher total sugars in osmo-air dried ber and blue berries respectively. The reducing sugar content was also maximum in osmo-air dried fruit (37.28 g/100 g).

A perusal of data showed that the maximum browning after dehydration was recorded in directly solar dried aenla (0.069) whereas the browning value in fresh fruit was observed to be 0.002 GD at 440 nm. The browning in indirectly solar dried aonla was much lower (0.027) than that in directl solar dried aonla. The loss of bright colour in the solar dried fruits may be possible due to the photooxidation of carotenoids because of long exposure to light and oxygen. Osmo-air dried aonla showed minimum browning (0.026).

5 Conclusion

It may be concluded that the moisture content was lowest and the per cent recovery of fruit after dehydration was maximum in case of osmo-air drying. The drying time was also comparatively less. The total ascorbic acid, total sugar and reducing sugar content of osmo-air dried aonla was found to be maximum and the tannin content and browning were lowest. Thus, osmo-air drying was considered to be overall best method for dehydration of aonla fruit. The indirect solar dehydration method was found to be comparatively better than the direct solar drying of aonla fruit.

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