

Preparation of dehydrated slices and RTS bevarage from aonla (*Emblica officinalis* Gaerth.) fruits

K. CHANDAN*, S.J. PRASHANTH¹, S.K. NATARAJ², S.M. INDUDHARA AND A.K.ROKHADE

Department of Post Harvest Technology, K.R.C. College of Horticulture, Arabhavi,
BELGAUM (KARNATAKA) INDIA

ABSTRACT

The investigation was conducted to standardize the protocol for preparation of dehydrated aonla slices and RTS beverage from drained aonla syrup. The organoleptically acceptable dehydrated aonla slices with better quality was obtained by blanching fruits for five minutes and sliced pieces steeped in two per cent salt for two hours + steeping in 60° B sugar syrup for 24 hours followed by drying under open sun. The RTS beverage prepared using drained aonla syrup obtained from blanched slices steeped in salt for two hours followed by steeping in 70° B syrup for 24 hours and adjusted to 20° Brix containing two per cent lime juice + one per cent ginger juice was found to be acceptable with good organoleptic scores.

Key words : Aonla, Dehydration, Drained syrup, RTS

INTRODUCTION

Aonla (*Emblica officinalis* Gaerth) is an important arid zone fruit crop. It is probably the only fruit to fill the gap of astringent food recommended by Ayurvedic system of medicine for a balanced diet and sound health. Fruit is a very rich source of ascorbic acid. Fruit is highly acidic and astringent in taste and hence, unsuitable for fresh consumption. Various products like murabba, candy, pickle, jam, sauce, squash, syrup are prepared from this fruit. But available information on preparation of dehydrated aonla slices is limited and during osmodehydration of aonla slices, syrup drained was found to contain a portion of juice which could be exploited for preparation of RTS (Keshatti, 2003). Hence, there is a need to study and standardize a simple, economical and appropriate method for preparation of highly acceptable, good quality dehydrated aonla slices and RTS beverage from drained syrup without wasting it. With this view, the present investigation was under taken to standardize the protocol for preparation of dehydrated sweetened slices and RTS beverage from aonla fruits.

MATERIALS AND METHODS

Preparation of dehydrated aonla slices

Fresh aonla fruits cv. SUREBAN (LOCAL VARIETY) procured from Lingadhhal village, Belgaum district (Karnataka) were used for present investigation. The experiment was laid out in factorial Completely Randomized Design (CRD) with three replications consisting of 15 tratments and two methods of drying.

Fresh fruits were washed in clean water and blanched for 5 minutes and made into slices. The details of treatments are as follows:

- T₁ : Control (blanching)
 - T₂ : Blanching + steeping slices in 2% salt for 1 hour
 - T₃ : Blanching + steeping slices in 2% salt for 2 hours
 - T₄ : Blanching + steeping slices in 2% salt for 3 hours
 - T₅ : Blanching + steeping slices in 2% salt for 1 hour + 50°B syrup* for 24 hours
 - T₆ : Blanching + steeping slices in 2% salt for 2 hour + 50°B syrup for 24 hours
 - T₇ : Blanching + steeping slices in 2% salt for 3 hour + 50°B syrup for 24 hours
 - T₈ : Blanching + steeping slices in 2% salt for 1 hour + 60°B syrup for 24 hours
 - T₉ : Blanching + steeping slices in 2% salt for 2 hour + 60°B syrup for 24 hours
 - T₁₀ : Blanching + steeping slices in 2% salt for 3 hour + 60°B syrup for 24 hours
 - T₁₁ : Blanching + steeping slices in 2% salt for 1 hour + 70°B syrup for 24 hours
 - T₁₂ : Blanching + steeping slices in 2% salt for 2 hour + 70°B syrup for 24 hours
 - T₁₃ : Blanching + steeping slices in 2% salt for 3 hour + 70°B syrup for 24 hours
 - T₁₄ : Dipping in 0.5% hot lye(NaOH) (90°C) solution for 5 minutes + steeping slices in 60°B syrup for 24 hours
 - T₁₅ : Dipping in 0.5% hot lye (NaOH) (90°C) solution for 5 minutes + steeping slices in 70°B syrup for 24 hours
- * Sugar syrup contains 0.2% Potassium Meta bisulphate (KMS).

* Author for correspondence.

¹Department of Olericulture, K.R.C. College of Horticulture, Arabhavi, BELGAUM (KARNATAKA) INDIA

²Department of Floriculture and Landscape Gardening, K.R.C. College of Horticulture, Arabhavi, BELGAUM (KARNATAKA) INDIA

The treated slices were dried under open sun and in solar cabinet drier and packed in 250 gauge polythene bags.

Preparation of RTS from drained aonla syrup :

The sugar syrups (50, 60 and 70°B) used for steeping aonla slices were preserved by boiling the syrup for 15 minutes and filled hot in to clean, sterile bottle and sealed with crown caps using crown sealing machine. Both aonla slices and drained syrup were stored under ambient conditions. The bottled aonla syrup was adjusted to 15°B and subjected to organoleptic evaluation. The drained syrup obtained in treatments which scored the highest in organoleptic evaluation (DS_5 and DS_8) were used for the preparation of RTS. The experiment was laid out in completely randomised design (CRD) with three replications. There were ten treatments. The details of treatments are as follows:

R_1 : Aonla syrup from T_9 + 1% lime juice + 0.5% ginger juice, TSS 15°B

R_2 : Aonla syrup from T_9 + 2% lime juice + 0.5% ginger juice, TSS 15°B

R_3 : Aonla syrup from T_9 + 1% lime juice + 0.5% ginger juice, TSS 20°B

R_4 : Aonla syrup from T_9 + 2% lime juice + 1.0% ginger juice, TSS 20°B

R_5 : Aonla syrup from T_9 + 3% lime juice + 1.5% ginger juice, TSS 20°B

R_6 : Aonla syrup from T_{12} + 1% lime juice + 0.5% ginger juice, TSS 15°B

R_7 : Aonla syrup from T_{12} + 2% lime juice + 1.0% ginger juice, TSS 15°B

R_8 : Aonla syrup from T_{12} + 1% lime juice + 0.5% ginger juice, TSS 20°B

R_9 : Aonla syrup from T_{12} + 2% lime juice + 1.0% ginger juice, TSS 20°B

R_{10} : Aonla syrup from T_{12} + 3% lime juice + 1.5% ginger juice, TSS 20°B

The dehydrated slices and RTS were analysed for physical and chemical parameters. Acidity in fruit extract was estimated by titrating it against 0.1 N sodium hydroxide using phenolphthalein as indicator and reported in terms of citric acid. Ascorbic acid was estimated as per the AOAC method (Anon, 1984). The organoleptic evaluation of dehydrated aonla slices and RTS was done by panel of 15 judges. The data has been analysed statistically and reported at 1% significance level (Panse and Sukhatme, 1985).

RESULTS AND DISCUSSION

The results obtained from the present investigation

are summarized in Table 1, 2, 3, 4 and 5 :

Preparation of dehydrated aonla slices :

The objective of the investigation was to standardize simple, economical and appropriate method for preparation of highly acceptable good quality dehydrated aonla slices. To meet the objective two methods of drying (sun and solar) were selected.

Significantly highest recovery (59.07 %) was recorded in blanched slices steeped in two per cent salt for two hours followed by steeping in 70° B sugar syrup, while lowest (19.37%) was recorded in blanched slices steeped in two per cent salt for one hour (Table 1). The sun dried slices gave higher per cent recovery (40.54%) as compared to solar dried slices. Similar results of higher recovery in sun drying as compared to solar drying has been reported by Keshatti (2003) in aonla and Indudhara (2003) in Fig.

Significantly highest total titratable acidity was recorded in control (1.61%) whereas, slices steeped in sugar syrup showed minimum acidity as compared to untreated control and brine treated slices. It may be due to transfer of sugar molecule to slices. Similar results of decreased acidity level in sugar syrup treated slices was observed by Kannan and Susheela (2001) in guava and Keshatti (2003) in aonla. The lower level of acidity (1.39%) was found in sundried slices as compared to solar dried slices (1.43%)(Table 1).

Significantly maximum ascorbic acid was observed in control (363.50 mg/100g), whereas, minimum ascorbic acid (271.68mg/100g) was observed in blanched slices steeped in two per cent salt for three hours + steeping in 70° B sugar syrup for 24 hours (Table 1). This might be due to loss of ascorbic acid during blanching and leaching during subsequent brining and syruing treatments. Significantly higher level of ascorbic acid was recorded in solar dried slices (307.18mg/100g) as compared to sun dried slices (302.32 mg/ 100g). Higher retention of ascorbic acid in solar dried slices may be due to lesser time of exposure to drying temperature as compared to sun drying. Similar results of higher levels of ascorbic acid in solar dried slices were observed by Balasaheb (1995) in fig and Keshatti (2003) in aonla.

Significantly highest total sugar content was recorded in lye treated slices steeped in 70° B sugar syrup for 24 hours (44.58%). The lye treated slices steeped in 70° B sugar syrup for 24 hours followed by drying in solar drier had recorded highest total sugars (46.07%) (Table 1).

The dehydrated aonla slices prepared by steeping the slices in two per cent salt for two hours followed by steeping in 60° B sugar syrup containing for 24 hours and

Table 1 : Effect of treatments and methods of drying on per cent recovery, total sugar content, titratable acidity and ascorbic acid content of dried aonla slices

Treatments	Recovery (%)			Total sugar content (%)			Titratable acidity (%)			Ascorbic acid (mg/100g)		
	Sun drying	Solar drying	Mean	Sun drying	Solar drying	Mean	Sun drying	Solar drying	Mean	Sun drying	Solar drying	Mean
T ₁	20.73	21.73	21.23	18.56	19.83	19.20	1.59	1.63	1.61	358.33	368.67	363.50
T ₂	19.67	19.06	19.37	17.40	18.93	18.17	1.54	1.59	1.57	354.58	359.58	357.08
T ₃	21.07	22.80	21.93	17.37	18.48	17.93	1.52	1.55	1.54	346.75	348.00	347.38
T ₄	20.13	20.40	20.27	17.33	18.37	17.85	1.51	1.53	1.52	338.00	340.67	339.33
T ₅	40.23	40.97	40.60	34.75	37.37	36.06	1.44	1.46	1.45	305.58	307.48	306.53
T ₆	40.57	42.30	41.43	34.28	37.18	35.73	1.34	1.46	1.40	296.87	300.00	298.43
T ₇	39.83	42.37	41.10	34.03	36.97	35.50	1.22	1.29	1.25	287.07	295.00	291.03
T ₈	46.00	40.40	43.20	38.50	42.18	40.34	1.40	1.44	1.42	291.92	294.00	292.96
T ₉	48.00	40.87	44.43	38.15	42.00	40.08	1.35	1.38	1.36	283.00	290.33	286.67
T ₁₀	46.67	41.90	44.28	38.02	41.85	39.94	1.24	1.26	1.25	270.25	282.83	276.54
T ₁₁	59.67	54.37	57.02	42.94	44.90	43.92	1.30	1.31	1.31	284.58	287.33	285.96
T ₁₂	57.33	54.60	55.97	42.62	43.43	43.03	1.26	1.30	1.28	275.50	280.57	278.03
T ₁₃	63.33	54.80	59.07	42.02	43.93	42.98	1.29	1.30	1.29	269.36	274.00	271.68
T ₁₄	37.90	36.27	37.08	38.83	42.08	40.46	1.50	1.52	1.51	295.17	298.23	296.70
T ₁₅	47.00	43.97	45.48	43.08	46.07	44.58	1.42	1.47	1.45	277.83	281.00	279.42
Mean	40.54	38.45	39.49	33.19	35.57	34.38	1.39	1.43	1.41	302.32	307.18	304.75
For comparing the means of												
	S.E.±	C.D. (P=0.01)	S.E.±	C.D. (P=0.01)	S.E.±	C.D. (P=0.01)	S.E.±	C.D. (P=0.01)	S.E.±	C.D. (P=0.01)	S.E.±	C.D. (P=0.01)
Treatment (T)	0.652	2.438	0.0554	0.2030	0.0033	0.021	0.461	1.687				
Drying method(D)	0.238	0.889	0.0202	0.0739	0.0012	0.0044	0.168	0.615				
T x D	0.922	3.447	0.0783	0.2865	0.0047	NS	0.651	2.382				

NS = Non significant

Table 2 : Organoleptic evaluation of dehydrated aonla slices as influenced by treatments and methods of drying (scores out of 5.0)

Treatment	Colour and appearance			Texture			Taste			Overall acceptability		
	Sun drying	Solar drying	Mean	Sun drying	Solar drying	Mean	Sun drying	Solar drying	Mean	Sun drying	Solar drying	Mean
T ₁	1.17	1.17	1.17	1.16	1.00	1.08	1.17	1.17	1.17	1.16	1.16	1.16
T ₂	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.66	1.16	1.42
T ₃	1.17	1.17	1.17	1.17	1.16	1.16	2.17	1.67	1.92	1.17	1.16	1.16
T ₄	1.17	1.17	1.17	1.17	1.17	1.17	2.17	1.17	1.67	1.42	1.16	1.29
T ₅	2.17	1.18	1.92	2.17	1.17	1.92	2.67	2.17	2.42	2.67	2.17	2.42
T ₆	2.67	2.57	2.62	2.17	2.16	2.17	2.16	2.17	2.17	2.77	2.67	2.72
T ₇	2.17	2.87	2.52	2.67	2.67	2.67	2.66	2.16	2.42	2.57	2.17	2.37
T ₈	4.17	3.17	3.67	3.67	3.47	3.57	2.66	3.66	3.17	3.17	3.67	3.42
T ₉	4.67	3.67	4.17	4.50	3.67	4.08	4.17	4.17	4.17	4.37	4.17	4.27
T ₁₀	4.17	3.77	3.97	3.83	3.66	3.75	3.83	3.87	3.85	4.17	3.92	4.04
T ₁₁	3.67	3.67	3.67	3.83	3.66	3.75	4.00	3.77	3.88	3.73	3.67	3.70
T ₁₂	4.00	3.67	3.83	4.17	3.92	4.04	4.20	3.87	4.03	4.37	4.07	4.22
T ₁₃	4.10	3.67	3.88	4.17	3.92	4.04	3.67	3.87	3.77	4.17	4.07	4.12
T ₁₄	3.27	2.67	2.97	3.16	3.17	3.17	2.50	3.42	2.96	2.67	3.66	3.16
T ₁₅	3.17	2.87	3.02	3.16	3.17	3.17	3.67	3.67	3.67	3.66	3.66	3.66
Mean	2.86	2.59	2.73	2.81	2.64	2.73	2.86	2.80	2.83	2.91	2.84	2.88
For comparing the means of												
	S.E. ±	C.D. (P=0.01)	S.E. ±	C.D. (P=0.01)	S.E. ±	C.D. (P=0.01)	S.E. ±	C.D. (P=0.01)	S.E. ±	C.D. (P=0.01)	S.E. ±	C.D. (P=0.01)
Treatment (T)	0.110	0.411	0.118	0.441	0.118	0.441	0.106	0.396				
Drying method (D)	0.040	0.149	0.043	0.161	0.043	NS	0.039	NS				
T x D	0.156	0.583	0.167	NS	0.167	0.624	0.151	0.565				

NS – Non Significant

Table 3 : Organoleptic evaluation of drained aonla syrup (TSS 15°B) as influenced by treatments (scores out of 5.0)

Treatments	Colour and appearance	Taste	Flavour	Overall acceptability
DS ₁	3.05	3.03	3.13	3.03
DS ₂	3.15	3.28	3.03	3.03
DS ₃	3.15	3.28	3.03	3.03
DS ₄	3.15	3.53	3.13	3.78
DS ₅	3.28	4.03	3.13	4.03
DS ₆	3.15	3.78	3.08	3.93
DS ₇	3.15	3.63	3.03	3.83
DS ₈	3.15	3.78	3.08	4.03
DS ₉	3.05	3.63	2.88	3.97
DS ₁₀	3.05	2.68	2.93	3.50
DS ₁₁	3.05	2.63	2.93	3.28
Mean	3.13	3.39	3.04	3.58
For comparing the means of				
S.E. ±	0.049	0.033	0.033	0.069
C.D.(P=0.01)	NS	0.132	0.132	0.275

DS₁ – Drained aonla syrup from T₅, DS₂ – Drained aonla syrup from T₆, DS₃ – Drained aonla syrup from T₇, DS₄ – Drained aonla syrup from T₈, DS₅ – Drained aonla syrup from T₉, DS₆ – Drained aonla syrup from T₁₀, DS₇ – Drained aonla syrup from T₁₁, DS₈ – Drained aonla syrup from T₁₂, DS₉ – Drained aonla syrup from T₁₃, DS₁₀ – Drained aonla syrup from T₁₄, DS₁₁ – Drained aonla syrup from T₁₅, NS – Non significant

drying under open sun had highest scores (out of 5.00) for colour and acceptance (4.7), texture (4.50) and overall acceptability (4.27) (Table 2). The sun dried slices had significantly higher scores for colour and acceptance (2.86), texture (2.81), taste (2.86) and overall acceptability

(2.91) as compared to solar dried slices.

Preparation of RTS from drained aonla syrup:

As drained aonla syrup had high sugar content, it was necessary to dilute it and blend with other fruit juices like lime juice and peeled ginger juice. Therefore, in the present investigation, different recipes containing drained aonla syrup at different TSS levels, different levels of lime juice and ginger juice and were tried in order to produce a good quality aonla RTS, which has ready acceptability by the consumer. The drained aonla syrup obtained from T₉ and T₁₂ were found to have highest organoleptic scores with respect to colour and appearance, taste, flavour and overall acceptability (Table 3). Also, these treatments had the highest scores for organoleptic characters of dehydrated slices (above 4.0). Hence, used for preparation of RTS.

Significantly highest ascorbic acid (mg/100 g) was observed in R₈ (8.58 mg/100 g), which was at par with R₁₀ (8.49 mg/100 g), whereas the lowest value was observed in R₁ and R₂ (4.10 mg/100 g). Significantly maximum reducing sugar was observed in R₈ (2.97%), which was at par with R₄ (2.93%), whereas minimum was recorded in R₁ (2.53). Significantly maximum non-reducing sugar was observed in R₉ (11.18%), which was at par with R₅ and R₁₀ (11.09%), whereas minimum was observed in R₁ (8.58). Significantly maximum total sugar was observed in R₉ (14.63%), which was at par with R₈ (14.60%), whereas minimum was observed in R₁ and R₂ (11.57%). Significantly maximum total titratable acidity was observed in R₅ and R₁₀ (0.26%), which was at par with R₄ (0.25%), whereas minimum value was observed

Table 4 : Ascorbic acid, reducing sugars, non-reducing sugars, total sugars, titratable acidity, sugar : acid ratio of aonla RTS as influenced by treatments

Treatment	Ascorbic acid content (mg/100g)	Reducing sugars (%)	Non-reducing sugars (%)	Total sugars (%)	Titratable acidity (%)	Sugar : acid ratio
R ₁	4.10	2.53	8.58	11.57	0.21	56.08
R ₂	4.10	2.47	8.65	11.57	0.22	52.58
R ₃	7.13	2.92	11.07	14.57	0.24	59.89
R ₄	7.13	2.93	11.02	14.53	0.25	57.39
R ₅	7.13	2.90	11.09	14.57	0.26	56.02
R ₆	5.35	2.55	8.60	11.60	0.18	64.44
R ₇	5.33	2.55	8.63	11.63	0.19	61.23
R ₈	8.58	2.97	11.07	14.60	0.20	73.00
R ₉	8.39	2.87	11.18	14.63	0.23	64.67
R ₁₀	8.49	2.90	11.09	14.57	0.26	56.02
Mean	6.57	2.76	10.10	13.38	0.22	60.13
For comparing the means of						
S.E. ±	0.120	0.040	0.045	0.037	0.005	0.908
C.D. (P=0.01)	0.483	0.160	0.181	0.149	0.020	3.652

Table 5 : Organoleptic evaluation of aonla RTS as influenced by treatments (scores out of 5.0)

Treatment	Colour and appearance	Taste	Flavour	Overall acceptability
R ₁	3.82	3.57	3.53	3.53
R ₂	3.82	3.82	3.53	3.78
R ₃	4.07	4.32	4.03	4.03
R ₄	4.07	4.32	4.53	4.28
R ₅	3.82	3.82	3.55	3.48
R ₆	4.17	4.32	4.13	4.18
R ₇	4.07	3.82	4.03	4.03
R ₈	4.07	3.82	4.03	3.78
R ₉	4.32	4.57	4.53	4.53
R ₁₀	4.07	4.07	4.13	4.03
Mean	4.03	4.04	3.99	3.97
For comparing the means of				
S.E.±	0.067	0.067	0.035	0.033
C.D. (P= 0.01)	0.261	0.261	0.136	0.129

in R₆ (0.18%). Significantly maximum sugar : acid ratio was observed in R₈ (73.00), whereas minimum ratio was observed in R₂ (52.58%) (Table 4).

The RTS having drained aonla syrup of T₁₂ + two per cent lime juice + one per cent ginger juice and TSS adjusted to 20°B was found to have the highest organoleptic scores with respect to colour and appearance, taste, flavour and overall acceptability. Another recipe of RTS containing drained aonla syrup of T₉ + two per cent lime juice + one per cent ginger juice and TSS adjusted to 20°B also had organoleptic scores comparable to that of earlier one. The organoleptic scores for overall acceptability were more than 4.25 in these two RTS indicating both the RTS are quite acceptable to consumers (Table 5). The addition of lime juice and ginger juice might have enhanced the flavour of RTS and masked acid taste. Thus, the evaluation of different recipes of

RTS revealed that, aonla RTS can be acceptable to the consumers only when it is blended with lime juice (2%) and ginger juice (1%).

Conclusion :

Keeping in view of the above discussion, it can be concluded that, good quality dehydrated aonla slices can be obtained by blanching the aonla fruits for five minutes + steeping in two per cent salt for two hours followed by steeping in 60°B syrup containing 0.2 per cent KMS for 24 hours and drying under sun. The RTS prepared with drained aonla syrup obtained from slices steeped in 60°B or 70°B syrup + two per cent lime juice + one per cent ginger juice adjusted to a TSS 20°B was readily acceptable.

REFERENCES

- Anonymous (1984).** *Official Methods of Analysis*. Ed. Sinewy, W., Association Official Analytical, Virginia, pp. 423-462.
- Balasaheb (1995).** Effect of methods of preparation and storage on quality of dried figs. M.Sc. (Hort.) Thesis, Mahatma Phule Krishi Vidyapeeth, Rahuri (M.S.).
- Indudhara, S.M. (2003).** Standardisation of drying techniques in fig fruits. M.Sc. (Hort.) Thesis, University of Agricultural Sciences, Dharwad (Karnataka).
- Kannan, S. and Susheela, T.A. (2001).** Effect of osmotic dehydration of guava. *Beverage & Food World*, **28**(12): 25-26
- Keshatti, G.I. (2003).** Dehydration of aonla (*Emblica officinalis* Gaerth.) fruits. M.Sc. (Hort.) Thesis, University of Agricultural Sciences, Dharwad (Karnataka).
- Panse, V.S. and Sukhatme, P.V. (1985).** *Statistical Methods For Agricultural Workers*, ICAR, New Delhi pp. 152-155.

Received : August, 2009; Accepted : December, 2009