AATCC Review

15 August 2023: Received
08 October 2023: Revised
21 December 2023: Accepted
11 January 2024: Available Online

www.aatcc.peerjournals.net

Research Article Open Access

Studies on the Effect of Sugar in Bioactive Components Retention on Amla Products

K. P. Sivakumar[1], B. Nallakurumban [2] and T. Balaji[3]

[1]Department of of FRM&CS, Community Science College & Res. Instt,.Tamil Nadu Agricultural University (TNAU), Madurai-625 104, India .
[2]Krishi Vigyan Kendra, Tamil Nadu Agricultural University, Aruppukottai, Virudunagar District, India .
[3]Krishi Vigyan Kendra, Tamil Nadu Agricultural University (TNAU), Ramnad, India.

ABSTRACT

Amla fruit (Emblica officinalis) commonly known as Indian gooseberry or Amla, is perhaps the most important medicinal plant in the Indian traditional system of medicine, the Ayurveda.Vitamin C, tannins and flavonoids present in amla have powerful antioxidant activities. Due to rich Vitamin C content, amla is successfully used in the treatment of diabetes mellitus. It is one of the oldest Indian fruits and considered as "wonder fruit for health". Amla pulp of fresh fruit contains 200-900 mg/100 g of vitamin C. Ascorbic acid retention was found to be decreased with increase in temperature. The fruit is highly perishable in nature and is available for short period from October to January. The amla fruit possess excellent nutritive and therapeutic value and to promote the use of amla among the public. Hence an attempt was made to standardized sweet-based products viz. jam, squash and jelly with different treatments. The prepared amla products were standardized based on sensory evaluation. The bio active components and sensory evaluation of amla products were analysed during the storage period. The shelflife studies of amla jam, squash and jelly were also done at room temperature and it has more shelflife with high organoleptic scores.

Keywords: *Amla products, bio active components, value-added products,shelf-life,room temperature, sensory evaluation & sugars.*

INTRODUCTION

Amla also known as Indian gooseberry (*Emblica officinalis*) is one of the useful fruit. It is consumed as a fresh fruit or in the form of food products like preserves. The amla is regarded as main ingredient in many ayurvedic preparations like chyvanprash and is regarded as rejuvenating herb. Amla is a rich source of vitamin C, Which rank second next to Barbados cherry which has maximum vitamin C. It is found to posses anti-aging, expectorant, purgative, antibacterial, antioxidant, hypoglycemic activity [7]. Many different products have been reported from amla like ready – to- serve beverage, candy, jam, powder, Amla bar [2]. Amla berries can be used as a valuable ingredient for the production of an herbal fermented beverage. The Indian gooseberry is native to India and also grows in tropical and subtropical regions. In addition of being an important medicinal herbs, it has potent antioxidant, several active tannoid principles (Emblicannin A, Emblicannin B, Punigluconin and Pedunculagin) have been identified which to account for its health benefits like antioxidant activity, antiaging property [8]. The Amla fruit, because of its high acidity and astringent taste is not preferred for direct consumption; hence it is consumed mainly after processing, as processed product. Present study was done to prepare preserved product utilizing bioactive rich underutilized fruit amla.

*Corresponding Author: ***K. P. Sivakumar***
*Email Address: ***sivakumar.kp@tnau.ac.in***

DOI: https://doi.org/10.58321/AATCCReview.2024.12.01.23

MATERIALS AND METHODS

Selection of Amla fruit

Fully matured and fresh Amla fruit (Kanchan Var.) were procured from the local market of Madurai city, Tamilnadu, India.

Standardization of Amla Jam

The selected fresh amla fruits were washed in clean water, surface dried, cut into small pieces, pulped in mixie, passed through a hand pulper, and strained using a muslin cloth and used for the preparation of amla jam. The amla jam was standardized with the addition of different levels (0.1 0.2 and 0.3 %) of pectin contents and without pectin. Among the jam prepared with and without the addition of pectin, the jam prepared with 0.1% of pectin was found to be best. The product was standardized on sensory evaluation in terms of acceptability with special reference to colour and appearance, flavour, texture taste and overall acceptability.

Standardization of Amla squash

Amla squash was standardized as per the FPO specification with the addition of mint extract (1, 1.5, and 2%), honey (10, 15, and 20%), and date syrup (10, 15 and 20). The prepared amla squash samples were poured in to a sterilized bottle (cap.680 ml) leaving one-inch head space and capped air tightly. The prepared amla squash was organoletpically evaluated using a 9 point hedonic scale by panel of 20 semi trained judges of Department of Food Science and Nutrition, Home Science College and Research Institute, Madurai.

Amal jelly

The amla jelly were tried with different proportions (50: 50, 65: 35 and 75: 25) of amla and guava extract and amla and jack fruit

rind at different levels (0.75, 1.0 and 1.5%) of commercial pectin and agar at 2,3 and 4 per cent level also. Among the above, the amla jelly was set at 1.5% level of pectin and 4% of agar. The prepared amla jelly was packed in air tight plastic jar and glass bottle. Amla, jelly samples were organoletpically evaluated using a 9 point hedonic scale by panel of 20 semi trained judges.

BIOACTIVE COMPONENTS ANALYSIS

The methods adopted to analysis the various bioactive components of the amla products before and during storage at regular intervals are given below.

Methods of bioactive components analysis

S.NO.	Bioactive components	Method adopted	Reference
1.	Moisture	Hot air oven	[1]
2.	Titrable acidity	Titrating against 0.01 N NaOH using phenolphthalein	[5]
3.	pH	pH meter	[3]
4.	TSS	Hand refractometer	[10]
5.	Reducing sugar and total sugars	Shaffer somogyi micro method	[4]
6.	Vitamin – C	2,6 dichlorophenol indophenol visual titration	[9]

STORAGE STUDY

The storage studies of prepared products were analysis by noting the changes in the bioactive components and sensory evaluation at regular intervals before and during storage.

STATISTICAL ANALYSIS

The data obtained were subjected to statistical analysis to find out the impact of storage period and packaging materials on the quality of amla products during storage. Factorial Completely Randomized Design (FCRD) was applied for the analysis [6].

RESULTS AND DISCUSSION

Shelf life studies of amla products during the storage period

Amla Jam

Amla jam was packed in a glass bottle and stored at room temperature. The storage behaviour of the jam was recorded by noting the changes in the chemical composition at regular intervals of once in 30 days.

Table 1 summarizes the changes observed in the moisture content of amla jam during storage. The freshly prepared amla jam contained 24.94 g per cent which had changed to 24.00 g per cent at the end of the nine months of storage period. Amla jam exhibited a gradual increase in acidity during storage. Initially, the sample had 1.05 g per cent and it was increased to 1.95 g per cent after nine months of storage. The minimum changes were observed in total soluble solids and total sugar. At the end of the storage period, the TSS and total sugar were 67.62bx and 52.23 g per cent respectively. Similar parameters changes were also observed [15].

The notable changes were exhibited (13.43 to 13.92%) in reducing sugar content of amla jam. The conversion of total sugar to simple sugar during storage might have increased the reducing sugar level in the stored samples. The straw berry fruit jam has increase trend was noted during storage period [11] .The vitamin C and tannin content of amla jam is presented in Table 5. There was a gradual reduction in vitamin C and tannin during storage. Initially 388.13 mg/100g and 0.96 mg/100g in vitamin C and tannin content respectively. After nine months of storage, the amla jam contained 387.42 mg/100g in vitamin C and 0.82 mg/100g in tannin respectively.

Table 1. Changes in bioactive components of amla jam during storage period

Storage period (in months)	Chemical Characteristics						
	Moisture (%)	Acidity (%)	TSS (°Bx)	Total sugar (%)	Reducing sugar (%)	Vitamin C (mg/100g)	Tannin (mg/100g)
Initial	24.94	1.05	68.10	52.76	13.43	388.13	0.96
1	24.94	1.06	68.10	52.71	13.51	388.13	0.96
2	24.81	1.06	68.10	52.54	13.63	388.13	0.96
3	24.70	1.19	68.02	52.47	13.64	388.04	0.95
4	24.54	1.32	67.94	52.41	13.67	387.93	0.93
5	24.39	1.53	67.94	52.33	13.73	387.88	0.93
6	24.26	1.70	67.88	52.30	13.80	387.81	0.90
7	24.12	1.82	67.80	52.30	13.82	387.68	0.86
8	24.03	1.88	67.70	52.25	13.85	387.50	0.85
9	24.00	1.95	67.62	52.23	13.92	387.42	0.82

	Moisture	Acidity	TSS	Total sugar	Reducing sugar	Vitamin C	Tannin
SED	0.0077	0.0081	0.0322	0.0100	0.0161	0.0351	0.0077
CD (0.01)	0.0246 **	0.0256**	0.1022 **	0.0317 **	0.0511 **	0.1112**	0.0246 **

Amla squash

Data on the changes in the chemical composition of amla squash during the storage is given in Tables 2 and 3. The freshly prepared amla squash had 1.04g / 100 ml of acidity in control (T_1), 1.06,1.04 and 1.01 g of acidity in 100 ml of amla squash treated with 1,1.5 and 2% of mint extract (T_2), 1.04, 1.03 and 1.01g / 100 ml of acidity treated with 10, 15 and 20% of honey (T_3) and 1.05, 1.03 and 1.02 g of acidity in 100 ml of the amla squash treated with 10, 15 and 20% of date syrup (T_4). A slight variation was observed between the treatments during the storage period. A gradual increase of acid content was observed during storage. After nine months of storage, the acidity was increased to 1.24 g per cent in control (T_1) 1.20, 1.19 and 1.21 g / 100 ml of acidity in amla squash treated with 1, 1.5, and 2% of mint extract (T_2), 1.21, 1.20 and 1.19 g per cent acid content treated with honey (T_3) and 1.20, 1.20 and 1.21 g / 100 ml of acidity treated with 10, 15 and 20% of date syrup (T_4) respectively. [11] reported that the strawberry squash showed an increasing trend in acid content from 1.20 to1.43 percent during storage period. The patharnakh pear juice had 0.44 per cent acid content after 3 month of storage [12]. Similar trend was noted in the present study during storage..

Table 3. Summarizes the changes noted in the vitamin C content of the amla squashes during the study period. A slight variation was observed between the squashes throughout the storage period. The initial vitamin C content of amla squashes were 535.16 mg /100 ml in control (T_1) which had decreased to 528.08 mg/100ml after nine month of storage. Amla squash treated with mint extract samples (T_2) initially had 537.12, 537.20 and 537.21 mg/100 ml which had changed to 533.18, 532.94 and 532.68 mg per cent in 1, 1.5 and 2% respectively after nine month of storage at room temperature. Similarly the vitamin C content was 534.72, 534.86 and 535.13 mg/100ml in 10, 15 and 20% at initially. After nine month of storage, it was (honey treated amla squash) decreased to 532.15, 532.89 and 531.44 mg/100 ml in 10, 15 and 20% respectively. Likewise date syrup treated amla squash contained 534.33, 534.55 and 535.20 mg/ 100 ml in 10, 15 and 20% in freshly prepared samples at room temperature. After nine month of storage, it was decreased to 530.69, 531.48 and 531.77 mg of vitamin C per 100 ml in 10, 15 and 20% of date syrup treated samples. The vitamin C content of the stored sample showed a very slight difference between treatments throughout the study period. The vitamin C content of the mango squash was 2.10, 2.08 and 2.05mg/100ml in T_1, T_2 and T_3 during storage [14].

Total sugar and tannin content of amla squashes were decreased during storage period. Total sugar was 40.02 g per cent in control (T_1) 40.30, 40.28 and 40.26 in amla squash treated with 1, 1.5 and 2% mint extract (T_2), 40.22, 40.10 and 40.12 g per cent in amla squash treated with 10, 15 and 20% honey (T_3) and 40.10, 40.13 and 40.12 g per cent in amla squash treated with 10, 15 and 20% of date syrup (T_4) at end of the storage. The same result was observed from [15] reported that the total sugar content was decreased in pear squash (35.05 to 34.52%) and pear and pineapple blended squash (35.19 to 34.06%) during the storage period (6 months). Likewise the tannin content of amla squash was 3.40 mg/100 ml in T_1, 3.29, 3.23 and 3.23 mg/100 ml in amla squash treated with 1, 1.5 and 2% of mint extract (T_2), 3.25, 3.26 and 3.24 mg/100 ml in amla squash treated with 10, 15 and 20% honey (T_3) and 3.28, 3.23 and 3.18 mg/100 ml in amla squash treated with 10, 15 and 20% of date syrup (T_4) at end of the storage. [13] revealed that tannin content decreased after storing for 60 days. The statistical examination of the data concluded that there was a significant difference in the bio active components between treatments and storage period.

Amla jelly

The changes observed in the chemical composition of amla jelly packed in glass bottles (PC_1) and plastic container (PC_2) is given in Tables 4 and 5.

Initially moisture content of pectin and agar added samples had 20.10 and 20.92/100g. A very slight variation was observed between the samples in both packaging materials throughout the storage period. After six month of storage the samples in PC_1, PC_2, AC_1 and AC_2 contained 19.27, 19.40, 20.22 and 20.15 per cent respectively. The moisture content of the mango jelly was decreased in T_1, T_2 and T_3 during storage [14].

A gradual increase in acidity was noted was in the acid content of the amla jelly packed in both materials. The freshly prepared amla jelly was 1.03 g per cent acidity in pectin and agar added samples which had changed 1.14 in PC_1, 1.17 in PC_2, 1.14 in AC_1 and 1.18 in AC_2 after six month of storage. A decreasing trend may observed in tannin and vitamin C content of amla jelly was seen during the storage period. After six month of storage, the tannin content was 0.85 and 0.82 mg/100mg in PC_1 and PC_2, 0.86 mg/100mg and 0.84 mg/100mg in AC_1 and AC_2 respectively. Similarly the vitamin C was 280.17 mg/100g in PC_1, 268.84 mg/100g in PC_2, 292.24 mg/100g in AC_1 and 273.53 mg/100g in AC_2 at the end of the storage period. [13] revealed that similar result after storing for 60 days in pineapple fruit jelly. The freshly prepared amla jelly had 65brix TSS, which had been maintained upto four months in the samples packed in both packaging materials. There was an increasing in the TSS, after fourth month to sixth month storage and the final values noted were 65.30brix, 66.00brix, 65.20brix and 65.80brix in PC_1, PC_2, AC_1 and AC_2 respectively.

Table 2. Changes in bioactive components of Amla squash during storage period

Treatments	Percentage levels	Acidity (g/100ml)					pH					Tannin (mg/100ml)				
		Storage period (in month)					Storage period (in month)					Storage period (in month)				
		Initial	1	3	6	9	Initial	1	3	6	9	Initial	1	3	6	9
Control (T_1)	-	1.04	1.05	1.10	1.17	1.24	3.38	3.37	3.34	3.29	3.20	3.85	3.82	3.75	3.65	3.40
Amla + Mint extract (T_2)	1%	1.06	1.08	1.12	1.17	1.20	3.41	3.40	3.37	3.33	3.25	3.69	3.68	3.60	3.51	3.29
	1.5%	1.04	1.06	1.10	1.15	1.19	3.46	3.44	3.43	3.36	3.27	3.68	3.66	3.55	3.46	3.23
	2%	1.01	1.05	1.09	1.14	1.21	3.47	3.46	3.44	3.37	3.24	3.69	3.66	3.59	3.45	3.23
Amla + Honey (T_3)	10%	1.04	1.08	1.10	1.16	1.21	3.50	3.48	3.46	3.41	3.27	3.72	3.70	3.61	3.47	3.25
	15%	1.03	1.05	1.10	1.17	1.20	3.52	3.52	3.49	3.40	3.26	3.71	3.68	3.61	3.48	3.26
	20%	1.01	1.03	1.06	1.12	1.19	3.55	3.54	3.51	3.40	3.25	3.74	3.70	3.65	3.51	3.24
Amla + Date syrup (T_4)	10%	1.05	1.05	1.10	1.16	1.20	3.51	3.50	3.47	3.37	3.25	3.61	3.59	3.53	3.45	3.28
	15%	1.03	1.08	1.10	1.15	1.20	3.52	3.50	3.47	3.40	3.24	3.65	3.62	3.53	3.41	3.23
	20%	1.02	1.03	1.09	1.14	1.21	3.57	3.55	3.53	3.40	3.25	3.69	3.64	3.55	3.40	3.18

Acidity pH Tannin

	SED	CD (0.01)			SED	CD (0.01)			SED	CD (0.01)
t	0.01451	0.03887 **		t	0.00767	0.02055 **		t	0.00477	0.01280 **
s	0.01026	0.02748 **		s	0.00542	0.001453 **		s	0.00338	0.00905 **
ts	0.03243	0.08691 NS		ts	0.01715	0.04595 **		ts	0.01068	0.02861 **

Table 3. Changes in bioactive components of Amla squash during storage period

Treatments	Percentage levels	Total sugar (g/100ml)					Reducing sugar (g/100ml)					Vitamin C (mg/100ml)				
		Storage period (in month)					Storage period (in month)					Storage period (in month)				
		Initial	1	3	6	9	Initial	1	3	6	9	Initial	1	3	6	9
Control (T_1)	-	41.04	41.00	40.88	40.35	40.02	2.93	2.99	3.27	3.66	3.96	535.16	535.10	534.82	533.45	528.08
Amla + Mint extract (T_2)	1%	40.95	40.93	40.80	40.52	40.30	2.80	2.85	2.99	3.42	3.81	537.12	537.03	536.81	535.64	533.18
	1.5%	40.91	40.87	40.71	40.56	40.28	2.76	2.81	2.97	3.32	3.79	537.20	537.15	536.88	535.11	532.94
	2%	40.90	40.87	40.75	40.58	40.26	2.71	2.80	2.94	3.27	3.77	537.21	537.11	536.84	535.05	532.68
Amla + Honey (T_3)	10%	40.70	40.64	40.58	40.38	40.22	2.92	2.97	3.19	3.54	3.92	534.72	534.58	534.31	533.79	532.15
	15%	40.74	40.66	40.41	40.22	40.10	2.95	3.01	3.22	3.58	3.95	534.86	534.80	534.54	533.22	532.89
	20%	40.80	40.70	40.52	40.31	40.12	2.97	3.05	3.23	3.60	3.95	535.13	535.08	534.85	533.85	531.44
Amla + Date syrup (T_4)	10%	40.72	40.70	40.53	40.30	40.10	3.05	3.10	3.25	3.64	3.99	534.33	534.25	533.99	532.66	530.69
	15%	40.75	40.66	40.54	40.32	40.13	3.09	3.19	3.38	3.72	4.05	534.55	534.43	534.17	533.33	531.48
	20%	40.85	40.80	40.62	40.34	40.12	3.15	3.21	3.50	3.81	4.18	535.20	535.09	534.79	533.59	531.77

Total sugar Reducing sugar Vitamin C

	SED	CD (0.01)			SED	CD (0.01)			SED	CD (0.01)
t	0.00687	0.1841 **		t	0.80706	2.16268 NS		t	32.91136	88.19215 NS
s	0.00486	0.1302 **		s	0.57068	1.52925 NS		s	23.27184	62.36127 NS
ts	0.01536	0.04117 **		ts	1.80465	4.83590 NS		ts	73.59203	197.20364 NS

Table 4. Changes in bioactive components of Amla jelly during storage period

Storage period (in month)	Moisture (%)				Acidity (g/100g)				Tannin (mg/100g)			
	Pectin		Agar		Pectin		Agar		Pectin		Agar	
	Glass bottle (PC_1)	Plastic jar (PC_2)	Glass bottle (AC_1)	Plastic jar (AC_2)	Glass bottle (PC_1)	Plastic jar (PC_2)	Glass bottle (AC_1)	Plastic jar (AC_2)	Glass bottle (PC_1)	Plastic jar (PC_2)	Glass bottle (AC_1)	Plastic jar (AC_2)
Initial	20.10	20.10	20.92	20.92	1.02	1.02	1.03	1.03	0.92	0.92	0.94	0.94
1	20.09	20.10	20.90	20.92	1.03	1.04	1.05	1.06	0.91	0.91	0.93	0.92
2	19.98	20.00	20.82	20.85	1.05	1.07	1.07	1.09	0.89	0.89	0.91	0.90
3	19.90	19.96	20.68	20.73	1.08	1.09	1.10	1.11	0.89	0.88	0.90	0.89
4	19.77	19.81	20.56	20.64	1.12	1.13	1.12	1.14	0.87	0.86	0.90	0.88
5	19.55	19.66	20.39	20.29	1.12	1.14	1.13	1.16	0.85	0.84	0.88	0.87
6	19.27	19.40	20.22	20.15	1.14	1.17	1.14	1.18	0.85	0.82	0.86	0.84

Moisture Acidity Tannin

	SED	CD (0.01)			SED	CD (0.01)			SED	CD (0.01)
t	1.20000	3.31641 NS		t	0.00598	0.01652 **		t	0.00443	0.01225 **
s	0.90712	2.50697 NS		s	0.00452	0.01248 **		s	0.00335	0.00926 **
ts	2.40001	6.63283 NS		ts	0.01195	0.03303 NS		ts	0.00886	0.02450 NS

Table 5. Changes in bioactive components of Amla jelly during storage period

Storage period (in month)	Total sugar(g/100g)				Reducing sugar (g/100g)				Vitamin C (mg/100g)			
	Pectin		Agar		Pectin		Agar		Pectin		Agar	
	Glass bottle (PC_1)	Plastic jar (PC_2)	Glass bottle (AC_1)	Plastic jar (AC_2)	Glass bottle (PC_1)	Plastic jar (PC_2)	Glass bottle (AC_1)	Plastic jar (AC_2)	Glass bottle (PC_1)	Plastic jar (PC_2)	Glass bottle (AC_1)	Plastic jar (AC_2)
Initial	51.75	51.75	51.84	51.84	9.42	9.42	9.48	9.48	302.12	302.12	310.44	310.44
1	51.64	51.68	51.76	51.79	9.57	9.60	9.55	9.58	302.05	302.00	310.31	310.28
2	51.57	51.60	51.68	51.71	9.72	9.77	9.62	9.71	301.22	301.08	309.87	309.33
3	51.45	51.49	51.55	51.60	9.72	9.81	9.70	9.80	300.86	300.73	308.82	308.43
4	51.30	51.33	51.43	51.50	9.79	9.86	9.84	9.88	300.05	299.44	307.98	307.27
5	51.20	51.16	51.37	51.31	9.88	9.90	9.86	9.90	291.43	283.61	300.11	297.36
6	51.08	51.00	51.22	51.17	9.98	10.02	9.96	9.99	280.17	268.84	292.24	273.53

Total sugar Reducing sugar Vitamin C

	SED	CD (0.01)
t	341.84851	944.75711 NS
s	258.41318	714.16925 NS
ts	683.69702	1889.51422 NS

	SED	CD (0.01)
t	62.31062	172.20612 NS
s	47.10240	130.17559 NS
ts	124.62125	344.41223 NS

	SED	CD (0.01)
t	1997.97489	5521.74702 NS
s	1510.32706	4174.04840 NS
ts	3995.94979	11043.49404 NS

ORGANOLEPTIC CHARACTERISTICS OF AMLA PRODUCTS

The amla products were stored at room temperature (nine months) and their organoleptic characteristics viz., colour, appearance, texture, taste and overall acceptability were also evaluated using a 9 point hedonic scale as per the procedure [16].

Amla jam

Neither the storage period nor the packaging materials had influenced the organolpetic evaluation score of the amla jam. Initially the amla jam had strong organoleptic scores at the end of the storage period, slight changes were observed. The score value were 8.4 (colour), 8.3 (appearance), 8.4 (texture), 8.3 (taste and overall acceptability), at the end of the storage (Table 6).

Table 6. Organoleptic evaluation of amla jam during storage

Storage period (in days)	Organoleptic characteristics				
	Colour	Appearance	Texture	Taste	Overall acceptable
Initial	8.7	8.5	8.6	8.5	8.5
90	8.6	8.5	8.5	8.5	8.5
180	8.5	8.4	8.4	8.4	8.4
270	8.4	8.3	8.4	8.3	8.3

Amla jelly and squashes

The amla jelly and squashes were evaluated using a nine point hedonic scale to assess the colour and appearance, flavour, taste, texture overall acceptability with a panel of twenty semi (trained judges) and it was highly acceptable at the end of the storage period.

CONCLUSION

This present study it is concluded that due to high nutritional and medicinal value of amla. It is used for preparation of some sweet-based amla products such as jam, squash, and jelly are highly nutritious and medicinal properties because the amla squash can be prepared with the substitute of date syrup and mint extract. The shelf life of amla products were found to be highly acceptable at ambient conditions. Three test samples were selected for the sensory evaluation by judges using a 9 point Hedonic scale. Test analysis of variance (ANOVA) were used to analyze the data and sample were analyzed several times. Hence several trials were done to make the objective successful finally three samples were selected. On the basis of sensory evaluation then we are selected a final products.

CONFLICT OF INTEREST

The author(s) declare(s) that there is no conflict of interest.

FUTURE SCOPEOF THE STUDY

Several investigations were made on the nutraceuticals properties of amla have to be retaining for curing of different diseases. There is a possibility that it will lead to the development of new food based drugs for control of disease management for humans in the future. Research must focus on making technology available to farmers at low cost. The utilization of bioactive compounds of amla fruit can enormously add value to the processed product. Post-harvest management of amla is also poor, which needs improvement. The medicinal property of amla is due to the presence of bioactive phytochemicals including ascorbic acid. Compounds such as gallic and ellagic acid, quercetin, kaempferol, vanillic acid, isocorilagin, and punigluconin have excellent antioxidant properties. In this case, many clinical trials have been conducted with the aim to reveal the therapeutic potential of amla fruit. However, evidence-based studies need to be the focus. The application of advanced techniques may be further helpful for the isolation of bioactive compounds from the fruit and value addition of this miraculous fruit.

ACKNOWLEDGEMENT

The authors declare that they received no funding for this review article.

REFERENCES

1. AOAC, 1995. Official methods of analysis. 14th edn. Association of official analytical chemists, Artington, USA.
2. Deka BC, Sethi V, Prasad R, Batra PK.. 2001. Applications of mixtures methodology for beverages from mixed fruit juice/pulp. J FoodSci Technol 38:615-618.
3. Hart, A.M. and H.J. Fischer. 1971. Modern Food analysis . Springer Veslay Berlin Heidelberg. New Delhi. PP 64-66.
4. Mc Dohald, E.J. and B.Y. Foley.1960. J. Assoc. Offi. Agri. Chem. 43:645.
5. Ranganna, S. 1995. Hand book of analysis and quality control for fruits and vegetable products. 2nd ed. Tata Mc. Graw Hill Publishing Co., Ltd., New Delhi. Pp 3-11,18-25 and 859.
6. Rangaswamy, R. 1995. Factorial Completely Randomized Design. A text book of agricultural statistics. New Age International Publisher Ltd., New Delhi.
7. Rastogi RP, Mehrotra BN.1993. Compendium of Indian Medicinal Plants. Central Drug Research Institute, Publication Information Directorate India.

8. Pater SS, Goyal RK . 2012. Emblica Officinalis Geart: A comprehensive review in phytochemistry, pharmacology and ethnomedicinal uses . Res J Med Plant 6: 6-16.

9. Sadasivam, B. and A. Manickam. 1996. Biochemical methods. Wiley Eastern Ltd and Tamil nadu Agricultural University, Coimbatore. Pp. 184-185.

10. Saini, R.S., K.D. Sharma,O.P. Dhankhar and R.A. Kaushik. 2001. Laboratory manual of analytical techniques in horticulture. Agrobios (India). Pp . 5-6, 63.

11. Saravanakumar, R., and Manimegalai, G. 1999. Value added products from Strawberry. M.Sc., Thesis. Department of Food Science and Nutrition, Tamilnadu Agricultural University, Coimbatore, Tamilnadu.

12. Saini, S.P.S. and V.S. Greual. 2000. Storage aspects of thermally processed patharnakh pear juice. Beverage and Food World. 27(9):17-18.

13. Seshadri, K.S., R.V. Gowhamma, M. Mahadeviah, K. Kumar and S. Mahendranapandian. 1994. Packaging of mango juice in flexible packaging materials. J. Food Sci. Technol. 13:26-29.

14. Sivakumar,K.P. and Malathi,D. 2004.Processing and Preparation of Mango and sapota powder by Foam-mat-Drying techniques. Ph.D., Thesis. Department of Food Science and Nutrition, Tamilnadu Agricultural University, Coimbatore, Tamilnadu.

15. Sudhagar, T. and Manimegalai., G. 2001. Value added products from Pears. M.Sc., Thesis. Department of Food Science and Nutrition, Tamilnadu Agricultural University, Coimbatore, Tamilnadu.

16. Watts, B.M., G.L. Ylimake, L.E. Jeffery and L.G. Elias. 1989. Basic sensory methods for food evaluation. International Development Research Center. Ottaua. Ontario. Canada.