



Research Article

STANDARDIZATION OF RECIPES AND ACCEPTABILITY OF VALUE ADDED PRODUCTS OF AONLA (*Emblica officinalis* Gaertn) PULP

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Abstract-Various recipes for the development and acceptability of different value added products made using Aonla and guava pulp were standardized. In mixed fruit leather, twelve recipes were prepared using different pulp concentrations. After the preparation of aonla, guava mixed fruit leather, it was stored for 100 days at room temperature for shelf life evaluation. For assessing the chemical and organoleptic qualities of stored mixed fruit leather, samples were analyzed at an interval of 20 days from 0 to 100 days. Various organoleptic parameters during storage period for leather were evaluated with respect to colour, texture, flavor, taste, and overall acceptability. The results revealed that treatment T9 (40% aonla+ 60% guava+ 500g sugar) showed maximum rating for colour, texture, taste, and overall acceptability during initial i.e. 0 day of storage period while elasticity was found maximum in the treatment T12 (40% aonla pulp+ 60% guava pulp+ 125 g sugar) and flavour was found maximum in the treatments T10 (40% aonla pulp+ 60% guava pulp+ 375g sugar). In chemical analysis it was evident from the result that all the parameters showed significant variation among all the treatments. Treatment T4 (60% aonla+ 40% guava+ 125g sugar) scored maximum values for acidity. Treatment T9 (40% aonla pulp+ 60% guava pulp+ 500g sugar) scored maximum values of TSS.

Keywords- Aonla, Guava, Pulp, Leather, Acceptability

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Introduction

Aonla (*Emblica officinalis* Gaertn) also known as Indian gooseberry, neli, amalkamu or Amla is native of India, Sri Lanka, Malaysia and China [1]. India is having maximum area in the world (107 thousand ha) with annual production of 1319 thousand tons [2]. The Aonla fruit is valued for its nutritional and medicinal properties. It is an excellent source of ascorbic acid (Vitamin C) and contains about 20 times more vitamin C than that of citrus fruits [3] and is one of the richest source of vitamin C among different fruit, containing 500-1500 mg ascorbic acid per 100 gm of pulp. Aonla fruit is also valued for its antiscorbutic, diuretic, laxative and alternative antibiotic properties. It is used in Ayurvedic and Unani system of medicines [4,5]. The ripen fruits of Aonla are widely used for preparation of ayurvedic medicines like Chavanprash, Triphala, Ashokarishta, and Triphalamasin [6]. Aonla becomes ready for harvesting from mid October to mid January in the Malwa region of Madhya Pradesh. Huge harvest creates glut and the growers are compelled to sell it at throw away prices. It is highly perishable in nature and thus it needs processing for increasing shelf life and value addition particularly during the glut period. The processing of fruits into various products like Murabba, Candy, Dried chips, Tablets, Jellies, Tophies, Powder and Leather etc is one of the best ways to reduce the losses due to high acidity and astringent taste in Aonla fruits. Guava (*Psidium guajava* L.) is one of the most protective fruit crops of India because of highest vitamin C (299 mg/100g) among table fruits [7]. Due to hardy nature of plant it can withstand adverse climatic conditions and grows under a wide range of soil types from sandy loam to clay loam [8]. It occupies an area of 251 thousand ha, with production 4083 thousand tons [2]. It is a good source of vitamin C ranging from 50-350 mg/100g, pectin ranging from 0.52 to 2% and minerals like calcium, phosphorus, iron, riboflavin, thiamine and niacin. This fruit is

equally important for processing industry [9].

A number of economically cheaper techniques have been evaluated to improve the quality of the dried fruits. Among these treatments of blanching before drying to check the enzymatic spoilage, remove the astringency and also improve the texture of the fruit. Therefore, blending of these two products could be an economic proposition to utilize them profitably. Developing such processing technology on blended products with these fruits may result not only in better utilization of these less exploited fruits, especially during glut and it will also save its nutritive value, good taste, which is appearance liked by all.

Since preparations of Aonla and guava using simple technology has tremendous scope, high acceptability, minimum volume, higher nutritional value and longer shelf- life. Therefore present investigation was conducted to standardize the methods of preparing leather and also evaluation of nutritional and sensory parameters of the developed products during storage.

Materials and Methods

The present experiment was carried out at Department of Horticulture, JNKVV, Jabalpur (M.P.) during October 2014 to June 2015 with twelve treatments [60% Aonla Pulp+40% Guava Pulp +500 g Sugar (T₁), 60%Aonla Pulp+ 40% Guava Pulp+375 g Sugar (T₂), 60%Aonla Pulp+ 40% Guava Pulp + 250g Sugar (T₃), 60% Aonla Pulp+ 40% Guava Pulp+125g Sugar(T₄), 50%Aonla Pulp+ 50%Guava Pulp +500 g Sugar (T₅), 50%Aonla Pulp + 50%Guava Pulp +375 g Sugar (T₆), 50%Aonla Pulp+50% Guava Pulp +250g Sugar(T₇), 50%Aonla Pulp+ 50% Guava Pulp +125 g Sugar(T₈), 40%Aonla Pulp + 60% Guava Pulp +500 g Sugar (T₉), 40%Aonla Pulp + 60% Guava Pulp +375 g Sugar (T₁₀), 40%Aonla Pulp+ 60% Guava Pulp +250 g Sugar (T₁₁) and 40% Aonla Pulp+ 60% Guava Pulp +125 g

Sugar (T₁₂) replicated thrice in Completely Randomized Design. After extracting the pulp of both the fruits leather was prepared using following method. The leather was stored in at (25-28°C) and observations were taken at 0, 20, 40, 60, 80 and 100 day after storage. Organoleptic evaluations like color, texture, flavour, taste and overall acceptability was performed by the panel of 10 judges based on sensory attributes. Sensory evaluation method used was given by [10] having a 9 point hedonic scale. Total soluble solid (TSS) was determined by hand refractometer and the acidity of leather was determined by alkaline titration method as described in [11].

Statistical analysis: The data was analysed as per the method given by [12]. Least significance at 5% level was used for finding the significant differences among the treatment means.

Result and Discussion

Blending of fruit pulp could be an economic requisite and also required to improve the appearance, nutrition and flavour. Sensory evaluation is generally the final guide of the quality from the consumer's point of view and it is an important

parameter in determining the quality of mixed fruit leather. It revolves around the colour, flavour, texture, taste, elasticity and overall acceptability of leather. All leathers were analyzed by a panel of judges using Hedonic scale (9 point.) was kept at 20 days interval i.e. fresh (0 day) and then each after 20 days for a total period of 100 days. Results of the organoleptic evaluation of mixed fruit leather revealed that all the treatments found acceptable during whole storage period.

Colour All treatments have slight difference in colour and during storage for 100 days, colour ratings value of mixed fruit leather diminished gradually [Table-1]. Decrease in colour of mixed fruit leather during storage may be due to the emphatic browning during storage. Browning of the leathers could have resulted from non enzymatic vitamin C oxidation and enzymatic oxidation of polyphenols. Similar findings were obtained by [13] in case of jack fruit leather. [14] also reported that in ber jam original colour disappeared at ambient temperature after 3 months of storage. This different blend ratio of Aonla and Guava pulp with different concentrations of sugar might be the reason for the difference in colour rating values. Highest colour rating value was observed with treatment T9 (40% aonla pulp + 60% guava pulp + 500g sugar) perhaps due to dominant effect of guava blending for colour appearance.

Table-1 Effect of different recipes and days after storage on color and flavor of mixed fruit leather

Treatment	Effect on colour of leather						Effect on flavour of leather					
	0 days	20 days	40 days	60 days	80 days	100 days	0 days	20 days	40 days	60 days	80 days	100 days
T1	8.27	7.80	7.80	7.60	7.40	7.13	7.29	7.23	7.20	7.15	7.11	7.01
T2	8.40	8.00	7.60	7.40	7.20	7.00	7.60	7.58	7.73	7.51	7.45	7.40
T3	8.20	7.90	7.50	7.30	7.13	6.93	7.74	7.69	7.52	7.59	7.51	7.44
T4	8.03	7.80	7.40	7.20	7.07	6.87	7.85	7.80	7.68	7.59	7.65	7.56
T5	8.47	8.20	8.00	7.80	7.60	7.33	7.49	7.42	7.75	7.73	7.33	7.30
T6	8.13	8.13	7.93	7.73	7.53	7.27	8.65	7.59	7.45	7.40	7.46	7.43
T7	8.00	7.90	7.83	7.63	7.43	7.20	7.56	7.47	7.50	7.53	7.41	7.36
T8	7.90	7.83	7.73	7.53	7.37	7.10	7.63	7.56	7.57	7.49	7.43	7.36
T9	8.67	8.33	8.07	7.87	7.67	7.47	7.76	7.67	7.66	7.62	7.53	7.43
T10	8.13	7.80	7.47	7.20	6.87	6.60	7.95	7.88	7.86	7.81	7.80	7.70
T11	8.03	7.70	7.37	7.30	6.80	6.57	7.53	7.43	7.40	7.40	7.35	7.28
T12	7.93	7.60	7.27	7.07	6.53	6.50	7.69	7.63	7.60	7.54	7.45	7.40
CD ($p>0.05$)	0.326	0.388	0.328	0.343	0.351	0.322	0.288	0.233	0.292	0.265	0.260	0.278

Flavour The mean panel list score for flavour profile of mixed fruit leather under storage indicated a decreasing trend with increase in sugar quantity. It was clear from the data presented in [Table-1] that the higher guava percentage imparted more flavour to mixed fruit leather. The results revealed highest score of leather in treatment T10 (40% aonla pulp + 60% guava pulp + 375g sugar). Similar results were found by [15] in guava leather. However, least flavor was found with treatment T160% aonla pulp + 40% guava pulp + 500g sugar). Decreasing patterns of flavour rating value were observed during storage of mixed fruit leather for 100 days. These results are in conformity with [16] also reported a little downfall in each sensory parameter in case of blended papaya leather.

Texture The highest value for texture was found in T9 (40% aonla + 60% guava

+500g sugar) while minimum in T4 (60% aonla + 40% guava + 125g sugar) [Table-2]. The results exhibited that higher proportion of guava pulp in comparison to aonla pulp was found better in improving the texture of leather. This might be due to the difference in their genetic makeup, rate of water absorption and protein content. Similar conclusions were drawn by [17] in pawpaw and guava leather. In addition to it, the higher quantity of sugar gave better texture of leather. This result is in conformity with result of [15] in guava and papaya leather. As storage period increased a very slight change in texture of mixed fruit leather was observed. This might be due to absorption of moisture at the time of sensory evaluation. Similar result was reported by [18] during storage papaya fruit bar.

Table-2 Effect of different recipes and days after storage on texture and taste of mixed fruit leather

Treatment	Effect on texture of leather						Effect on taste of leather					
	0 days	20 days	40 days	60 days	80 days	100 days	0 days	20 days	40 days	60 days	80 days	100 days
T1	8.40	8.20	8.00	7.80	7.60	7.47	7.90	7.80	7.70	7.60	7.50	7.40
T2	8.00	7.83	7.60	7.40	7.30	7.17	7.77	7.67	7.57	7.47	7.37	7.27
T3	7.93	7.80	7.53	7.33	7.23	7.10	7.67	7.57	7.47	7.37	7.27	7.17
T4	7.87	7.73	7.50	7.27	7.17	7.03	7.53	7.43	7.33	7.23	7.13	7.03
T5	8.40	8.37	8.17	8.00	7.80	7.73	7.97	7.87	7.77	7.67	7.57	7.47
T6	8.00	7.97	7.83	7.60	7.47	7.37	7.87	7.77	7.67	7.57	7.47	7.37
T7	7.93	7.90	7.77	7.53	7.40	7.30	7.77	7.67	7.57	7.47	7.37	7.27
T8	7.87	7.83	7.73	7.47	7.33	7.23	7.60	7.50	7.40	7.30	7.20	7.10
T9	8.47	8.40	8.17	8.00	7.80	7.73	8.13	8.07	7.97	7.87	7.77	7.67
T10	8.20	8.03	8.00	7.80	7.60	7.53	7.90	7.77	7.67	7.57	7.47	7.37
T11	8.13	8.00	7.93	7.73	7.53	7.47	7.80	7.70	7.60	7.50	7.40	7.30
T12	8.07	7.93	7.87	7.67	7.43	7.40	7.50	7.43	7.33	7.30	7.20	7.10
CD ($p>0.05$)	0.225	0.129	0.217	0.204	0.265	0.303	0.082	0.093	0.093	0.091	0.091	0.091

Taste The best result of leather was obtained for the Treatment T9 (40% aonla pulp + 60% guava pulp + 500g sugar) which was preferred most by judges. [16] reported that blended leather was superior for most of the quality parameters

[Table-2]. During storage, a significant reduction in taste of mixed fruit leather was observed. These results are in agreement with [19] with guava bar and [20] with value added products of sapota.

Overall acceptability The overall acceptability of mixed fruit leather is dependent on colour, texture, flavour and taste rating of the product [Fig-1]. The results obtained showed that highest score (8.47) for overall acceptability found in Treatment T9 (40% aonla pulp + 60% guava pulp+ 500g sugar) combination. During storage, it was observed that overall acceptability of mixed fruit leather was highest at 0 day of storage and slightly decreased as the days of storage were increased. Similar results were found by [19] with guava fruit bar.

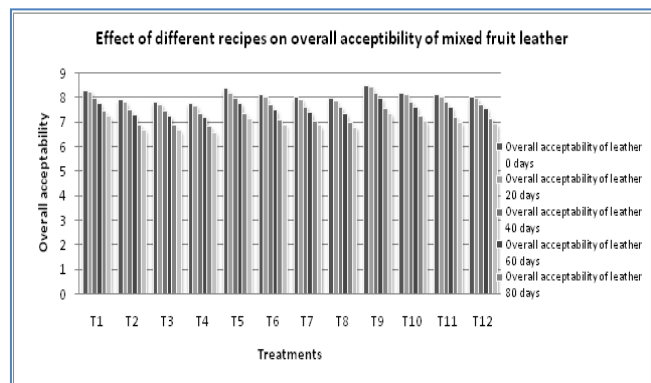


Fig-1 Effect of different recipes and days to storage on overall acceptability of mixed fruit leather

Total Soluble Solid Percentage As per the results recorded from present investigation, it was found that 500 g of sugar with 40% aonla + 60% guava in

leather increased TSS and this effect on TSS persisted up to 100 days of storage [Table-3]. The increase in TSS during storage might be due to the conversion of polysaccharides like starch and pectin into simple sugar. The present findings are in conformity with results reported by [21] in RTS beverages of guava and papaya. This might be due to conversion of some of the insoluble fraction. Similar trend was reported by [22] in sapota fruit products where TSS contents increased during storage period. [23] reported that total soluble solids increased gradually during storage of blended ready-to-serve from ber and jamun and increase in TSS during storage might be attributed to conversion of polysaccharides and other constituents of juice into sugar. [24] reported increase in TSS of fruit bar (sapota + papaya 50:50) throughout the storage period of 3 months.

Acidity percentage In case of acidity, it was found that the higher value was recorded in Treatment T4 (60%aonla pulp + 40%guava pulp) with 125g sugar [Table-3]. Further, it was observed that acidity of the leather also decreased significantly with increase in sugar content. Similar result was also reported by [15] with guava leather. Results noted for the acidity percentage, clearly indicated that the acidity of mixed fruit leather increased with the increasing storage period continuously up to 100 days of storage. These findings are in conformation with the findings of [25] who observe that there was gradual increase in acidity value with an increase in the storage period in guava RTS. Increase in acidity during storage might be due to the formation of organic acid by degradation of ascorbic acid. [26] indicated that there was an increase in acidity and reducing sugar and a decrease in pH, total sugars and ascorbic acid during storage of 3 months. These results are in agreement with results reported by [27] with sweet orange RTS beverages and [28] with bael guava blends beverage.

Table-3 Effect of different recipes and days after storage on TSS and acidity of mixed fruit leather

Treatment	Effect on TSS of leather						Effect on acidity of leather					
	0 days	20 days	40 days	60 days	80 days	100 days	0 days	20 days	40 days	60 days	80 days	100 days
T1	37.25	37.33	37.35	37.37	37.39	37.40	1.07	1.07	1.08	1.09	1.13	1.15
T2	37.12	37.23	37.25	37.28	37.32	37.34	1.08	1.10	1.09	1.10	1.14	1.19
T3	36.53	36.60	36.62	36.63	36.65	36.67	1.10	1.11	1.15	1.18	1.20	1.25
T4	34.97	34.99	35.01	35.01	35.02	35.05	1.13	1.18	1.18	1.22	1.25	1.32
T5	37.96	37.97	38.00	38.07	38.08	38.10	1.03	1.05	1.05	1.06	1.10	1.15
T6	37.67	37.75	37.76	37.78	37.82	37.80	1.04	1.07	1.07	1.08	1.12	1.17
T7	37.43	37.44	37.45	37.46	37.47	37.50	1.14	1.12	1.17	1.17	1.18	1.22
T8	35.59	35.61	35.62	35.64	35.65	35.67	1.13	1.16	1.16	1.17	1.19	1.19
T9	38.91	38.93	38.96	39.11	39.18	39.44	1.03	1.10	1.06	1.06	1.10	1.17
T10	37.92	37.93	37.95	37.97	37.99	38.07	1.13	1.10	1.15	1.16	1.17	1.22
T11	37.64	37.67	37.71	37.72	37.76	37.80	1.15	1.12	1.17	1.16	1.19	1.24
T12	35.14	35.17	35.17	35.18	35.20	35.22	1.13	1.18	1.16	1.19	1.23	1.27
CD ($p>0.05$)	0.378	0.410	0.422	0.440	0.449	0.495	0.050	0.060	0.044	0.053	0.053	0.056

Conclusion

On the basis of TSS, acidity, color and other organoleptic evaluations, it might be concluded that mixing of aonla and guava pulp in the ratio of 40:60 with 500 g sugar was found best during storage period of 100 days. Hence, it is clear that both the fruits are suitable for the preparation of mixed fruit leather with good quality and high nutritive value.

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Abbreviations: TSS-Total Soluble Solids

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

Conflict of Interest: None declared

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