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Standardization of recipe and studies on storage life of blend beverage of bitter gourd along with aonla

Satish Beck, SP Sharma and Praveen Gupta

Abstract
The Experiment entitled "Standardization of recipe and studies on storage life of blend beverage of bitter gourd along with aonla" which was conducted at research laboratory of Pt. K.L. Shukla college of Horticulture and Research station, Rajnandgaon during the year 2020-2021. The blended juice of bitter gourd was prepared by using aonla. TSS was tried for optimization of a suitable combination by stevia non-nutritive sweeteners. To standardize the best recipe, 10 combinations were prepared and evaluated through organoleptic test. The Physico-chemical changes were also studied under ambient condition up to 45 days of storage period. According to the organoleptic evaluation treatment 30% bitter gourd + 70% aonla + 40% TSS had the higher organoleptic out comes in terms of overall acceptability, taste, colour and appearance of the different recipe tried in this study Whereas, with regard to flavour, the beverage comprising recipe 50% bitter gourd + 50% aonla + 40% TSS had the higher organoleptic outcomes. In case of Physico-chemical characteristics acidity, ascorbic acid, total soluble sugar, non-reducing sugar, reducing sugar and total sugar (at 0, 15, 30, 45 days) recorded highest under 10% bitter gourd + 90% aonla + 40% TSS, except pH. The organoleptic score, non-reducing sugar, total sugar and ascorbic acid, acidity resulted a decreasing and TSS, reducing sugar, pH was increasing with expanding storage periods in room temperature during the 45 days of storage of beverage.

Keywords: Bitter gourd, aonla, organoleptic, beverage, storage

Introduction
The Bitter gourd (*Momordica charantia*) family Cucurbitaceae, is known variously as balsam pear, bitter melon, bitter cucumber, and African cucumber. It is tropical and subtropical climber. That is a fruit grown on a climber. The skin has a warty texture and the fruit is oblong. There is a very thin layer inside the fruit and flesh that surrounds the flat seeds. Both flesh and skin of bitter gourd are edible. Bitter gourd is mainly grown in Maharashtra, Gujarat, Rajasthan, Punjab, Tamil Nadu, Kerala, Karnataka, Andhra Pradesh, West Bengal, Odisha, Uttar Pradesh, Bihar and Assam state.

Bitter gourd has long been an important component of indigenous herbal medicine, particularly in Asia and is underutilized fruit in spite of being one of the cheapest source of nutrients and potential source of natural antioxidants. Ascorbic acid, phosphorous and iron are present in high amounts as well as protein, minerals and dietary fiber are also present in small amount in bitter gourd (Kalra *et al.* 1988) [5]. It contain 2.1 g of protein, 4.2 g of carbohydrates, 1.8 mg iron, 20 mg of calcium, 55 mg of phosphorus, 210 IU of vitamin A and 88 mg of vitamin C per 100 gram of edible portion (Akryod, 1963) [1]. It is one of the excellent fruits gifted by nature to human beings having composition of all the essential constituents that are required for good health and quality human life. It is generally known for its medicinal value of bitter gourd in the treatment of infectious diseases and diabetes is attracting the attention of scientists worldwide. Bitter gourd is anti-diabetic, stimulant, stomachie, laxative, blood purifier and control diabetes (Raman and Lau, 1996) [8].

Aonla (*Emblica oficinalis*) belongs to the family Euphorbiaceae also known as Indian Gooseberry, it is a minor fruit. Aonla due to its strong antioxidant and biological properties prevent innumerable health disorders as it contains essential nutrients and highest amount of vitamin C. It can be used as a possible food additive or in nutraceuticals and biopharmaceutical industries.

In the form of vegetable it is difficult to consume fresh bitter gourd to meet daily recommended requirement, for convenience it needs to be converted into RTS, nectar, beverages so as to make it available as and when required. Non-nutritive sweeteners (stevia) are non-toxic, economic and able to mimic sugar without increasing the calorie.

Sweet taste is one of the fundamental sensations for which people continue to demonstrate their desire. Therefore, availability of fruit beverage which are sweet in taste but with reduced calorie value can play an important role in health promotion and prevention of such diseases. One of the alternative for development of low calorie blend beverages seems to replace bulk calorie sweeteners with stevia sweeteners.

Materials and Methods

For the preparation of bitter gourd beverage, well-developed soft bitter gourd and aonla were used. Fruit was chopped into small pieces using a knife. To deactivate enzymes and prevent browning, bitter gourd and aonla were blanched in boiling water at 75-80 ºC for 2-3 minutes. Then pulp was extracted by using hydraulic press filtered through muslin cloth. Different quantities of bitter gourd and aonla pulp needed for beverages were taken after pulp extraction. With the addition of water to each recipe combination, the volume of the final product was retained in each replication. Total soluble solid were tried for optimization of a suitable combination for the preparation of beverages by non-nutritive sweeteners stevia. A calculated amount of stevia was added in to the pulp at 40% in the recipe and then boiled together. The prepared beverages were filtered through a sieve to obtain a uniform consistent product. The hot beverages were put into sterilised bottles with a volume of 200 ml, leaving a 2 to 2.5 cm headspace, and corked with a sterilised crown cork using a crown corking machine. The filled bottles were pasteurised in boiling water until the product reached the temperature of 80°C. It took about 15 minutes to attain required temperature.

Results and Discussion

Proximate analysis of bitter gourd and aonla

The data pertaining to the various chemical and physical characteristics of bitter gourd and aonla are presented in table 1 and 2. The values obtained for various physico-chemical characteristics of fresh fruit and juice of bitter gourd and aonla are within the range reported in literature (Satkar *et al*., 2013) and (Kirtiraj *et al.*, 2013) [10, 6].

Physical properties of fresh bitter gourd and aonla

Table 1: Physical properties of fresh bitter gourd and aonla fruit

Physical Parameters	Bitter gourd	Aonla
Shape	Oblong	Oval to round
Colour	Dark green	Light green yellowish
Length	8.54	2.73
Diameter	4.18	3.24
Weight of fruit	76.41	21.88

Each observation is a mean of five determinations

Chemical composition of fresh bitter gourd and aonla per 100g

Table 2: Chemical composition of bitter gourd and aonla per 100g

Physical Parameters	Bitter gourd	Aonla
TSS (0Brix)	4.00	9.00
pH	3.20	2.3
Ascorbic acid (mg/100 ml)	74.28	445.83
Acidity (%)	0.14	2.12
Total sugar (%)	1.70	6.50
Reducing sugar (%)	0.90	1.30
Non-reducing sugar (%)	0.67	4.44

Standardization of recipe

The panel of five judges did organoleptic evaluation of beverage prepared from different recipes using a nine-point hedonic rating test as described by Ranganna (1997) [9]. The organoleptic scores are presented in Table 3. Colour & appearance scored maximum 9.5 by T_7. Flavour scored 8.2 by T_5, T_9 and taste 8.5 was obtained by T_7. The overall acceptability of beverage was maximum 8.4 by T_7.

Table 3: Organoleptic score of beverage

Organoleptic score (9-point hedonic rating test)				
Treatments	**Colour & Appearance**	**Flavour**	**Taste**	**Overall acceptability**
(T0: 100% bitter gourd + 0% aonla + 30% pulp + 40% TSS)	3.2	3.2	2.2	2.8
(T1: 90% bitter gourd + 10% aonla + 30% pulp + 40% TSS)	4.2	4.2	3.2	3.8
(T2: 80% bitter gourd + 20% aonla + 30% pulp + 40% TSS)	4.4	4.1	3.4	3.9
(T3: 70% bitter gourd + 30% aonla + 30% pulp + 40% TSS)	5.2	5.1	4.2	4.8
(T4: 60% bitter gourd + 40% aonla + 30% pulp + 40% TSS)	6.4	6.1	5.4	5.9
(T5: 50% bitter gourd + 50% aonla + 30% pulp + 40% TSS)	7.5	8.2	6.5	7.4
(T6: 40% bitter gourd + 60% aonla + 30% pulp + 40% TSS)	8.2	6.0	7.2	7.1
(T7: 30% bitter gourd + 70% aonla + 30% pulp + 40% TSS)	9.5	7.3	8.5	8.4
(T8: 20% bitter gourd + 80% aonla + 30% pulp + 40% TSS)	8.3	7.1	7.3	7.5
(T9: 10% bitter gourd + 90% aonla + 30% pulp + 40% TSS)	8.0	8.2	7.0	7.7
CD at 5%	0.22	0.19	0.22	0.42
S.Em ±	0.65	0.57	0.65	1.27
CV	5.87	5.58	6.93	12.38

TSS (oBrix)

The total soluble solids (TSS) of beverages were determined using a hand refractometer and presented in Table 4. The TSS was maximum for T_9 and ranged between 3.10 to 3.26. T_0 scored lowest for TSS and varied from 1.23 to 1.56 during the course of storage. The increasing trend of TSS in blended bitter gourd beverage was probably due to conversion of insoluble carbohydrate into soluble carbohydrate (sugars). Similar finding was reported by (Barwal *et al*., 2006) and (Satkar *et al*., 2013) [2, 10] in bitter gourd beverage.

Table 4: Changes in TSS during storage

	TSS (oBrix)			
Notation	**Storage periods (in days)**			
	0	**15**	**30**	**45**
T0	1.23	1.30	1.53	1.56
T1	1.36	1.53	1.60	1.66
T2	1.56	1.63	1.70	1.86
T3	1.76	1.86	1.93	1.96
T4	1.90	2.06	2.16	2.20
T5	2.16	2.20	2.23	2.33
T6	2.26	2.36	2.56	2.63
T7	2.56	2.60	2.86	2.93
T8	2.83	2.86	2.90	3.00
T9	3.10	3.16	3.23	3.26
CD at 5%	0.17	0.20	0.22	0.22
S.Em ±	0.52	0.61	0.65	0.66
CV	14.65	16.65	16.82	16.56

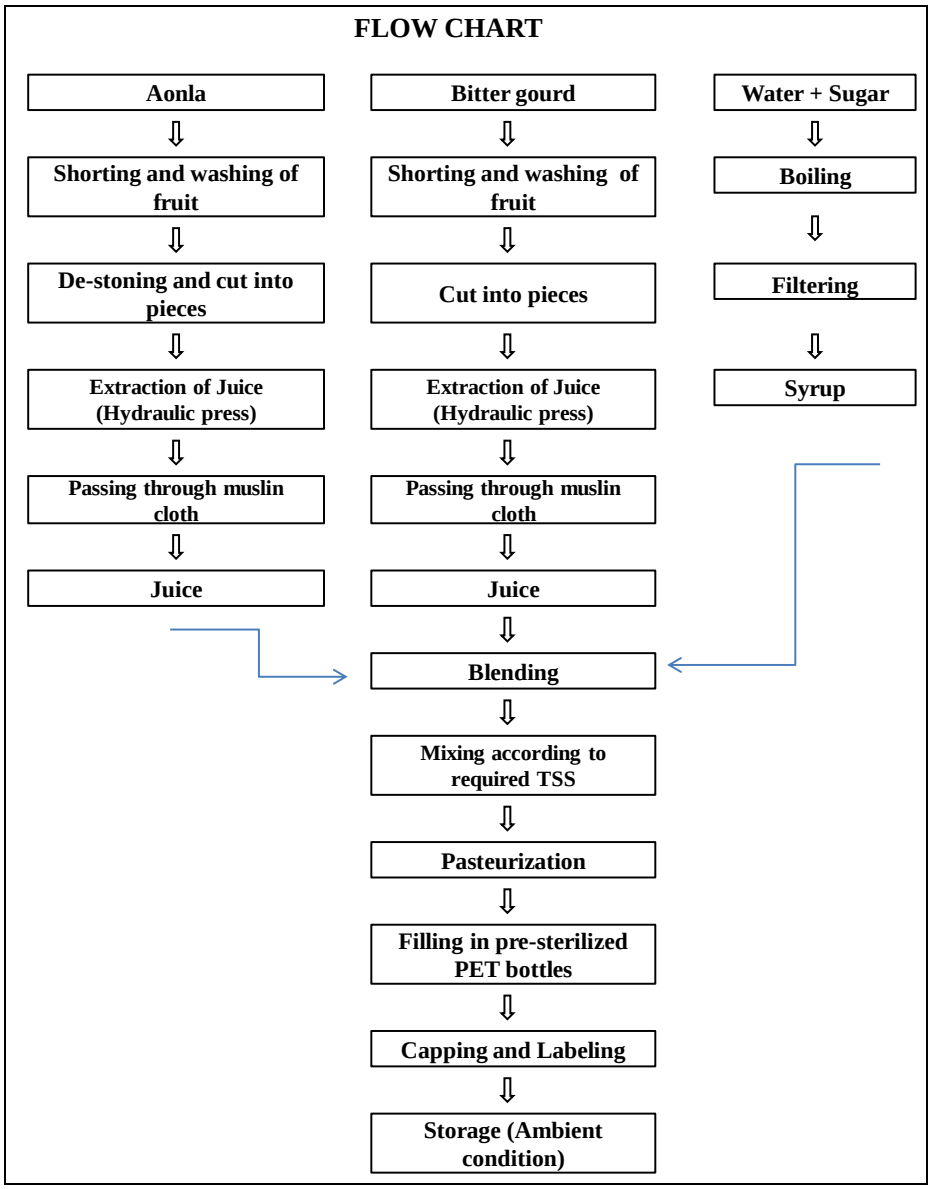

Fig 1: Sheet for preparation of bitter gourd beverage blended with aonla

Acidity (%)

To determine the acidity of the beverages, Ranganna's (1997) [9] method was used and described in Table 5. The acidity of beverage was maximum for T_9 and ranged from 0.602 to 0.586, whereas minimum value for T_0 ranged from 0.076 to 0.056. The decrease in acidity of blended bitter gourd beverage during storage might be due to formation of other organic acids. Similar finding was also reported in the beverage of bitter gourd- kiwi blend squash (Sharma *et al.*, 2016) and (Satkar *et al.*, 2013) [13, 10].

Table 5: Changes in acidity during storage

Acidity (%)				
Notation	**Storage periods (in days)**			
	0	**15**	**30**	**45**
T0	0.076	0.068	0.062	0.056
T1	0.135	0.128	0.119	0.108
T2	0.192	0.186	0.178	0.171
T3	0.256	0.246	0.239	0.234
T4	0.314	0.307	0.297	0.294
T5	0.370	0.364	0.357	0.352
T6	0.430	0.426	0.416	0.409
T7	0.486	0.486	0.477	0.469
T8	0.548	0.545	0.535	0.530
T9	0.602	0.611	0.595	0.586
CD at 5%	0.009	0.011	0.012	0.012
S.Em ±	0.003	0.004	0.004	0.004
CV	1.517	1.918	2.190	2.150

pH

The pH value of beverages was taken on pen type digital pH meter and described in Table 6. The highest pH value was obtained by T_0 and ranged from 6.24 to 6.36. Whereas lowest was T_9 which is ranged between 2.04 to 2.16. Significant increase in pH under all the recipe treatments may be due to corresponding decrease in acidity during storage period. The present findings are in agreement with Thakur and Barwal (1998) [14] kiwifruit squash.

Table 6: Changes in pH during storage

pH				
Notation	**Storage periods (in days)**			
	0	**15**	**30**	**45**
T0	6.24	6.28	6.32	6.36
T1	4.13	4.17	4.21	4.25
T2	3.75	3.79	3.83	3.87
T3	3.45	3.49	3.53	3.57
T4	3.24	3.28	3.32	3.36
T5	2.93	2.98	3.02	3.06
T6	2.64	2.68	2.72	2.76
T7	2.33	2.37	2.41	2.45
T8	2.12	2.16	2.20	2.24
T9	2.04	2.08	2.12	2.16
CD at 5%	0.007	0.006	0.006	0.006
S.Em ±	0.020	0.019	0.019	0.019
CV	0.352	0.329	0.326	0.321

Ascorbic acid (mg/100ml)

The ascorbic acid of beverage was determined by the procedure given by Ranganna (1997) [9]. The data of ascorbic acid was described in Table 7. The maximum ascorbic acid was in T_9 which was ranged from 444.73 to 428.56. The least ascorbic acid content was in T_0 and ranged 19.83 to 7.50 during the course of storage. Significant decrease in ascorbic acid during storage may be due to thermal degradation during processing and subsequent oxidation during storage period as it is highly sensitive to heat, oxidation and light. Similar reduction in ascorbic acid content have also been reported in bitter gourd – kivi blend squash (Sharma *et al.*, 2016) [13], bitter gourd – aonla blend beverage (Sharma and Thakur 2017) [12].

Table 7: Changes in Ascorbic acid (mg/100ml) during storage

Ascorbic acid (mg/100ml)				
Notation	**Storage periods (in days)**			
	0	**15**	**30**	**45**
T_0	19.83	16.40	12.41	7.50
T_1	45.74	39.37	34.40	29.40
T_2	103.66	99.44	95.40	88.76
T_3	151.90	146.40	140.74	136.40

T_4	197.33	196.71	192.37	186.80
T_5	242.41	234.77	229.40	223.41
T_6	292.71	286.90	283.37	277.73
T_7	340.43	331.93	327.00	320.41
T_8	394.80	387..40	381.40	376.38
T_9	444.73	439.37	434.36	428.56
CD at 5%	1.219	1.212	1.047	1.008
S.Em ±	3.621	3.602	3.11	2.994
CV	0.945	0.964	0.851	0.841

Sugars

Sugars were determined by the method of Lane and Eynon as described by Ranganna (1997) [9].

Reducing sugar (%)

Data related to the changes on the reducing sugar of beverage during ambient storage (0 to 45 days) conditions is described in Table 8. T_0 100% bitter gourd + 0% aonla recorded 0% reducing sugar however, T_1 to T_3 reducing sugar showed slightly increasing from (0.001- 0.002%) followed by T_4 to T_9 (0.002) at storage period. An slightly increase in reducing sugars content during storage was observed which might be due to the inversion of non-reducing sugars to reducing sugars under acidic conditions reported (Sharma *et al.*, 2018) [11] in Aloe vera- aonla blended functional squash using stevioside. Similar results were also reported by (Hamid *et al.*, 2017) [4] in mulberry RTS beverage.

Table 8: Changes in reducing sugar (%) during storage

Reducing sugar (%)				
Notation	**Storage periods (in days)**			
	0	**15**	**30**	**45**
T_0	0	0	0	0
T_1	0.001	0.001	0.001	0.001
T_2	0.001	0.001	0.002	0.002
T_3	0.001	0.002	0.002	0.002
T_4	0.002	0.002	0.002	0.002
T_5	0.002	0.002	0.002	0.002
T_6	0.002	0.002	0.002	0.002
T_7	0.002	0.002	0.002	0.002
T_8	0.002	0.002	0.002	0.002
T_9	0.002	0.002	0.002	0.002
CD at 5%	0	0	0	0
S.Em ±	0	0	0	0
CV	3.734	3.596	3.445	3.340

Non reducing sugar (%)

Data related to the changes on the non reducing sugar of beverage during ambient storage (0 to 45 days) conditions is described in Table 9. Non reducing sugar was maximum in the treatment T9 and ranged between 0.44 to 0.22 whereas minimum in T_0 was between 0.06 to 0.05. The significant decrease in non reducing sugar might be due to inversion of non-reducing sugars into reducing sugars in the presence of acidic environment of the beverage. This type of changes in sugar content was also observed by (Barwal *et al.*, 2005) [3] in bitter gourd RTS.

Table 9: Changes in Non reducing sugar (%) during storage

Non reducing sugar (%)				
Notation	**Storage periods (in days)**			
	0	**15**	**30**	**45**
T_0	0.06	0.06	0.05	0.05
T_1	0.11	0.10	0.10	0.09
T_2	0.13	0.12	0.10	0.10
T_3	0.14	0.13	0.11	0.10
T_4	0.16	0.14	0.13	0.11
T_5	0.19	0.17	0.15	0.13
T_6	0.22	0.19	0.16	0.15
T_7	0.25	0.22	0.19	0.16
T_8	0.32	0.26	0.22	0.19
T_9	0.44	0.33	0.24	0.22
CD at 5%	0.001	0.001	0	0
S.Em ±	0.002	0.002	0.001	0.001
CV	0.526	0.613	0.565	0.413

Total sugar (%)

The data related to total sugar was described in Table 10. The maximum total sugar was observed in T_9 ranged from 0.46 to 0.38 whereas minimum value in T0 ranged from 0.06 to 0.05.

The total sugar decrease significantly with increasing storage period which may be due to the hydrolysis of polysaccharides such as starch and their conversion into simple sugars. Similar finding have also been reported in beverage of bitter gourd RTS (Barwal *et al.,* 2005) [3] and whey-based papaya RTS (Kumar and Manimegalai 2005) [7].

Table 10: Changes in total sugar (%) during storage

Total sugar (%)				
Notation	**Storage periods (in days)**			
	0	**15**	**30**	**45**
T_0	0.06	0.06	0.06	0.05
T_1	0.12	0.11	0.10	0.09
T_2	0.13	0.12	0.11	0.10
T_3	0.15	0.14	0.12	0.11
T_4	0.17	0.15	0.14	0.12
T_5	0.20	0.18	0.16	0.14
T_6	0.24	0.22	0.21	0.20
T_7	0.27	0.27	0.25	0.23
T_8	0.34	0.31	0.29	0.27
T_9	0.46	0.43	0.41	0.38
CD at 5%	0.001	0.001	0.001	0.001
S.Em ±	0.002	0.002	0.002	0.002
CV	0.52	0.56	0.49	0.51

Conclusion

The bitter gourd was added in different proportion in different treatments with the aonla. The best treatment was obtained by organoleptic test which is treatment T_7 pulp 30% (bitter gourd 30% + aonla 70%), TSS 40 oBrix got highest score in respect of colour, appearance and overall acceptability. Hence this recipe was standardized for preparation of bitter gourd beverage blended aonla. The Physico-chemical properties of beverage non-reducing sugar, reducing sugar, total sugar and ascorbic acid, acidity resulted a decreasing and pH, TSS increasing with expanding storage periods in room temperature during the 45 days of storage period.

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