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Standardization and Storage Study of Aonla (*Emblica officinalis* Gaertn) based Blended Ready-To-Serve Beverages

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A B S T R A C T

The present study was conducted with comprised six levels of recipe, three blending ratio, 9 treatments with ginger juice (2%) and 9 treatment without ginger juice {aonla: lime (25:75, 50:50 and 75:25), aonla: orange (25:75, 50:50and 75:25), aonla: pomegranate (25:75, 50:50 and 75:25)with ginger juice aonla: lime: ginger (25:73:2,50:48:2 and75:23:2), aonla: orange: ginger (25:73:2, 50:48:2 and 75:23:2), aonla: pomegranate: ginger (25:73:2, 50:48:2 and 75:23:2) and one control (100% aonla juice)+ acidity (0.3%)+TSS (10%)}, thus total 19 treatment combination were laid out under CRD statics design with three replication. Among various treatments tried in this investigation, the aonla based blended RTS beverage T_{16} treatment aonla: pomegranate: ginger (25:73:2) and T_{17} aonla: pomegranate: ginger (50:48:2) were statistically at par with each other and found best on the basis of organoleptic quality (taste, flavour and overall acceptance) after 120th days of storage. The TSS, total sugars, reducing sugars and non-enzymatic browning showed increasing trend while, the acidity, ascorbic acid, pH and phenols showed decreasing trend under ambient condition. However, maximum retention of ascorbic acid was recorded in T_{17} (44.50mg/100ml) treatment and minimum acidity in T_{18} (0.34%) followed by T_{17} (0.39%) treatment. The relative economics of treatment T_{17} gave the highest net return (Rs 36.95/lit) RTS as compared to other treatments.

Introduction

The aonla (*Emblica officinalis* Gaertn) fruits are richest source of vitamin C being 200 to 1814mg/100g (Ram, 1990). But it has very little table value due to acrid and bitter taste. The fruits are utilized generally after processing into various products therefore, this, investigation was under taken to standardize the appropriate ratio of *Aonla* with lime, orange and pomegranate with and without ginger juice for preparing *Aonla* based blended RTS. *Aonla* fruit is sour and astringent in taste; hence it is not popular as table fruit and goes as a waste due to limited usage. The excellent nutritive and therapeutic value of fruits has great potentiality for processing into various quality products viz. preserve, sauce, candy, dried chips, tablets, jellies, pickles, toffees, powder, chayvanprash, etc. These products can get position in national and international markets.

Aonla fruit juice can also be blended with other fruit juices like lime, orange, pomegranate, ginger, etc. to improve nutritional quality, taste and consumer acceptance of RTS and make use of high vitamin C available in *Aonla* fruits, processing of *Aonla* fruits is necessary for sustainable crop cultivation and alleviating malnutrition among rural population in addition to several health benefits. Blended RTS of *Aonla* with lime, orange, pomegranate and ginger for the production of new products is necessary for the survival and growth of the processing industry, to meet new taste and demand in home as well as in export market. Hence, there is an urgent need to develop some suitable technologies for the preparation of *Aonla* beverages which are economical and easily available to a large population. In India, soft drinks have a good demand throughout the year. Traditionally, our country has been well known for offering syrup or *sharbat.* If synthetic drinks can be substituted with the fruit juice, it would be beneficial to the consumers as well as fruit growers. Looking to the demand of natural beverages, there are great scopes for the preparation of juices and other fruit based beverages.

Ready-To-Serve (RTS) is a type of fruit beverage containing at least fruit juice (10%), total soluble solids (10%) and acidity (0.3%) (F.P.O.1955). However, the problem encountered during processing is development of bitterness, the juices of two or more fruits are mixed to yield well balance, rightly flavoured drink, which is rich in essential minerals and vitamins. Besides, the blending of two or more juices helps in utilization of astringent and too acidic fruits like lime, sour palm, sour cherry, etc. These fruits and spice are also famous for excellent quality with pleasant flavour, rich in sugar, vitamin C, minerals and ginger juice have antimicrobial and antibiotic properties which are good for human health. Therefore, blending of two or more fruit juices for the preparation of ready-to-serve beverage appears to be a convenient and economic alternative for utilization of *Aonla*. Sandhu and Sindhu (1992), Saxsena *et al.,* (1996), Attri *et al.,* (1998) and Langthasa (1999), have reported that two or more fruit juices/pulp may be blended in various proportions for the preparation of nectar, RTS beverage, etc.

Materials and Methods

The fully mature, Fresh and uniform fruits of *Aonla* were taken from the Horticulture farm of Rajasthan College of Agriculture, MPUAT, Udaipur (Raj.). There are total 19 treatment combination were laid out under Completely randomized design with three replication The immature, brownish, damaged and off type fruits were discarded and fruits of lime, orange, pomegranate and ginger were purchased from the market and brought to the Post Harvest Technology Laboratory of the Department on the same day. Fruits were inspected thoroughly for any damage and spoilage. The selected fruits were washed with tap water thoroughly to remove dirt and dust particles adhering to the surface of fruit then again washed with chlorinated water and allowed to surface dry. Their individual juice was extracted by coil type juice extractor machine, filtered through a cleaned muslin cloth and kept for few hours in refrigerator (4^0+2^0C) for sedimentation then after blended as per recipe treatments. Stored *Aonla* based blended RTS beverages was analysed for sensory (Rangana, 1978) and chemical parameters analysed as per slandered methods of (A.O.A.C, 1995) at 0, 30^{th}, 60^{th}, 90^{th} and 120^{th} day of storage. The total soluble solids (TSS) measured by the "Zeiss" Hand Refractometer (0-50) and value obtained was corrected at 20ºC (A.O.A.C, 1995). The ascorbic acid was estimated by methods suggested by (A.O.A.C, 1995), pH by digital

pH meter (Systronics micro pH system-361) after standardization with a buffer (pH 4.0 at 20°C), non-enzymatic browning by alcohol extraction method (Klim and Nagy, 1998), phenols content was determined by Folin-ciocalteau phenol reagent method suggested by (Sadasivam and Manickam, 1991), total sugar content was determined by using anthrone reagents method (Dabois *et al.*, 1951) and reducing sugar content was measured as suggested by Miller (1972) using dinitrosalicyclic acid.

Results and Discussion

Data pertaining to the effect of recipe and storage period on physico-chemical changes of *aonla* based blended RTS beverage (TSS, acidity, ascorbic acid, total sugar, reducing sugars, non- reducing sugars, pH, phenols and non-enzymatic browning) during storage were studied at 15 days interval upto 120th days.

Total Soluble Solids (TSS)

The total soluble solids content of stored *aonla* based blended RTS beverage increased with advancement of storage period upto the end of experimentation. The treatments found to be non-significant during entire period of storage (Table 1a). On the first day of storage the highest TSS content was observed in T_{18} (10.20%) treatment, closely followed by T_{15} and T_{17} (10.10%). Similarly, on the 120th day of storage the maximum TSS content was observed in T_{15} (13.00%), followed by T_{14} (12.91%) whereas minimum in T_{10} (11.60%) followed by T_8 (11.70%).The increase in total soluble solids content (on an average 10% at fresh and) of *Aonla* based blended RTS beverages during storage, this might be due to hydrolysis of polysaccharides (starch), starch and pectin substances into monosaccharides (sugars) and concentration of *Aonla* based blended RTS beverage due to dehydration. Similar, results were observed by Godara and Pareek (1985) in date palm RTS beverage and guava beverage (Baramanray *et al.*, 1995 and Pandey, 2004). Murtaza *et al.*, (2004) in straw berry drink and Verma and Gehlot (2007) in bael RTS during storage.

Total sugar

A perusal of data given in table 1b indicates that the total sugar content of *aonla* based blended RTS beverage was non-significantly influenced by recipe and storage period. On the first day of storage the highest total sugar was observed in T_6 (9.40%) followed by T_{15} and T_{18} (9.39%) whereas lowest in T_7 (7.01%) followed by T_1 and T_4 (8.30%) treatments. The total sugar content increased gradually with the increasing period of storage in all the treatments. On 120th days of storage highest total sugar was recorded at T_{15} (12.00%) followed by T_{14} (11.88%) treatment. Whereas, lowest total sugar were recorded in T_7 (10.28%) followed by T_8 (10.53%) treatment.

Reducing sugar

On the first of storage the highest reducing sugars was observed in T_{12} (7.58%) followed by T_6 (7.52%) whereas lowest in T_7 (5.25%) followed by T_8 (6.26%) treatments. The reducing sugar content increased gradually with the increasing period of storage. On 120th days of storage highest reducing sugars were recorded at T_6 and T_{12} (10.00%) followed by T_{19} (9.95%) treatment. Whereas, lowest reducing sugars were recorded in T_7 (8.00%) followed by T_8 (8.42%) treatment. However, treatments T_2, T_3, T_5, T_6, T_{12}, T_{14}, T_{15}, T_{16}, T_{17}, T_{18} and T_{19} were found statistically at par with each other (Table 2a). The total sugar content of *Aonla* based blended RTS beverages increased during storage period. This could be attributed to the fact that, the hydrolysis of polysaccharides during storage results an increase in soluble sugars.

Table.1 Effect of recipe treatments on (A) total soluble solids and (B) total sugar content of *Aonla* based blended RTS beverages during storage

S.N.	Treatments	(A) Total soluble solids (%)					(B) Total sugar (%)				
		Storage Period (Days)					Storage Period (Days)				
		0	30	60	90	120	0	30	60	90	120
1.	*Aonla*: Lime (25:75)	10.00	10.32	11.00	11.50	11.90	0.76	0.40	0.42	0.57	0.75
2.	*Aonla*: Lime (50:50)	10.00	10.35	11.15	11.90	12.30	2.09	1.91	1.32	1.86	2.00
3.	*Aonla*: Lime (75:25)	10.00	10.45	11.16	12.00	12.40	1.40	1.22	0.72	0.82	1.06
4.	*Aonla*: Orange (25:75)	10.00	10.16	10.83	11.45	12.10	1.19	0.99	0.52	0.75	1.13
5.	*Aonla*: Orange (50:50)	10.00	10.11	10.80	11.42	12.20	1.25	1.05	0.53	0.82	1.13
6.	*Aonla*: Orange (75:25)	10.00	10.20	10.90	11.69	12.50	3.17	2.89	2.55	2.81	2.90
7.	*Aonla*: Pomegranate (25:75)	10.00	10.45	11.00	11.75	12.30	1.98	1.62	1.21	1.43	1.50
8.	*Aonla*: Pomegranate (50:50)	10.00	10.29	11.00	11.17	11.70	1.00	0.82	0.55	0.73	0.85
9.	*Aonla*: Pomegranate (75:25)	10.00	10.32	11.02	11.46	12.10	0.97	0.72	0.67	0.86	0.92
10.	*Aonla*: Lime: Ginger (25:73:2)	10.00	10.19	10.45	11.00	11.60	1.10	0.81	0.58	0.78	0.99
11.	*Aonla*: Lime: Ginger (50:48:2)	10.00	10.21	10.85	11.35	12.00	2.01	1.80	1.41	0.67	1.86
12.	*Aonla*: Lime: Ginger (75:23:2)	10.00	10.24	10.90	11.48	12.10	0.99	0.75	0.49	0.75	0.91
13.	*Aonla*: Orange: Ginger (25:73:2)	10.00	10.26	11.05	11.71	12.30	1.01	0.85	0.51	0.72	0.81
14.	*Aonla*: Orange: Ginger (50:48:2)	10.00	10.26	11.03	11.71	12.91	1.26	0.96	0.61	0.84	0.99
15.	*Aonla*: Orange: Ginger (75:23:2)	10.00	10.48	11.17	11.86	13.00	1.06	0.86	0.64	0.88	0.98
16.	*Aonla*: Pomegranate: Ginger (25:73:2)	10.00	10.45	10.89	11.45	12.20	1.00	0.82	0.51	0.60	0.80
17.	*Aonla*: Pomegranate: Ginger (50:48:2)	10.00	10.57	11.09	11.60	12.50	1.29	0.96	0.75	0.89	1.07
18.	*Aonla*: Pomegranate: Ginger (75:23:2)	10.00	10.68	11.28	12.00	12.90	1.49	0.99	0.75	0.94	1.09
19.	Control(100% *Aonla* juice)	10.00	10.45	11.20	11.90	12.80	1.60	1.03	0.80	0.98	1.22
SEm ±		0.24	0.25	0.27	0.28	0.30	0.037	0.030	0.022	0.021	0.031
CD (P=0.01)		NS	NS	NS	NS	NS	0.140	0.114	NS	NS	NS

Table.2 Effect of recipe treatments on (A) Reducing sugar and (B) Ascorbic acid content of *Aonla* based blended RTS beverages during storage

S. N.	Treatments	(A) Reducing sugar (%)					(B) Ascorbic acid (mg/100ml)				
		Storage Period (Days)					Storage Period (Days)				
		0	30	60	90	120	0	30	60	90	120
1	*Aonla*: Lime (25:75)	6.72	7.18	7.81	8.29	8.81	70.00	61.70	52.00	43.80	30.30
2	*Aonla*: Lime (50:50)	6.82	7.55	8.23	9.12	9.55	75.00	69.30	60.70	52.30	40.10
3	*Aonla*: Lime (75:25)	6.88	7.65	8.60	9.15	9.81	92.40	88.20	85.00	76.00	65.00
4	*Aonla*: Orange (25:75)	6.54	6.88	7.44	8.13	8.71	56.00	50.50	42.30	31.90	20.00
5	*Aonla*: Orange (50:50)	7.25	7.40	8.03	8.38	9.21	65.67	61.28	53.00	45.30	36.37
6	*Aonla*: Orange (75:25)	7.52	7.79	8.43	9.36	10.00	82.50	78.11	68.70	59.00	47.10
7	*Aonla*: Pomegranate (25:75)	5.25	5.64	6.48	7.13	8.00	45.40	39.60	32.50	23.50	15.00
8	*Aonla*: Pomegranate (50:50)	6.26	6.79	7.42	7.89	8.42	57.20	49.00	41.00	32.00	21.01
9	*Aonla*: Pomegranate (75:25)	6.74	7.16	7.91	8.40	9.00	60.00	52.20	45.30	37.70	25.00
10	*Aonla*: Lime: Ginger (25:73:2)	6.63	7.03	7.44	8.15	8.90	65.00	57.80	47.40	38.00	26.00
11	*Aonla*: Lime: Ginger (50:48:2)	6.75	7.11	7.72	8.42	9.02	73.00	62.90	53.90	42.30	31.00
12	*Aonla*: Lime: Ginger (75:23:2)	7.58	8.08	8.49	9.29	10.00	90.00	81.70	73.60	61.80	50.70
13	*Aonla*: Orange: Ginger (25:73:2)	6.80	7.02	7.71	8.29	9.11	53.40	48.30	41.40	33.60	19.60
14	*Aonla*: Orange: Ginger (50:48:2)	6.80	7.12	7.82	8.41	9.38	63.96	56.03	46.50	37.65	24.83
15	*Aonla*: Orange: Ginger (75:23:2)	7.04	7.39	8.21	9.00	9.84	82.00	73.70	65.50	56.00	43.90
16	*Aonla*: Pomegranate: Ginger (25:73:2)	6.57	6.94	7.75	8.32	9.19	57.70	48.00	41.70	31.80	19.90
17	*Aonla*: Pomegranate: Ginger (50:48:2)	6.85	7.36	8.24	8.88	9.80	64.20	57.80	48.00	36.90	25.10
18	*Aonla*: Pomegranate: Ginger (75:23:2)	7.04	7.43	8.29	8.96	9.85	71.50	91.43	52.00	38.00	27.00
19	Control(100% *Aonla* juice)	6.82	7.24	8.00	8.97	9.95	95.00	91.40	87.70	81.60	80.00
SEm±		0.17	0.18	0.20	0.21	0.23	1.78	1.56	1.43	1.17	0.88
CD (0.01%)		NS	NS	NS	0.81	0.88	6.58	5.97	5.49	4.47	3.38

Table.3 Effect of recipe treatments on (A) pH (B) phenol of *Aonla* based blended RTS beverages during storage

S.N.	Treatments	(A) pH					(B) Phenol (%)				
		Storage Period (Days)					Storage Period (Days)				
		0	30	60	90	120	0	30	60	90	120
1.	*Aonla*: Lime (25:75)	2.73	2.69	2.58	2.49	2.44	0.76	0.40	0.42	0.57	0.75
2.	*Aonla*: Lime (50:50)	2.72	2.70	2.62	2.52	2.47	2.09	1.91	1.32	1.86	2.00
3.	*Aonla*: Lime (75:25)	2.84	2.81	2.73	2.68	2.54	1.40	1.22	0.72	0.82	1.06
4.	*Aonla*: Orange (25:75)	3.00	2.96	2.92	2.88	2.82	1.19	0.99	0.52	0.75	1.13
5.	*Aonla*: Orange (50:50)	2.93	2.91	2.90	2.80	2.65	1.25	1.05	0.53	0.82	1.13
6.	*Aonla*: Orange (75:25)	2.96	2.91	2.87	2.80	2.68	3.17	2.89	2.55	2.81	2.90
7.	*Aonla*: Pomegranate (25:75)	2.77	2.75	2.71	2.69	2.68	1.98	1.62	1.21	1.43	1.50
8.	*Aonla*: Pomegranate (50:50)	2.58	2.55	2.53	2.50	2.48	1.00	0.82	0.55	0.73	0.85
9.	*Aonla*: Pomegranate (75:25)	2.66	2.64	2.59	2.57	2.55	0.97	0.72	0.67	0.86	0.92
10.	*Aonla*: Lime: Ginger (25:73:2)	2.59	2.55	2.47	2.41	2.36	1.10	0.81	0.58	0.78	0.99
11.	*Aonla*: Lime: Ginger (50:48:2)	2.79	2.76	2.71	2.70	2.68	2.01	1.80	1.41	0.67	1.86
12.	*Aonla*: Lime: Ginger (75:23:2)	2.93	2.90	2.84	2.80	2.78	0.99	0.75	0.49	0.75	0.91
13.	*Aonla*: Orange: Ginger (25:73:2)	2.98	2.91	2.87	2.81	2.78	1.01	0.85	0.51	0.72	0.81
14.	*Aonla*: Orange: Ginger (50:48:2)	2.86	2.85	2.78	2.68	2.58	1.26	0.96	0.61	0.84	0.99
15.	*Aonla*: Orange: Ginger (75:23:2)	2.85	2.81	2.78	2.69	2.61	1.06	0.86	0.64	0.88	0.98
16.	*Aonla*: Pomegranate: Ginger (25:73:2)	2.72	2.70	2.64	2.57	2.46	1.00	0.82	0.51	0.60	0.80
17.	*Aonla*: Pomegranate: Ginger (50:48:2)	2.74	2.70	2.63	2.58	2.56	1.29	0.96	0.75	0.89	1.07
18.	*Aonla*: Pomegranate: Ginger (75:23:2)	2.78	2.76	2.74	2.70	2.68	1.49	0.99	0.75	0.94	1.09
19.	Control(100% *Aonla* juice)	3.03	2.79	2.70	2.63	2.60	1.60	1.03	0.80	0.98	1.22
SEm ±		0.061	0.057	0.063	0.057	0.058	0.037	0.030	0.022	0.021	0.031
CD (P=0.01)		0.324	NS	NS	NS	NS	0.140	0.114	NS	NS	NS

Table.4 Effect of recipe treatments on (A) non-enzymatic browning (OD) and (B) Overall organoleptic score of *Aonla* based blended RTS beverages during storage

S. N.	Treatments	(A) Non-enzymatic browning					(B) Overall organoleptic score				
		Storage Period (Days)					Storage Period (Days)				
		0	30	60	90	120	0	30	60	90	120
1	*Aonla*: Lime (25:75)	0.018	0.018	0.041	0.068	0.100	8.17	7.82	7.23	6.36	5.48
2	*Aonla*: Lime (50:50)	0.023	0.026	0.080	0.092	0.110	8.15	7.72	7.06	7.71	5.41
3	*Aonla*: Lime (75:25)	0.025	0.039	0.093	0.150	0.180	8.00	7.46	6.82	6.09	5.29
4	*Aonla*: Orange (25:75)	0.027	0.033	0.058	0.080	0.094	8.18	7.87	7.31	6.71	5.60
5	*Aonla*: Orange (50:50)	0.032	0.034	0.083	0.105	0.115	8.09	7.67	7.10	6.36	5.39
6	*Aonla*: Orange (75:25)	0.037	0.058	0.092	0.135	0.152	8.03	7.50	7.09	6.27	5.31
7	*Aonla*: Pomegranate (25:75)	0.035	0.035	0.067	0.082	0.108	8.25	7.89	7.33	6.75	5.90
8	*Aonla*: Pomegranate (50:50)	0.041	0.047	0.086	0.110	0.134	8.19	7.76	7.24	6.66	5.79
9	*Aonla*: Pomegranate (75:25)	0.047	0.068	0.093	0.138	0.144	8.14	7.68	7.10	6.43	5.72
10	*Aonla*: Lime: Ginger (25:73:2)	0.020	0.020	0.057	0.076	0.105	8.58	8.18	7.62	7.27	6.92
11	*Aonla*: Lime: Ginger (50:48:2)	0.024	0.035	0.066	0.076	0.109	8.45	8.07	7.48	7.04	6.80
12	*Aonla*: Lime: Ginger (75:23:2)	0.024	0.041	0.069	0.085	0.118	8.41	8.05	7.37	6.95	6.60
13	*Aonla*: Orange: Ginger (25:73:2)	0.023	0.034	0.061	0.070	0.106	8.46	8.16	7.91	7.30	6.84
14	*Aonla*: Orange: Ginger (50:48:2)	0.035	0.041	0.067	0.081	0.110	8.36	8.06	7.82	7.16	6.76
15	*Aonla*: Orange: Ginger (75:23:2)	0.047	0.047	0.082	0.085	0.120	8.27	8.00	7.75	7.07	6.70
16	*Aonla*: Pomegranate: Ginger (25:73:2)	0.041	0.044	0.076	0.084	0.118	9.00	8.85	8.70	8.57	8.13
17	*Aonla*: Pomegranate: Ginger (50:48:2)	0.045	0.050	0.085	0.106	0.125	8.88	8.61	8.17	7.97	7.75
18	*Aonla*: Pomegranate: Ginger (75:23:2)	0.048	0.057	0.099	0.127	0.134	8.58	8.35	8.15	7.79	7.37
19	Control(100% *Aonla* juice)	0.033	0.041	0.076	0.101	0.125	6.66	6.29	5.75	4.97	4.05
SEm±		0.0008	0.0012	0.0018	0.0022	0.0027	0.20	0.19	0.17	0.16	0.15
CD (0.01%)		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Total sugars of beverages were depended on the total soluble solids as anticipated. There was considerable rise in reducing sugars and non-reducing sugars. This might be due to inversion on non-reducing sugars to reducing sugars caused by acids present in of *Aonla* based blended RTS beverages. Increase in total and reducing sugars during storage is a general phenomenon as noticed by Ray and Singh (1979) in bael beverages, Godara and Pareek (1985) in date palm RTS beverage at room temperature (25 ± 5^0C) Verma and Gehlot (2007) in bael RTS.

Ascorbic acid

The ascorbic acid content of *aonla* based blended RTS beverage decreased with advancement of storage period in all the treatments. The treatments had significant effect on ascorbic acid content of *aonla* based blended RTS beverage during the entire storage period (Table 2b). On the first day of storage the maximum ascorbic acid content was observed in T_{19} (95.00mg/100ml) and minimum in T_7 (45.40mg/100ml), however treatment T_3, T_{12} and T_{19} were found statistically at par with each other. Similarly, on 120th day of storage, the maximum ascorbic acid content was observed at T_{19} (80.00mg/100ml), followed by T_3 (65.00mg/100ml) treatment whereas minimum in T_7 (15.00 mg/100ml), followed by T_{13} (19.60mg/100ml). A gradual and significant decrease in ascorbic acid content with the increasing period of storage was observed in all the treatments. The maximum retention of ascorbic acid was observed in T_{17} (44.50mg/100ml) and minimum in T_{19} (25.00mg/100ml) treatment. The trend observed same throughout the storage period. Ascorbic acid content reduced considerably during storage period might be due to the oxidation or irreversible conversion of L-ascorbic acid into dihydro ascorbic acid oxidase (ascorbinase) because of heat processing and the presence of air at the head space of glass bottles. Similar, trend of declining was noticed by Palainswamy and Muthukrishnan (1974) in lemon juice during storage varied between 21.76 to 62.06 mg/100ml juice. Ray and Singh (1979) in bael beverages and by Reddy and Chikkasubbanna (2008) in lime blended amla squash during storage period of 90 days.

pH value

The pH content of *aonla* based blended RTS beverage decreased with advancement of storage period in all the treatments. The treatments have a non-significant effect on pH content of *aonla* based blended RTS beverage during entire storage periods except on the 15 days of storage (Table 3a). On the first day of storage the maximum pH content was observed in T_{19} (3.03) treatment, closely followed by T_4 (3.00), whereas minimum in T_8 (2.58). Similarly, at the end of storage period the maximum pH content was observed in T_4 (2.82) and minimum in T_{10} (2.36). The pH of *Aonla* based blended RTS beverage decreased with the increased period of storage. A corresponding decrease in acidity due to chemical reaction taking place between organic acids and pigments could be responsible for change in pH (Kannan and Thirumaran, 2004). Similar observations were reported by Krishnaveni *et al.*, (2001) in jackfruit RTS beverage during storage at room temperature. Murtaza *et al.*, (2004) in strawberry drinks at ambient temperature (25^0C). An increasing trend in pH of lime-*Aonla* blended squash during storage period of 90 days has also been reported by Reddy and Chikkasubbanna (2008).

Phenols

The maximum phenols contents on first day of storage was recorded at T_6 (3.17 %), followed by T_2 (2.09 %), which continued to be maximum till the end of storage period (2.90 %) and (2.00%) respectively. While minimum phenol content were observed in T_1 (0.76%) followed by T_9 (0.97%). The minimum phenolic content at 120th days of storage was recorded in treatment T_1 (0.75%) followed by T_{16} (0.80%).The Phenols contents of *Aonla* based blended RTS beverage decrease slightly during storage period (Table 3b). Initial content of

phenols in RTS compaired at end of storage period was less, which may be due to thermal degradation during pasteurization and processing. The decrease in phenols content might also be due to increased activity of polyphenol oxidase (PPO) enzyme activity. Poonam and Tandon (2007) obtained similar results in guava-*Aonla* blended beverage. Verma and Gehlot (2007) in bael RTS beverage during storage, Reddy and Chikkasubbanna (2008) in lime-*Aonla* blended squash.

Non-enzymatic browning

The non-enzymatic browning content of *aonla* based blended RTS beverage non-significantly affected by the recipe and storage period of *aonla* based RTS beverage during storage period except on 45th, 75th and 105th days of storage (Table 4a) and increased with the advancement of storage. On the first day of storage the non-enzymatic browning found to be highest in T_{18} (0.048 OD), followed by T_9 and T_{15} (0.047 OD) treatments whereas, the least in T_1 (0.018 OD) followed by T_{10} (0.020 OD). Similarly, on the 120th days of storage the maximum non-enzymatic browning contents observed in T_3 (0.180 OD) followed by T_6 (0.152 OD) treatment, whereas minimum in T_4 (0.94 OD). A gradual increase in non-enzymatic browning in *Aonla* based blended RTS beverage with increase in storage period at room temperature might be due to enzymatic and non-enzymatic reactions in RTS. The possibility of browning due to enzymes is ruled out because at such high temperature, enzymes get inactivated. Therefore, browning has taken place through the non-enzymatic reactions and oxidation of various phenolics and other compounds which lead to the formation of brown pigment. Similar, results were observed by Brekke *et al.*, (1970) in guava concentrates 2 months of storage. Khurdiya and Anand (1981) in phalsa beverages and by Poonma and Tondan (2007) in the guava-*Aonla* blended beverages increased with prolongation of storage period.

Overall acceptance

It is clear from the data that the overall acceptance of *aonla* based RTS beverage was decreased as the storage period increased in all the treatments. However, on the 120th the highest overall acceptance value (8.13) was obtained at T_{16} followed by T_{17} (7.97) treatment which, were significantly higher than the other treatments (Table 4b). The lowest value (4.05) was recorded at T_{19} (control) treatment. On the 120 days of storage treatments T_{16} and T_{17} were found statistically at par with each other. Overall acceptance of *Aonla* based blended RTS beverages was influenced by recipe and treatment combination revealed that it decreased as the storage period increased. On 120th day of storage the maximum overall acceptance score decreased from 9.00 to 8.13 (T_{16}) followed by T_{17} (8.88). The colour, taste and flavour are important consideration for overall acceptance of *Aonla* RTS beverage. The present findings are in accordance with findings reported by Khurdiya and Anand (1981) in phalsa and Jain *et al.*, (1984) in lemon, orange and bael fruit squashes. Similarly, Pandey (2004) in guava RTS beverage and squash gradually decreased at ambient temperature for 5 months. Kotcha and Kadam (2003) in RTS, syrup and concentrate of tamarind, Poonam and Tondan (2007) observed that as the concentration of *Aonla* pulp increased their acceptability decreased in guava-*Aonla* blended beverage.

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