

Research Article

Effect of processing on physiochemical and sensory parameters of low calorie therapeutic RTS beverage blend of Aloe Vera and Aonla Fruit using artificial sweeteners

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Abstract

Aloes have been used therapeutically for their medicinal and nutraceutical value. Indian gooseberry or aonla (*Emblica officinalis*) juice contains high vitamin C (478.56 mg/100 ml). It was classified as stimulant and carminative, and used frequently for dyspepsia and colic. Hence Aloe vera juice was blended with aonla fruit juice for increasing the therapeutic, nutritional and functional value of ready-to-serve (RTS) beverages. Aloe vera juice and aonla juice were utilized at various combinations with sugar and artificial sweeteners (aspartame, saccharine and neotame) for preparation of therapeutic RTS beverages and evaluated for physicochemical and sensory attributes during storage. The study revealed that the therapeutic RTS beverages prepared by blending of aloe vera and aonla juices with saccharine has scored maximum for almost all sensorial quality attributes such as appearance, colour, flavour, taste and overall acceptability and also found ascorbic acid content (180 mg/100 g). A reducing trend was observed in ascorbic acid and increasing trend was observed in acidity content during the storage of beverages at room temperature over a period of 60 days. The beverage changed significantly with respect to TSS content along the storage period.

Keywords: *Emblica officinalis*, *Aloe barbadensis*, ready-to-serve, aspartame, saccharine, neotame, ascorbic acid, storage, India.

Introduction

Fruit and fruit products both are an important supplement to the human diet as they provide almost all the vital components required for normal growth and development of the human body leading to the healthy physique and mind. Blending of fruit juice is practiced to overcome the high cost of some exotic fruit juices, scarcity or seasonal availability, balancing of strong flavours, high acidity, astringency, or bitterness, improving total soluble solids, bland flavour, improving and stabilizing colour. Nutritional or phytochemical properties can be improved by blending which offers to adjust sugar/acid ratios and compensate undesirable juice consistency

The true Aloe vera plant is called *Aloe barbadensis* Miller which belongs to the family Liliaceae. It is a perennial, drought resisting succulent plant. It has a history of use in folk medicine for treating skin and other disorders. The health benefits of Aloe vera have been propagated throughout the world. The bitter yellow and slightly sticky Aloe latex from the pericyclic tubules just beneath the outer skin of the leaves is commonly referred to as Aloe juice and it also has laxative properties. In the food industry, it is used as an ingredient for functional food and therapeutic purposes, mainly in the development of health drinks and beverages. Today, the Aloe vera industry is flourishing and the gel is used in many products, such as fresh gel, juice and other formulations for health, medical and cosmetic purposes [1]. Proper scientific investigations on Aloe vera have gained more attention over the last decade due to its reputable medicinal, pharmaceutical and food properties. Photochemistry of Aloe vera gel has revealed the presence of more than 200 active substances including vitamins, minerals, enzymes, sugars, anthraquinones of phenolic compounds, lignin, saponins, sterols, amino acids and salicylic acid. Polysaccharides are considered to be the active ingredients for Aloe's anti-inflammation and immune modulation effects [2].

The edible fruit tissues of Aonla (*Emblica officinalis* Geartn.) contain about 3 times as much protein and 160 times as much vitamin C as apple, as reported by Barthakur and Arnold [3]. The fruit contains a chemical substance called leucanthocyanin which retards the oxidation of ascorbic acid. Antioxidant effect of gallic acid, present in Aonla fruit has been well acknowledged. Dachiya [4] reported that the fresh fruit of Aonla is a very rich source of ascorbic acid (454.40 mg/100g) and appreciable source of total sugar (7.53mg/100g), calcium (14.91 mg/100g), iron (0.62 mg/100g) and phosphorus (11.81 mg/100g) and also has great potential for processing. Singh [5] noted that vitamin C content is in no way lower than that of Barbados cherry. A number of products like jam, squash, candy, dried shreds, powder, tablets, chutney, murabba and preserve may be prepared with ease from Aonla fruit.

These blended fruit beverages are far superior to synthetic beverages in terms of quality during the season. They are easily digestible, highly refreshing, thirst-quenching, appetizing and nutritionally far superior to many synthetic and aerated drinks [6]. According to the Food Standard and Safety Authority of India [7], the RTS beverage should have a juice content of not less than 10% (5% for lime), TSS of not less than 10% and preservatives as sulphur dioxide not more than 350 ppm or as benzoic acid not more than 600 ppm and 0.3% acidity. These beverages are not diluted before serving, hence the term ready-to-serve (RTS).

Beverages based on Aloe vera gel and aonla fruit juice continue to receive a considerable amount of attention reflecting a growing awareness of the potential of these products in the market place. These beverages have high nutritional quality, functional properties and increased energy value. These could be particularly useful in places where there is lack of food and improper nutrition leading to deficiencies of certain nutrients [8]. The development of any process for its economical utilization would be of great benefit to the beverage industry, the development of nutritionally value added products could therapeutically help in improving the health of consumers. Introduction of new types of value added beverages might also improve socio-economic status of the country [9, 10].

Materials and Methods

Preparation of aloe vera juice

The chemical composition of juices depends mostly upon the method of juice extraction [11]. Aloe vera gel was extracted using cold extraction method and processed into juice as per the method reported by Ramachandra and Srinivasa [12]. Freshly harvested Aloe vera leaves were dipped into 500 ppm KMS solution and washed thoroughly with tap water and kept for flash cooling to 5°C for gel stabilization. Further leaves were cut vertically into two halves and gel was separated using stainless steel knife. It was allowed to settle for 12 hrs and then homogenized using mixer grinder and enzymatically treated with 1% pectolytic enzyme at 50°C for 20 minutes. Then it was filtered and pH was adjusted to 3.0 by adding citric acid and ascorbic acid to control browning. Further it was de-aerated, pasteurized, flash cooled and stored. The obtained juice was stored at refrigerated temperature until further use.

Preparation of aonla juice

Fresh, fully ripe, sound aonla was used for extraction of juice. Each fruit was cleaned, thoroughly washed, blanched and blended in a laboratory blender to a pulp and the juice was extracted by filtering through muslin cloth and stored separately.

Preparation of aloe vera and aonla based therapeutic RTS beverage using sugar and artificial sweetener

The aloe vera and aonla beverages were prepared by blending of aloe vera and aonla fruit juices in different proportions at the same ratio (85:15) [13], ending with three samples, sugar (control) aspartame (sample A), saccharine (sample B) and neotame (sample C) respectively. The recipe for preparation of 85 ml aloe vera juice and 15 ml of aonla fruit juice with addition of sugar, aspartame, saccharine and neotame in varying proportions is presented in Table 1 [14]. Thus prepared beverages were filtered and filled in previously sterilized glass bottles (200 ml) leaving 2.5 cm head space and sealed airtight by crown corking. Then in-bottle sterilization was done at 105°C for 10 min and cooled to room temperature and stored at 7 ± 1°C for storage studies [15]. Samples were drawn at a regular interval of 15 days and evaluated for various quality attributes.

Standardization of low calorie therapeutic RTS beverages

In the present investigation three samples were prepared, i.e. control sample using sugar, sample A using aspartame, sample B using saccharine and sample C using neotame and their nutritive value was compared respectively.

Table 1. Standardization of low calorie therapeutic RTS beverages.

Parameters	Control	Sample A	Sample B	Sample C
Aloe vera juice	90ml	90ml	90ml	90ml
Aonla juice	10ml	10ml	10ml	10ml
Sugar	6gm	---	---	---
Aspartame	---	0.2gm	---	---
Saccharine	---	---	0.02gm	---
Neotame	---	---	---	0.002gm
Citric Acid	2gm	2gm	2gm	2gm
Sodium Benzoate	0.57gm	0.57gm	0.57gm	0.57gm

Physicochemical properties

The pH values were determined with the help of an electronic pH meter (Thermo Scientific, 2 star), TSS measurement was done using a hand refractometer (Bellingham Stanley Ltd., UK) (0-32°C) and values were expressed as °Brix. Acidity of various samples was determined by titrating against 0.1 N NaOH according to AOAC (1995) method. Ascorbic acid content was determined by the titration method using 2,6-dichlorophenol endophenol dye (C₁₂H₇NCI₂) as recommended by Ranganna [10].

Sensory evaluation

Sensory evaluation was made using a panel of 10 semi-trained judges. The panel evaluated the acceptance level of beverage for colour, flavour, taste and overall acceptability. A 9-point hedonic scale was used for this purpose [16]. The data obtained were subjected to statistical analysis using analysis of variance technique and comparison of means by LSD test.

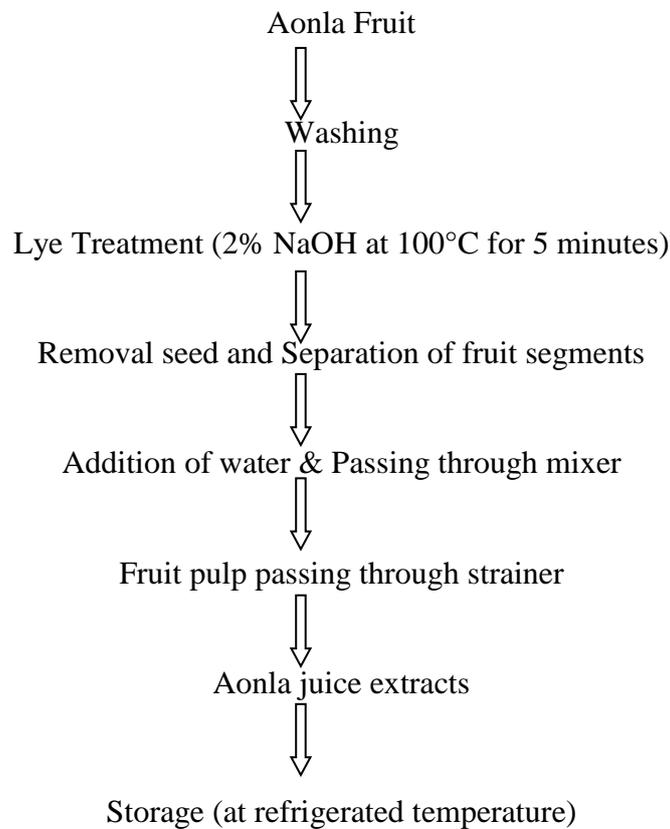


Figure 1. Process Flow Chart of Aonla Fruit Juice Extraction.

Statistical analysis

The data generated in the experiments were recorded and subjected to statistical analysis using standard procedures [17]. The standard errors (SE) and critical differences (CD) at 5% level of significance were worked out for comparison of treatments and presented in the respective tables.

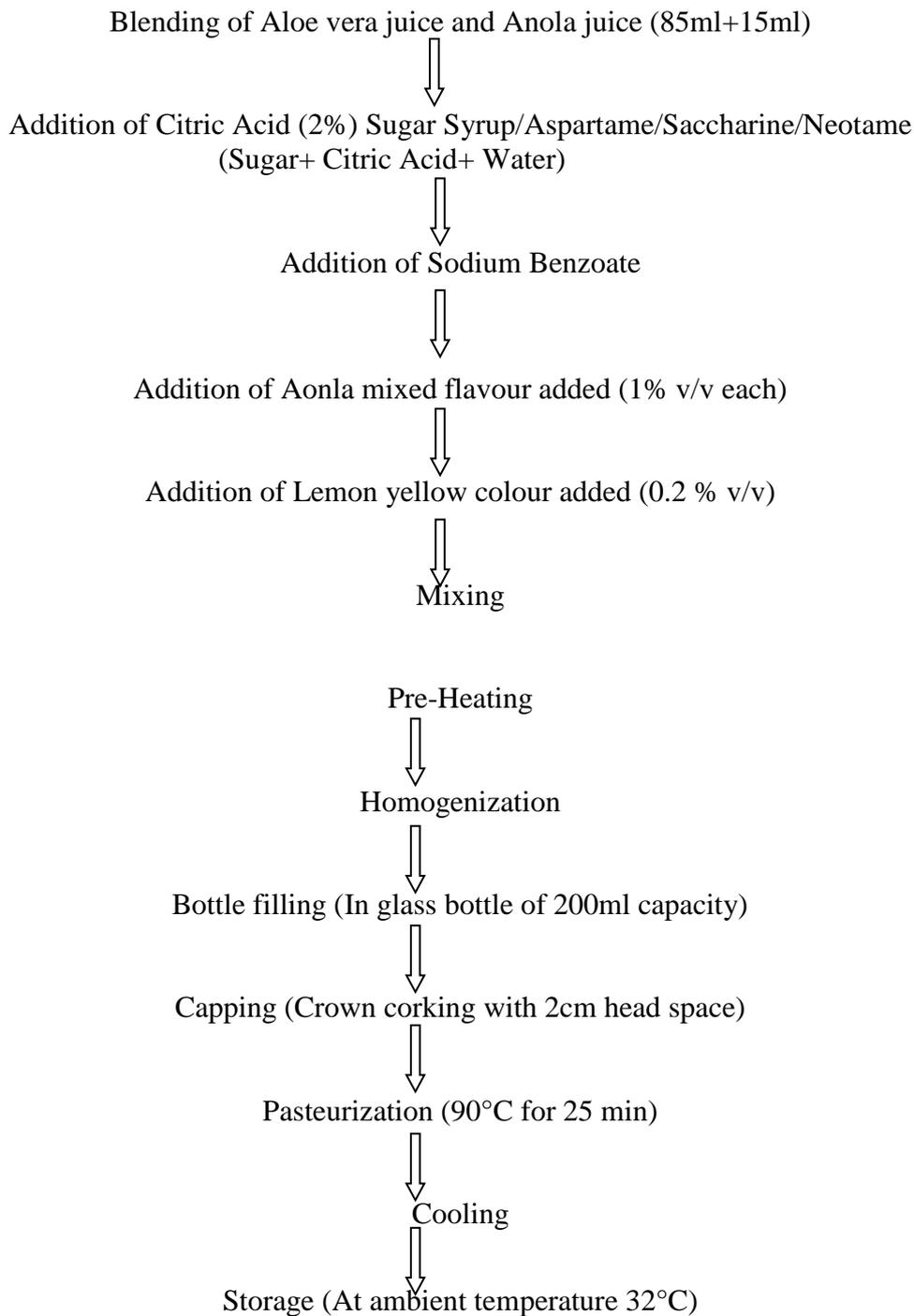


Figure 2. Process flowchart for preparation of therapeutic RTS beverages by blending of Aloe vera and Anola fruit juices using artificial sweeteners.

Results and Discussion

Yield of Aloe vera gel

The Aloe vera gel is a relatively new and novel ingredient for processing into beverages. Hence, it was preferred to collect the data pertaining to yield of gel from different structure of leaves and the obtained results are presented in Table 2.

It can be observed from Table 2 that long developed Aloe vera leaves recorded maximum weight (112.4 g) as gel yield (45.37%) while minimum weight of leaf (89.3 g), weight of gel (31 g) and gel yield (34.71%) was recorded for small spotted leaves. The difference in leaf structure and gel yield may be due to different growing stages, morphology and maturity profile of Aloe vera

leaves. On the basis of obtained results, it could be suggested that long fully developed Aloe vera leaves should be preferred for extraction of gel for maximum yield.

Table 2. Yield of Aloe vera gel from different leaf structures.

Structure of leaf	Physical Properties*		
	Weight of leaf (g)	Weight of Gel (g)	Gel yield (%)
Long developed	112.4	51	45.4
Medium developed	106.7	45	42.2
Small developed	93.5	39	41.7
Small spotted	89.3	31	34.7

*Each value is average of 10 determinations.

Compositional profile of Aloe vera juice and Aonla fruit juice

Prepared Aloe vera and aonla juice were analyzed for their proximate composition and the obtained results are depicted in Table 3.

Table 3. Chemical composition of aloe vera juice and aonla juice per 100gm of fruit.

Constituent	Aloe Vera Juice	Aonla Juice
Moisture (%)	97.34	82.5
pH	4.4	3.1
Acidity (%)	1.2	2.6
TSS (°Bx)	2.1	2.8
Vitamin C (mg)	7	900

*Each value is average of 10 determinations.

Effect of storage on physico-chemical parameters of therapeutic RTS beverages

Effect of addition of artificial sweeteners on therapeutic beverages in blend of aloe vera and aonla juice on physico-chemical parameters of beverage changes during storage was studied and obtained results are presented in Table 4. Physico-chemical properties of beverages such as TSS, pH, ascorbic acid, acidity and overall acceptability were affected significantly by changing the ingredients. A reducing trend was observed in ascorbic acid whereas an increasing trend was observed in acidity content during storage. Significant change was observed in TSS content of the samples during 60 days of storage. Increase in percentage acidity might be due to the slight growth of micro-organism in the beverage [18].

Table 4. Chemical parameters of low calorie therapeutic RTS beverages during 0 days storage.

Parameters	Control	Sample A	Sample B	Sample C	F-Test	S.Ed	C.D
Acidity (%)	0.2	0.25	0.27	0.29	S	0.007	0.019
TSS 0Brix	13	7	7	7	S	0.481	1.189
pH	4.5	4.4	4.4	4.4	S	0.260	0.643
Vitamin C(Mg)	200	185	185	185	S	6.220	14.154

(Control – Addition of sugar; Sample A – Addition of aspartame; Sample B – addition of saccharine; Sample C neotame)

The sample B contains similar values for vitamin C and TSS, while slight variation occurred in acidity and PH as compared to sample A. Moreover, the TSS of control was found to have increased more than samples A and B. This may be due to the addition of sugar, while in samples A and B the TSS was lower due to the addition of aspartame and saccharine respectively in place of sugar.

Table 5. Chemical parameters of low calorie therapeutic RTS beverages during 30 days storage.

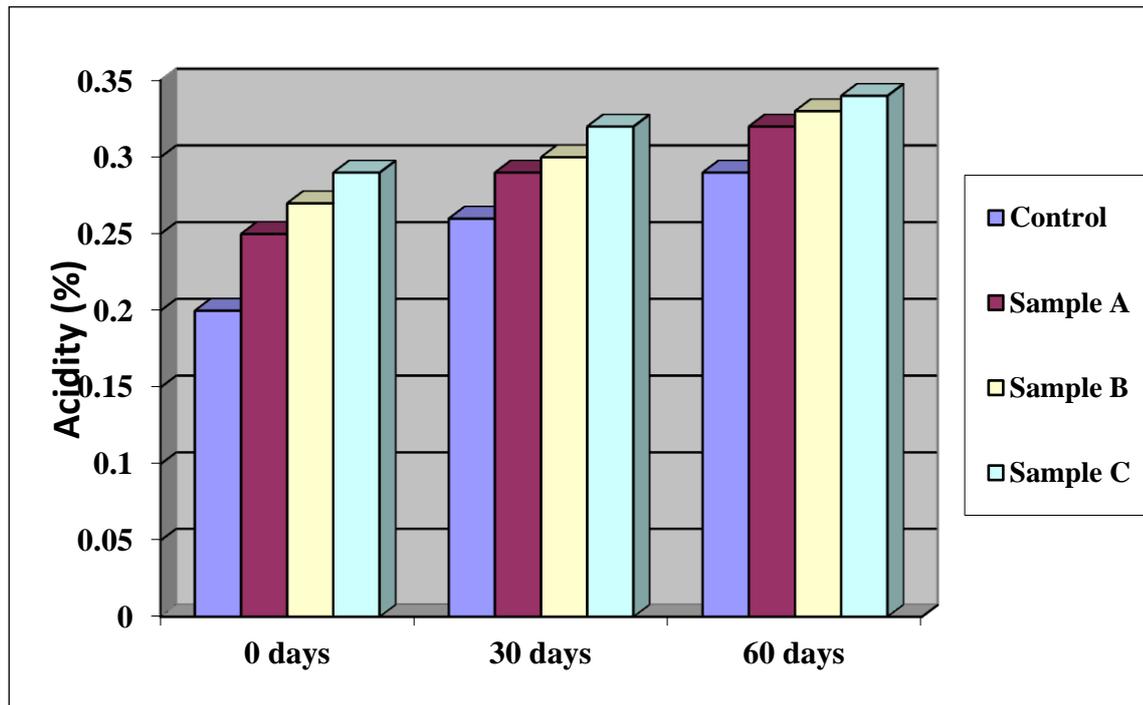
Parameters	Control	Sample A	Sample B	Sample C	F-Test	S.Ed	C.D
Acidity (%)	0.26	0.29	0.3	0.32	S	0.019	0.033
TSS 0Brix	12	6	6	6	S	1.181	3.184
pH	4.8	5.0	5.1	5.1	S	0.110	0.316
Ascorbic Acid (Mg)	195	180	180	180	S	3.270	6.544

(Control – Addition of sugar; Sample A – Addition of aspartame; Sample B – addition of saccharine; Sample C neotame)

Table 6. Chemical parameters of low calorie therapeutic RTS beverages during 60 days storage.

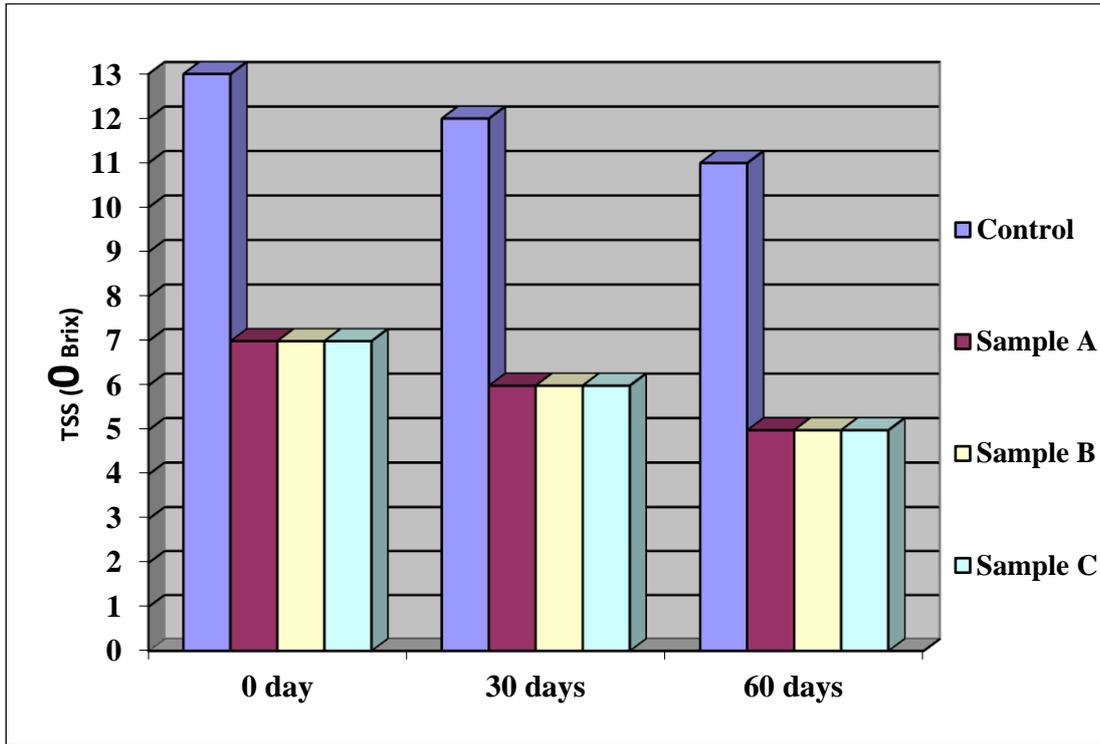
Parameters	Control	Sample A	Sample B	Sample C	F-Test	S.Ed	C.D
Acidity (%)	0.29	0.32	0.33	0.34	S	0.022	0.041
TSS 0Brix	11	5	5	5	S	1.513	0.916
pH	5.0	5.3	5.4	5.4	S	0.145	0.416
Vitamin C(Mg)	180	170	170	170	S	3.110	7.446

(Control – Addition of sugar; Sample A – Addition of aspartame; Sample B – addition of saccharine; Sample C neotame)



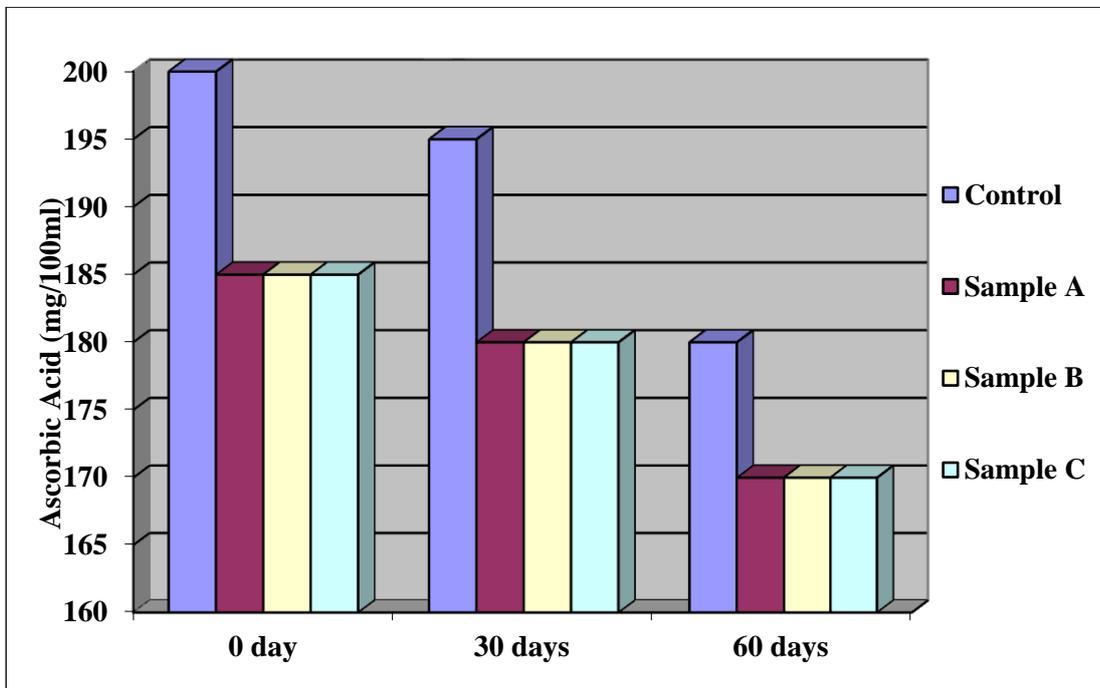
(Control – Addition of sugar; Sample A – Addition of aspartame; Sample B – addition of saccharine; Sample C neotame)

Figure 3. Acidity Content of Low Calorie Therapeutic RTS Beverage During Storage Period.



(Control – Addition of sugar; Sample A – Addition of aspartame; Sample B – addition of saccharine; Sample C neotame)

Figure 4. TSS Content of Low Calorie Therapeutic RTS Beverage During Storage Period.



(Control – Addition of sugar; Sample A – Addition of aspartame; Sample B – addition of saccharine; Sample C neotame)

Figure 5. Ascorbic Acid Content of Low Calorie Therapeutic RTS Beverage During Storage Period.

Sensory evaluation

The beverages prepared by blending of aloe vera and aonla fruit juices in different combinations with sugar, aspartame, saccharine and neotame were analysed for various sensorial attributes for their acceptance by using 9 point hedonic scale. The sensory scores obtained with respect to colour, flavour, taste and overall acceptability are presented in Table 7. It is observed that beverage sample (B) prepared by addition of saccharine was liked most by sensory panel members as compared to the other combinations. The colour, flavour and taste of sample B beverage maintained the highest organoleptic score other than the sample A, sample C and control sample beverages respectively. The storage study of aloe vera and aonla based beverage revealed that all the characteristics, i.e. appearance, colour, flavour, taste and overall acceptability of sensory evaluation showed a decreasing trend. This might be due to changes occurring during storage of the beverage [19].

Table 7. ANOVA for sensory analysis of low calorie therapeutic RTS beverages.

Sample	Sensory Evaluation Scores					
	Colour	Taste	Aroma	Flavour	Appearance	Overall Acceptability
Control	6	7	7	6	6	6
Sample A	7	7	8	7	7	7
Sample B	9	9	9	8	9	9
Sample C	8	9	8	8	8	8
F.test	S	S	S	N.S	S	S
S.Ed.(+)	0.431	0.223	0.142	0.146	0.438	0.047
C.D(p=0.05)	0.592	0.393	0.198	0.199	0.690	0.098

(Control – Addition of sugar; Sample A – Addition of aspartame; Sample B – addition of saccharine; Sample C neotame)

Conclusion

In the present investigation, attempts have been made to prepare and standardize the method for low calorie Aloe vera and Aonla-based beverage. The nutritious beverages with better storage life could be developed by addition of aloe vera and aonla to a certain extent. After preparation the quality of product was evaluated with the help of various experiments, like moisture content, ash content, ascorbic acid, pH etc. The quality of product was found good for a period 60 days. Low calorie therapeutic RTS prepared by Aloe vera and Aonla by using the artificial sweeteners like saccharine proved to be the best among samples prepared and found to be organoleptically most acceptable. The sweetness of the product seems to be a highly appreciated characteristic that must be related to the consumer habits.

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