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Studies on Blend Beverage form Pomegranate (*Punica granatum* L.), Aonla (*Emblica officinalis* Gaertn.) and Aloe Vera (*Aloe barbadensis* Miller)

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

The pomegranate (*Punica granatum* L.), aonla (Emblica officinalis Gaertn.), and aloe vera (Aloe barbadensis miller.) have nutritional, medicinal, and therapeutic values. The present research was conducted at the Post Graduate Laboratory of the Department of Post Harvest Management, College of Horticulture and Forestry, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya (U.P.) during the year 2022–23. In the present studies, pomegranate juice, aonla juice and aloe vera gel were blended in different ratios viz., 100:0:0 (T1), 0:100:0 (T2), 0:0:100 (T3), 33.33:33.33:33.33 (T4), 40:30:30 (T5): 50:25:25 (T6), 60:20:20 (T7),

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70:15:15 (T8), 80:10:10 (T9) and 90:5:5 (T10) for the preparation of RTS 10 percent of blend comprising 80 percent pomegranate juice, 10 percent aonla juice,10 percent aloe vera gel was found best on 9- point hedonic scale for the preparation of RTS with 13 percent TSS, 0.3 percent acidity and 120 ppm benzoic acid. than other blend combinations. Whereas ascorbic acid (vitamin C), non-reducing sugars, and organoleptic quality declined as the storage period progressed, TSS, acidity, reducing sugars, total sugars, and browning increased. At room temperature, the squash was kept. When stored at room temperature for five months, the beverage retained its organoleptic qualities. In terms of taste, colour, flavour, nutrition, and medicinal and therapeutic qualities, the current study showed that pomegranate, aonla, and aloe vera can be used to make palatable RTS that can benefit consumers.

Keywords: RTS pomegranate juice; aonla juice and aloe vera gel; blend combination; storage; organoleptic quality.

1. INTRODCUTION

A beverage is any liquid meant for human consumption. Besides just being used to quench one's thirst, beverages are significant to human culture (Wikipedia, 2019). There are two kinds of beverages: fermented (alcoholic) and unfermented (non-alcoholic). When it comes to the interpretation of sensory nutritional characteristics, blended beverages made with a variety of fruits, vegetables, spices, extracts, and medicinal plants will undoubtedly draw in customers. Pomegranate (*Punica granatum* L.) member of the Punicaceae family. It is sometimes referred to as the Carthage apple, the Chinese apple, or the apple with numerous seeds. a significant crop of dessert fruits grown in tropical and subtropical climates worldwide is the pomegranate. The edible portions of pomegranate are eaten raw or used to make canned drinks, fresh juice, jelly, jam, paste, and beverage products that are flavored and colored.

Aonla (*Emblica officina*lis Gaertn.) widely known as Indian Gooseberry belongs to family Euphorbiaceae is an indigenous fruit tree mainly cultivated in subtropical, arid and semi-arid regions of the worldwide. “It is considered useful in treating haemorrhage, diarrhoea, chronic dysentery, diabetes, jaundice, ophthalmic disorders, dyspepsia, cough, skin diseases, leprosy and greyness of hair” (Ganachari et al*.,* 2010). Blending two or more fruit juices to make a ready-to-serve beverage seems like a practical and cost-effective option for both Aonla as well as consumer. Choudhary and Kathuria [1]. Aloe vera, is a member of the Liliaceae or Asphodelaceae family. It is a perennial succulent plant resistant to drought, commonly referred to as "Gheegwar" and "Ghrit Kumari.

Aloe vera possesses antibacterial, antiviral, antiseptic, anticarcinogenic, and anti-inflammatory properties. It is supposed to prevent infection and has been reported to cure eczema, diabetes, and arthritis. Aloe vera is cultivated all over the world, and in India, it has long been utilized as an ayurveda remedy or as a component of other ayurvedic remedies (Sudha et al*.,* 2011). Plant extracts with medicinal, nutritional, and therapeutic properties as well as blends of various fruits can be used to make blend beverages that are tolerably tasty. Pomegranate, aonla, and aloe vera blends could be used to create drinks that would maximise the use of these perishable raw materials while minimising post-harvest loss and giving consumers access to tasty drinks with therapeutic benefits. Naturally occurring beverages with medicinal qualities are in higher demand on the market than synthetic ones as consumers become more health conscious and cautious about their fitness and well-being. Among the main obstacles facing the beverage processing industries are the availability of delectable recipes, processing techniques, and storage life for drinks with high nutritional and medicinal value.

2. MATERIALS AND METHODS

2.1 Raw Materials

Pomegranate (*Punica granatum* L.), purchased from local market Aonla (*Emblica officinalis* Gaertn.) (var.NA-7) purchased from Horticultural farm Acharya Narendra Deva University of Agriculture & Technology Kumarganj Ayodhya Aloe vera (var. Samsheetal) purchased from National Botanical Research Institute, Lucknow used for preparation of ready to serve.

2.2 Extraction of Pomegranate juice, Aonla juice and Aloe vera gel

The methods applied to extract the Pomegranate juice, Aonla juice, and Aloe vera gel are shown in Fig. 1, Fig. 2, Fig. 3 respectively.

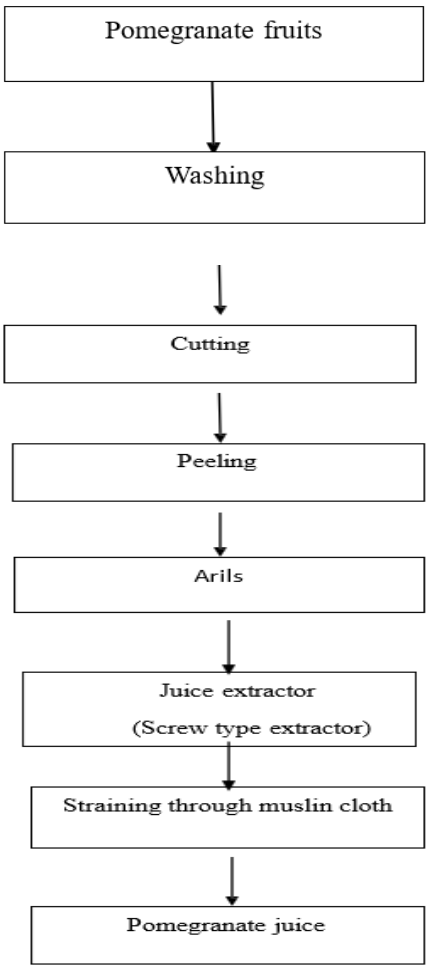


Fig. 1. Flow chart of juice extraction from pomegranate fruits

2.3 Standardization of Blends for Ready-to-Serve Beverages (RTS)

Following each combination (Treatment) of Pomegranate juice, Aonla juice, and Aloe vera gel to obtain the best combination for the development of palatable and quality RTS List 1.

Preparation of RTS: RTS consisting 10% blend, 13% TSS, 0.3% acidity and 120 ppm benzoic acid. were prepared by different treatments for each blend combination of pomegranate juice ,aonla juice and aloe vera gel mentioned under Table 2. These RTS were organoleptically evaluated on 9- point Hedonic scale to find out the best combination of blend. The technique used for RTS making is shown in Fig. 4.

2.4 Storage Studies

After preparing 10 litres of RTS using the optimal blend (Treatment-9), the bottles were filled with a 2 cm headspace, corked, pasteurised, and stored at room temperature for storage research. The following are the results of monthly observations made during the course of three months of storage regarding changes in TSS, acidity, vitamin C, reducing and non-reducing sugars, total sugars, browning, and organoleptic quality. A hand refractometer (Erma Inc. Tokyo, Japan) was used to calculate the sample's TSS, which was expressed as a percentage (0–32% and 28–62%). Using a reference table, the TSS values recorded at room temperature were adjusted to 20 °C, and the sample mean was expressed as a percentage of the total TSS content. By titrating a known quantity of sample against a N/10 NaOH solution and using two to three drops of phenolphthalein as an indicator, the acidity was calculated and expressed as a percentage of anhydrous citric acid. By first preparing the sample in a solution of 3% metaphosphoric acid and titrating it against a solution of 2, 6-dichlorophenol indophenols dye

until a light pink colour appeared, the amount of vitamin C in the sample was determined. Fehling's solutions A and B, along with methyl blue as an indicator in the boiling stage, were used to analyse the reducing, non-reducing, and total sugars. A sample was taken and thoroughly mixed with 30 millilitres of 60% alcohol to determine the non-enzymatic browning. The mixture was then centrifuged for 15 minutes at 1500 rpm and filtered through Whatman filter paper No. 1 to obtain a clear solution. After that, the sample's absorbance was measured using a 60% aqueous alcohol blank at 440 nm wavelength on a "Igene Labserve" model UV vis Double Beam spectrophotometer. Non-enzymatic browning was defined as the increase in a sample's optical density at 440 nm. A panel of nine judges, who were semi-trained, evaluated the colour, flavour, and texture of the beverages using the Hedonic Rating Scale, which has a maximum score of nine points. This was done to assess the organoleptic quality of RTS.

List 1. Treatment details

T_1 10% Blend combination No.1 + 13% Sugar+ 0.3acidity+ 120 ppm Benzoic acid
T_2 10% Blend combination No.2 + 13% Sugar+ 0.3acidity+ 120 ppm Benzoic acid
T_3 10% Blend combination No.3 + 13% Sugar+ 0.3acidity+ 120 ppm Benzoic acid
T_4 10% Blend combination No.4 + 13% Sugar+ 0.3acidity+ 120 ppm Benzoic acid
T_5 10% Blend combination No.5 + 13% Sugar+ 0.3acidity+ 120 ppm Benzoic acid
T_6 10% Blend combination No.6 + 13% Sugar+ 0.3acidity+ 120 ppm Benzoic acid
T_7 10% Blend combination No.7 + 13% Sugar+ 0.3acidity+ 120 ppm Benzoic acid
T_8 10% Blend combination No.8 + 13% Sugar+ 0.3acidity+ 120 ppm Benzoic acid
T_9 10% Blend combination No.9 + 13% Sugar+ 0.3acidity+ 120 ppm Benzoic acid
T_{10} 10% Blend combination No.10 + 13% Sugar+ 0.3acidity+ 120 ppm Benzoic acid

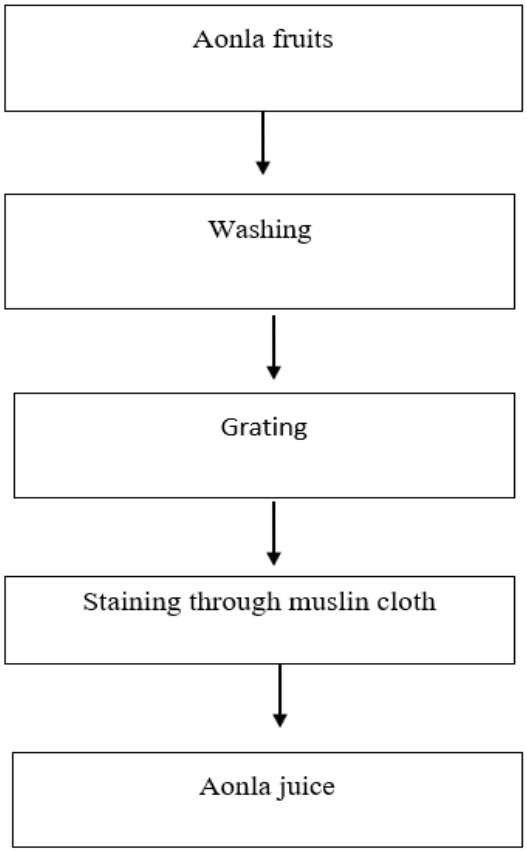


Fig. 2. Flow chart of juice extraction from Aonla fruits

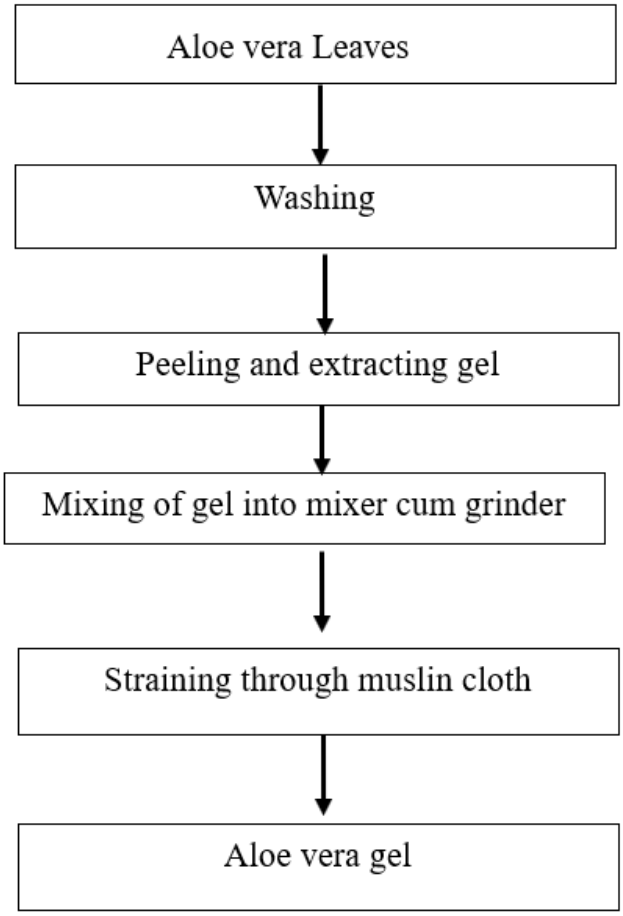
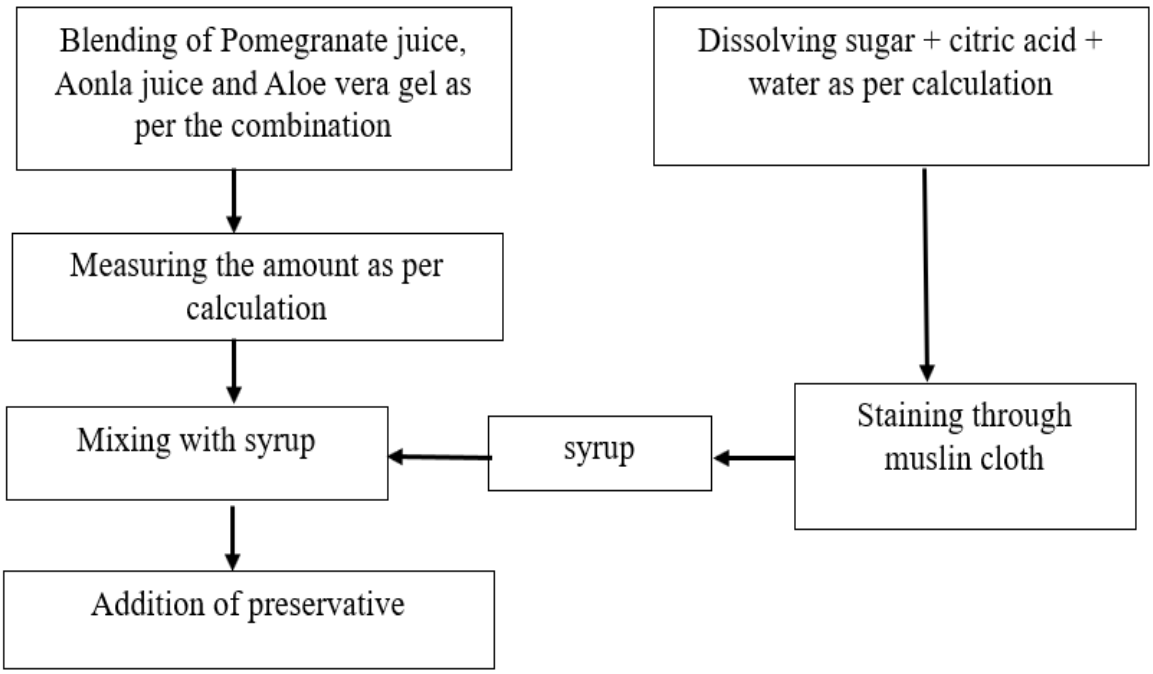


Fig. 3. Flow chart of aloe vera Gel extraction



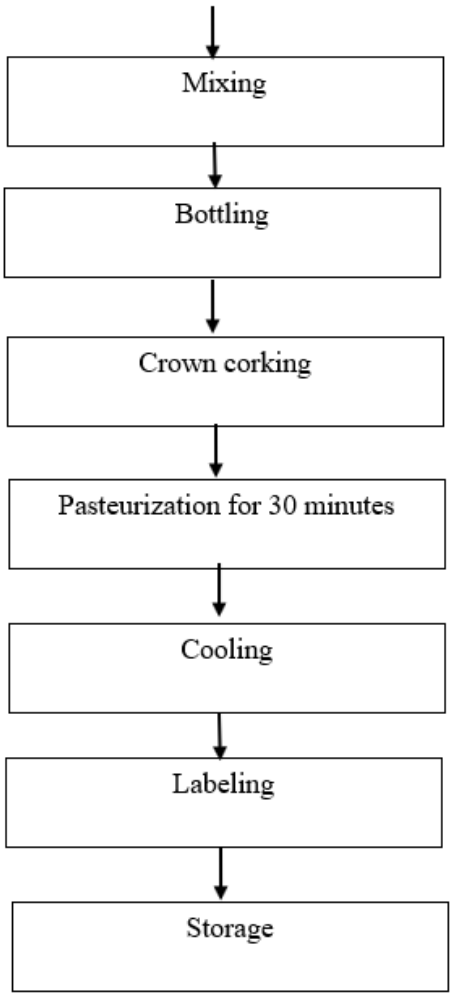


Fig. 4. Flow chart of pomegranate, aonla and aloe vera blended RTS preparation

2.5 Statistical Analysis

The experiments were conducted three replications and the observations were recorded on a monthly basis. The statistical analysis of the data was performed using computer software called SPSS (Statistical Package for Social Sciences) and followed a completely randomized design (CRD)as described by Panse and Sukhatne [2].

3. RESULTS AND DISCUSSION

3.1 Chemical Attributes of Pomegranate Juice, Aonla Juice and Aloe Vera Gel

The data pertaining to chemical attributes of Pomegranate juice, Aonla juice and Aloe vera gel is presented in Table 1. The Total Soluble Solids of pomegranate juice, Aonla juice, and Aloe vera gel were recorded 12.71 percent ,12.7 percent ,0.8 percent respectively. The acidity of Pomegranate juice, aonla juice and aloe vera gel were recorded 0.88 percent ,2.34 percent and 0.24 percent respectively. The vitamin C content of Pomegranate juice,Aonla juice and Aloe vera gel were recorded 14.63 percent ,420.95 percent and 1.93 respectively. The reducing sugars, non-reducing sugars and total sugars content in Pomegranate juice, were recorded 11.60 percent ,5.33 percent and 16.93, respectively Similarly finding were reported by Byanna et al. [3], Sasikumar (2013) reported that Indian gooseberry or aonla (*Emblica officinalis*) juice contains high amount of vitamin C (478.56 mg/100 ml). and Elbandy et al. (2014) reported that Aloe vera gel contains 96.31% total soluble solids, 0.10% acidity; 41.40 mg/100g ascorbic acid and 3.69% total sugars. Harendra and Deen [4] observed that aloe vera gel contains 1.88% TSS, 0.24% acidity, 2.53 mg/100g vitamin-C, 0.53% reducing sugars, 1.18% non-reducing sugar and 1.71% total sugars.

3.2 Standardization of the Blends

3.2.1 Organoleptic quality of RTS prepared from different blends pomegranate juice aonla juice,and aloe vera gel

The data recorded on organoleptic quality of RTS prepared from various combinations of Pomegranate juice, Aonla juice and Aloe vera gel blends are presented in Table 2. Results. reveals that the treatment no. 9 comprising 80 % Pomegranate juice, 10 % Aonla juice, and 10 % Aloe vera was found to be superior over rest treatments and also differed significantly with other treatments. Thus 10% blend comprising 80 % pomegranate juice, 10 % aonla juice and10 % aloe vera gel can be used to prepare quality palatable RTS containing 13% TSS, 0.3% acidity and 120 ppm Benzoic acid. can be used to obtain quality palatable RTS beverages.

3.2.2 Biochemical changes during storage of prepared products

"Data pertaining to biochemical changes during storage of RTS presented in Table 3. which indicates that total soluble solids increased gradually after one month of storage from 13.00 0brix to 13.45 ºbrix. This change might be due to the conversion of polysaccharides into sugars". Similar increasing trend in TSS during storage was reported trend in TSS during storage was reported Anand [5] recorded those "total soluble solids increased in Aonla and Aloe vera blended RTS during storage under ambient temperature which are in agreement of present observations. The total acidity of RTS increased gradually during storage. Total acidity was increased from 0.56 per cent at initial day to 0.88 per cent at final days". Shagiwal and Deen [6] "Degradation of pectic substances and formation of organic acid Similar results that an increase in acidity content during storage of products" were reported by Singh et al*.* (2018) found that the acidity content increased in blend RTS prepared from mango and aloe vera during two months of storage at 25o C. Similarly, Gill et al. [7] noticed that "acidity content increased in RTS prepared from Kagzi lime juice, aloe vera gel and rose juice during storage period under ambient condition. Vitamin C content was continuously decreased from the first day (16.22 mg/100) to the end of storage (15.56mg/100g) throughout the storage period. This decrease in vitamin C content might be due to the oxidation of ascorbic acid into dehydro-ascorbic acid".

Table 1. Chemical attributes of Pomegranate juice, Aonla juice and Aloe vera gel

S. No.	Chemical Attributes	Mean Value		
		Pomegranate Juice	Aonla Juice	Aloe Vera Gel
1	Total soluble solids (%)	12.71	12.70	0.88
2	Acidity (%)	0.88	2.34	0.24
3	Vitamin-C (mg/100 g)	14.63	420.95	1.93
4	Reducing sugars (%)	11.60	7.60	0.61
5	Non-reducing sugar (%)	5.33	0.31	1.13
6	Total sugars (%)	16.93	7.91	1.74

Table 2. Organoleptic quality of RTS prepared from different blends of Pomegranate juice, Aonla juice and Aloe vera gel

Treatments	Different Combination of Blends			Organoleptic Quality	
	Pomegranate juice (%)	Aonla Juice (%)	Aloe Vera Gel (%)	Score	Rating
T1	100	Nil	Nil	8.23	Like moderately
T2	Nil	100	Nil	7.92	Like moderately
T3	Nil	Nil	100	7.17	Like slightly
T4	33.33	33.33	33.33	7.17	Like moderately
T5	40	30	30	7.02	Like moderately
T6	50	25	25	7.82	Like moderately
T7	60	20	20	7.76	Like slightly
T8	70	15	15	7.05	Like moderately
T9	80	10	10	8.05	Like very much
T10	90	5	5	6.76	Like slightly
S.Em±				**0.04**	
CD at 5%				**0.11**	

LVM: Like Very Much, LM: Like Moderately

Table 3. Changes during storage life of prepared RTS

Storage Period (Months)	TSS (%)	Acidity (%)	Vitamin-C (mg/ 100ml)	Reducing Sugars (%)	Non-Reducing Sugar (%)	Total Sugars (%)	Browning (O.D.)	Organoleptic	
								Score	Rating
0	13.00	0.56	16.22	6.25	3.81	10.06	0.33	8.23	LVM
1	13.45	0.67	16.00	6.41	3.68	10.09	0.35	7.82	LM
2	13.87	0.82	15.69	6.60	3.55	10.15	0.38	7.63	LM
3	13.98	0.88	15.56	6.79	3.43	10.22	0.44	7.18	LM
S.Em±	**0.03**	**0.03**	**0.03**	**0.01**	**0.01**	**0.02**	**0.01**	**0.10**	
CD at %	**0.11**	**0.11**	**0.09**	**0.01**	**0.03**	**0.06**	**0.04**	**0.33**	

LVM: Like Very Much, LM: Like Moderately

The loss of vitamin C in RTS of different fruits-based beverages during storage at ambient temperature was also reported by Pebam et al. (2022) observed that "ascorbic acid content was found to decreases with storage. Significantly highest ascorbic acid content (134.65 mg/100g) was observed in NA-7 and significantly lowest ascorbic acid content (112.3 mg/100g) in Kanchanat day of storage". And Kausar et al. [8] observed that "vitamin-C content decreased from 8.43 to 7.64 mg/100ml in RTS prepared from aloe vera and lemon juice during storage of 90 days".

The reducing sugars and total sugars of blended RTS, increased continuously during entire period of storage and it was increased from 6.25 per cent to 6.79 per cent and 10.06 per cent to 10.22 per cent respectively. The increase in reducing sugars of products might be due to conversion of non-reducing sugar into reducing sugars. This finding was supported by Tiwari and Deen [9]. noticed that total sugars and reducing sugars increased, during storage period in blended beverages prepared from bael and aloe vera. Kausar et al. [8] observed that "reducing sugars increased from 3.75 to 4.32% while non-reducing sugar decreased from 9.53 to 8.91% in RTS prepared from aloe vera and lemon juice during storage of 90 days".

The increase in total and reducing sugars. This increment in sugars also may be due to hydrolysis of some carbohydrates into sugars. Further similar trend in changes of sugars content with the advancement of storage period was observed. Mishra and Sangma (2017) found "an increasing trend in reducing sugars and decreasing trend in total sugars during 60 days of storage period in all aloe vera, ginger, sweet lime and amla RTS drinks at ambient temperature when filled into PET bottles".

The non-reducing sugar content of RTS showed gradual decreasing from 3.81% to 3.43% Antithesis to reducing and total sugars, reduction in non-reducing sugar might be due to conversion of non-reducing sugar. The results are similar with Harendra and Deen [4] notice that reducing sugars and total sugars increased whereas, non- reducing sugars decreased continuously up to the end of the storage period under ambient temperature (20.1-29.4o C) in syrup prepared from blend of mango, citrus, aloe vera and ginger in case of both glass and polypet bottles. Singh et al. (2018) noticed that "reducing sugars, total sugars increased whereas, non-reducing sugar decreased in blend RTS prepared from mango and aloe vera during two months storage at 25o C" [10].

The changes in browning could be mainly because of Maillard reaction between organic acids with sugars and amino acids which lead to the formation of brown pigment [11]. The browning was also found to be increased in lime-aonla spiced RTS beverages during storage The results are similar with Anand [5] mentioned that browning increased in aonla and aloe vera blended RTS and squash during storage under ambient temperature. Chaudhary (2014) reported that browning increased in blended RTS, prepared from mango and aloe vera during storage under ambient condition. Organoleptic score decreased gradually with increase in storage period at temperature and acceptability of blended RTS under studies was maintained up to three months [12,13]. The score was significantly decreased from 8.17 at first day to 7.50 at final day of storage. Similar findings were reported by Chaudhary et al. [14] reported that "the organoleptic score decreased continuously with storage period. The syrup prepared from blend of mango pulp and aloe vera gel could be stored up to five months under ambient conditions with acceptable quality". Sangma et al. [15] showed that the physico-chemical and the sensory quality of the RTS blends (Aloe vera + sweetlime + amla + ginger) were acceptable up to 60 days of storage [16-18]. Moreover, they studied on microbial analysis of RTS during up to 60 days of storage period and revealed that it was free from any spoilage [19,20].

4. CONCLUSION

It may be concluded from above findings that 10 per cent of the blend containing 80% pomegranate juice, 10% aonla juice and 10% aloe vera gel was found best on Hedonic Scale by the panel of semi trained judges for the preparation of palatable quality of RTS adjusted to 13 % TSS, 0.3% percent acidity and 120 ppm benzoic acid. The TSS, acidity, reducing sugars, total sugars and browning was increased, whereas vitamin-C, non-reducing sugar, and organoleptic quality was decreased during storage under ambient temperatures. The RTS can be stored with acceptable quality up to 5 months under ambient temperatures.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models

(ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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