Studies on Blend beverage form pomegranate (*Punica granatum* L.),Aonla (*Emblica officinalis*Gaertn.) and Aloe vera(*Aloe barbadensis*Miller)

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), 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 blendcombinations.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.

Keywoeds*:* RTS Pomegranate juice, Aonla juice and Aloe vera gel, blend combination, Storage, Organoleptic quality

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 2022). 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.

Materials and Methods

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.

Extractionof Pomegranatejuice,AonlajuiceandAloeveragel

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

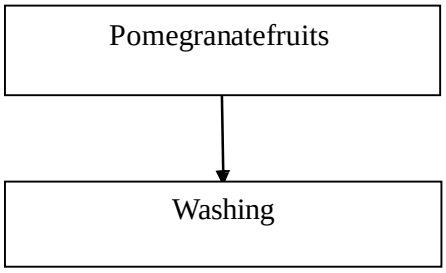
Standardization of blends for ready-to-serve beverages (RTS)

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:

T 10% Blend combination No.1 + 13% Sugar+ 0.3acidity+ 120 ppm Benzoic acid
T 10% Blend combination No.2 + 13% Sugar+ 0.3acidity+ 120 ppm Benzoic acid
T 10% Blend combination No.3 + 13% Sugar+ 0.3acidity+ 120 ppm Benzoic acid
T 10% Blend combination No.4 + 13% Sugar+ 0.3acidity+ 120 ppm Benzoic acid
T 10% Blend combination No.5 + 13% Sugar+ 0.3acidity+ 120 ppm Benzoic acid
T 10% Blend combination No.6 + 13% Sugar+ 0.3acidity+ 120 ppm Benzoic acid
T 10% Blend combination No.7 + 13% Sugar+ 0.3acidity+ 120 ppm Benzoic acid
T 10% Blend combination No.8 + 13% Sugar+ 0.3acidity+ 120 ppm Benzoic acid
T 10% Blend combination No.9 + 13% Sugar+ 0.3acidity+ 120 ppm Benzoic acid
T 10% Blend combination No.10 + 13% Sugar+ 0.3acidity+ 120 ppm Benzoic acid

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



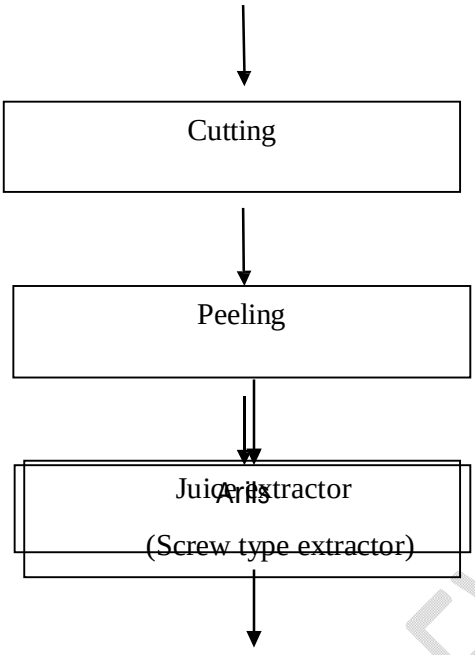
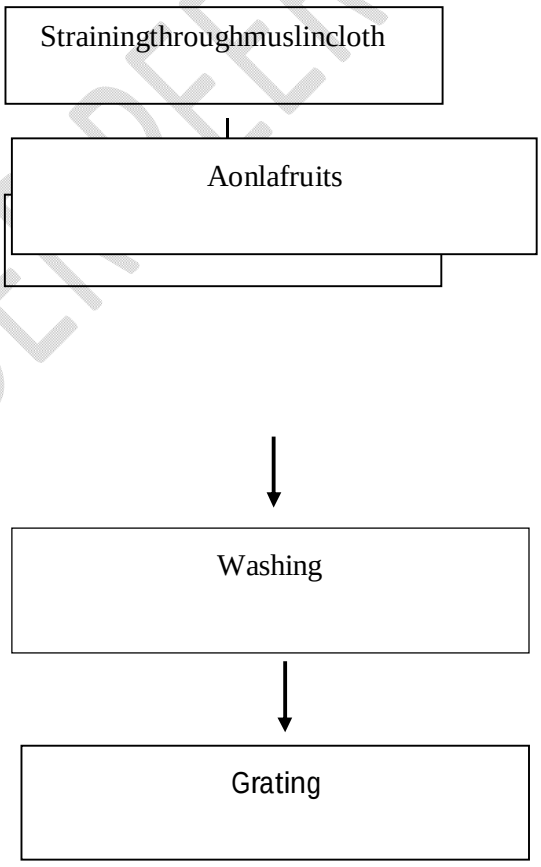


Fig.-1:Flow chartofjuiceextraction frompomegranatefruits



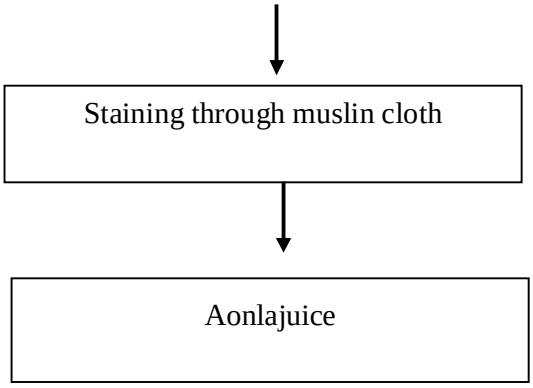


Fig.-2: Flowchartofjuice extractionfrom Aonla fruits

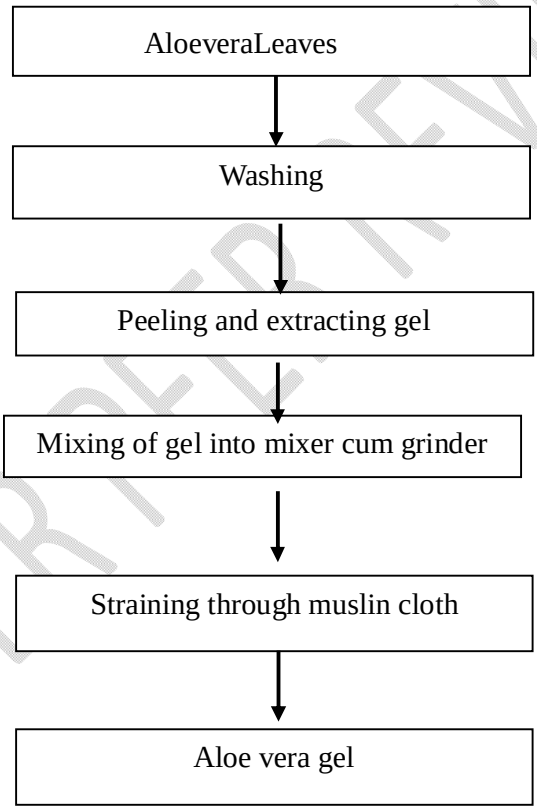
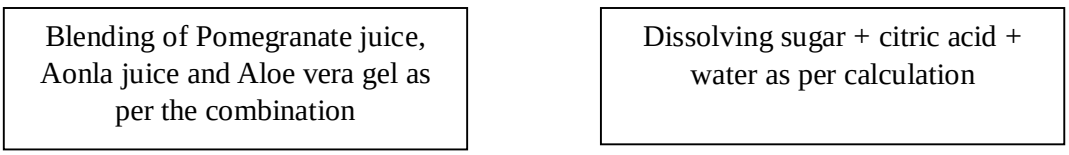


Fig.-3: Flow chart of aloe vera Gel extraction



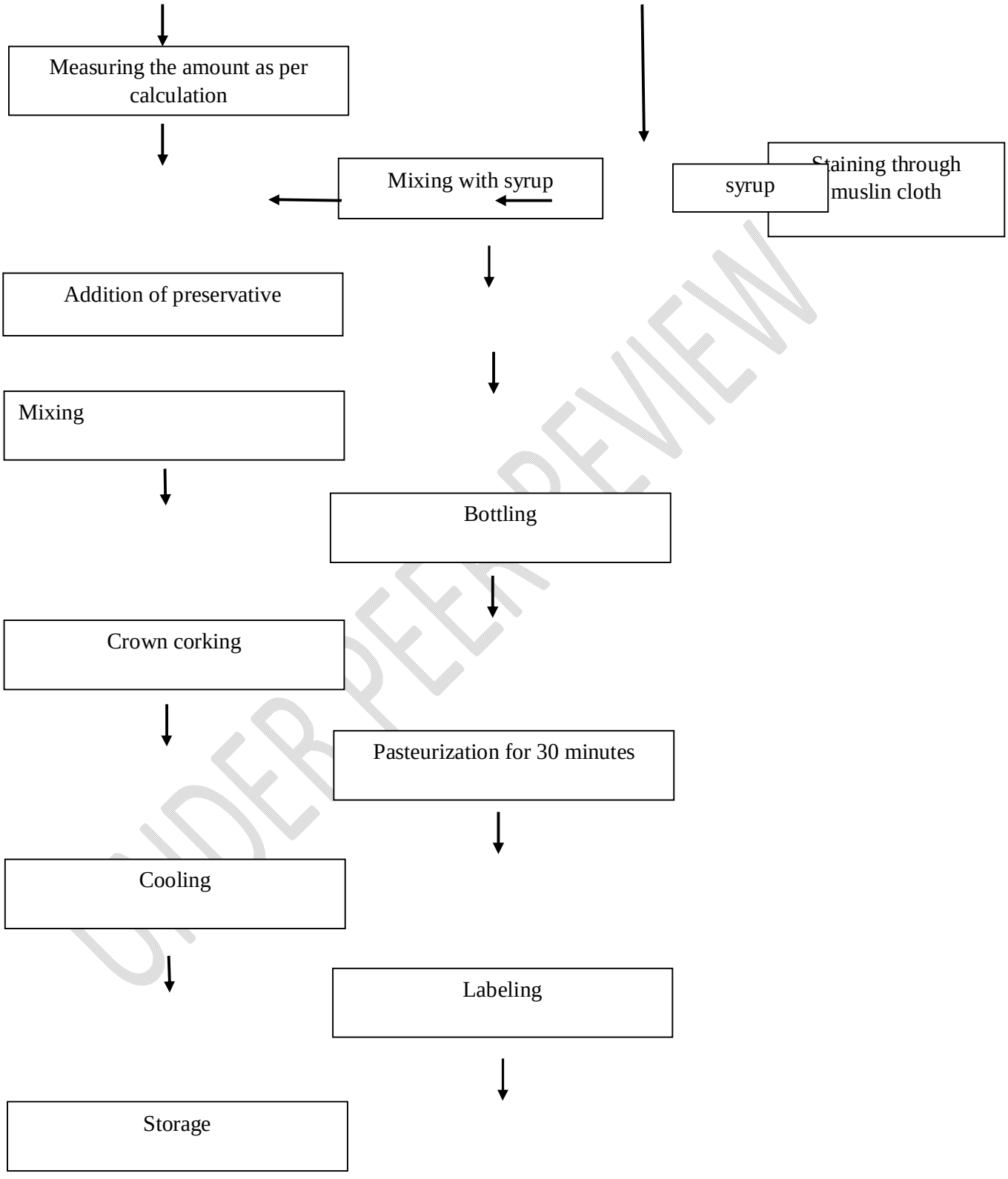


Fig.-4: Flow chart ofpomegranate, aonla and aloe vera blended RTS preparation.

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 "IgeneLabserve" 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.

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 (1985).

Results and Discussion

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.* (2012**),** 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 (2022) 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.

Table-1:ChemicalattributesofPomegranate juice,Aonla juiceandAloe vera gel.

S.No.	Chemicalattributes	Meanvalue		
		Pomegranate juice	Aonla juice	Aloe vera gel
1	Totalsolublesolids(%)	12.71	12.70	0.88
2	Acidity(%)	0.88	2.34	0.24
3	Vitamin-C(mg/100g)	14.63	420.95	1.93
4	Reducingsugars(%)	11.60	7.60	0.61
5	Non-reducingsugar(%)	5.33	0.31	1.13
6	Totalsugars(%)	16.93	7.91	1.74

Standardization of the blends:

OrganolepticqualityofRTSpreparedfromdifferentblendspomegranate 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.

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 (2012) 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". [20]"Degradation of pectic substances and formation of organic acid Similar results that an increase in acidity content during storage of products" were reported bySingh *et al.* (2018) found that the acidity content increased in blend RTS prepared from mango and aloe vera duringtwo months of storage at 25o C.Similarly, Gill *et al*. (2020) noticed that "acidity content increased in RTS prepared fromKagzi 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".

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 observedin NA-7 and significantly lowest ascorbic acid content (112.3 mg/100g) inKanchanat day of storage". And Kausar *et al*. (2016) 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 reducingsugars.This finding was supported by Tiwari and Deen (2014).noticed that total sugars and reducing sugars increased,during storage period in blended beverages prepared from bael and aloe vera.Kausar *et al*. (2016) 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 (2022) 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".

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. The browning was also found to be increased in lime-aonla spiced RTS beverages during storageThe results are similar withAnand (2012) 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. 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.* (2017) 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.* (2016) 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.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.

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

Treatments	Differentcombinationofblends			Organolepticquality	
	Pomegranate juice(%)	Aonla juice (%)	Aloeveragel(%)	Score	Rating
T1	100	Nil	Nil	8.23	Likemoderately
T2	Nil	100	Nil	7.92	Likemoderately
T3	Nil	Nil	100	7.17	Likeslightly
T4	33.33	33.33	33.33	7.17	Likemoderately
T5	40	30	30	7.02	Likemoderately
T6	50	25	25	7.82	Likemoderately
T7	60	20	20	7.76	Likeslightly
T8	70	15	15	7.05	Likemoderately
T9	80	10	10	8.05	Likevery much
T10	90	5	5	6.76	Likeslightly
S.Em±				0.04	
CD at5%				0.11	

LVM: Like very much, LM: Like moderately

Table3: ChangesduringstoragelifeofpreparedRTS

Storage period(Months)	TSS(%)	Acidity (%)	Vitamin - C(mg/100ml)	ReducingSugars(%)	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

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.

Acknowledgement

In conducting the research and preparing this manuscript, I have the pleasure of expressing my sincere gratitude and thanks to my major advisor, Dr. BhagwanDeen, Professor & Head, Department of Post Harvest Management, ANDUA&T, Kumarganj, Ayodhya, for his best knowledge, wealth of experience, inspirational, learnt guidance, constructive criticism, constant encouragement, and reasonable scientific advice. I am incredibly grateful to the post-harvest management department at the College of Horticulture and Forestry at Acharya Narendra Deva University of Agriculture and Technology in Kumarganj, Ayodhya, Uttar Pradesh, for their various forms of assistance in making this experiment possible.

Disclaimer (Artificial intelligence)

Option 1:

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.

Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc have been used during writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

1.

2.

3.

Reference

1. Anand, P. K. 2012. Studies on development of blended beverages of Aonla (Emblica officinalis Gaertn.) and Aloe vera (Aloe barbedensis Millar.) M.Sc. Thesis, N. D. Univ. of *Agric. & Tech.,* Faizabad, (U. P.).
2. Brar, R.S., Topno, S.E., Bahadur, V. andSharma, A. 2023. Effect of different packaging materials and chemicals on shelf life and quality of aonla (*Emblica officinalis* L.)*Int.j. plantsoilsci.*35(15):78-88.
3. Byanna, C. N. and Gowda, I. N. 2012. Standardization of sweet orange and pomegranate blended RTS beverage preparation and its storage. *Crop Research.*, *44*, 109-115.
4. Chandra N, Sarkar S, Sinha R, Sharma B. 2018. Development and Evaluation of Ready to Serve Beverage (RTS) from blend of Awala, Aloe-Vera, Mint and Ginger. *Int. J Curr. Microbiol. App. Sci,7*, 3467-3472.
5. Chaudhary, M., Deen, B., Gautam, D. K., & Mishra, K. K. 2017. Studies on development of squash from mango (Mangifera indica L.) pulp and aloe vera (Aloe barbadensis Miller.) gel blend.*Int. j. curr. microbiol. appl. sci.*, *6*(7), 1962-1969.
6. Choudhary, S. and Kathuria, K. 2022. Standardization of Blended Beverage prepared from Aonla (*Embilica officinali*s Gaertn) fruits aonla(*Embilicaofficinalis*Gaertn)fruits.*J.Pharm.Innov.*11(9):1498-1501.
7. Deen, B. and Singh, I. S. 2012. Development of Karonda (Carissa carandas L.) squash, *Bev. and Fd World*.39(2): 37-39.
8. Gill, H.S., Kaushal, N., Kaur, M., Jyoti, S. and Singh, G. 2020. Standardization of recipe for RTS of kagzi lime fruit blended with aloe vera gel and rose juice. *J. Pharmacogn. Phytochem*9(3): 1739-1742.

9. Harendra, Deen B. 2022. Studies on syrup preparation from mango (Mangifera indica L.), citrus (Citrus aurantifolia Swingle.), aloe vera (Aloe barbadensis Miller.) and ginger (ZingiberofficinaleRosc.) blends. *Int. J. Plant Soil Sci.* 34(6):70-82.
10. Hirdyani H. 2015. Development and Quality Evaluation of RTS (Ready to Serve) Beverages Made from Traditional Indian Medicinal Plants. *J Nutr. Food Sci*.,(S13), 1.
11. Kausar, H.; Parveen, S.; Saeed, S.; Ishfaq, B. and Ali, M.A. 2016. Development and standardization of ready to serve Aloe vera-lemon functional drink. *J. Environ. Sci. Toxicol. Food Technol., 10(4): 47 52*.
12. Lane, Eyenone L. 1923. Determination of reducing sugars by means of Fehling solution with methylene blue indicator as an internal indicator. *J. Soc. Chem. Ind., 17*, 32-37
13. Panse VG, Sukhatme PV. 1985. Statistical methods for agricultural workers. Indian *Co. Agric. Res. Pub., 3rd rev. ed*.,
14. Ranganna S. 2010. Analysis and quality control for fruit and vegetable products, Tata Mc Graw-Hill Ltd., New Delhi.
15. Sangma, C. M. D.; Sarkar, S. and Mishra, L.K. 2016. Preparation and Evaluation of ready-to-serve drink made from blend of Aloe vera, sweet lime, amla and ginger. *Intl. J. Food. Ferment. Technol.*, 6(2): 457-465.
16. Serra, F.C.Estrada,P., Fuentes, R. M., and Femenia A. 2023 Evaluation of acemannan in different commercial beverages containing aloe vera (*Aloe barbadensis*Miller) gel. *Gels*, 9 (552): 1-15.
17. Shukla, P. and Hussain, S. (2018). Development and storage studies of therapeutic made ready to serve (RTS) from blend of Aloe vera with ginger, sweet lime Juice and aonla juice. *Int. J. of Sci. Eng. and App. Sci*., 4(2): 20-31.
18. Srivastava, R. P. and Kumar, S. 2005. Fruit and vegetable preservation: principles and practices. Lucknow. Int. Book Distribu Company. pp. 140-142.
19. Tiwari, D.K. and Deen. B. 2014. Studies on Development of squash from bael (Aegle marmelos Correa.) pulp and Aloe vera (Aloe Barbadensis Miller.) gel blend. *Ann. Agri. Bio. Res.*, 19(3): 483-487.
20. Shagiwal M, Deen B. Studies on development of ready-to-serve (RTS) beverage from strawberry (Fragaria ananassaDuch), ginger (ZingiberofficinaleRosc) and aloe vera (Aloe barbadensis Miller) blend. The Pharma Innovation Journal. 2022;11(7):2308-17.