Asian Jr. of Microbiol. Biotech. Env. Sc. Vol. 25, No. (2) : 2023 : 334-340

ISSN-0972-3005

DOI No.: http://doi.org/10.53550/AJMBES.2023.v25i02.024

EVALUATION OF QUALITY ATTRIBUTES DURING STORAGE OF READY-TO-SERVE (RTS) BLENDED BEVERAGE FROM PINEAPPLE (*ANANAS COMOSUS*), GINGER (*ZINGIBER OFFICINALE*), AND ALOEVERA (*ALOE BARBADENSIS MILLER*)

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(Received 3 December, 2022; Accepted 27 January, 2023)

Key words: *Pineapple, Ginger, Aloe vera, Blended RTS, Polypet Bottles, Organoleptic quality, Storage.*

Abstract–The current study was conducted in 2022–2023 at the Post Graduate Laboratory of the Department of Horticulture, School of Agriculture, ITM University Gwalior (M.P.). By using blending technology in beverage processing, it is possible to combine the sensory, nutritional, and therapeutic qualities of two or more plant species into a beverage. The storability of the RTS created from the best combination was examined. The results of the study showed that, compared to other blend combinations, a 10% blend of appealing RTS beverage that contained 95% pineapple juice, 2.5% ginger juice, and 2.5% aloe vera gel was preferred by semi-trained judges, including both men and women, on a 9-point hedonic scale. Up until the end of the storage period at room temperature, the TSS, acidity, reducing sugars, and total sugars increased while the pH, vitamin C, vitamin A, non-reducing sugar, and organoleptic score steadily fell (23.1-28.7 ^{0}C). Additionally, it had been claimed that the beverage could be kept in polypet bottles for 4 months while retaining an adequate level of sensory quality.

INTRODUCTION

Pineapple (*Ananas comosus* L.), Family: Bromeliaceae is one of the most important commercial fruit crops in the world. It is known as the queen of fruits due to its excellent flavour and taste (Baruwa, 2013). Pineapple is the third most important tropical fruit in the world after Banana and Citrus. One healthy ripe pineapple fruit can supply about 16.2% of daily requirement for vitamin C (Hemlatha *et al.*, 2013). Pineapple juice is widely used for preparation of palatable beverages such as RTS, squash and syrup.

Ginger (*Zingiber officinale*) is one of the important medicinal crops belonging to the family of Zingiberaceae. It is extensively cultivated in the state of Karnataka, Kerala, Tamil Nadu, Maharashtra, West Bengal, Bihar, Uttar Pradesh, and Himachal Pradesh. Due to its medicinal properties, it is broadly used to prevent joint pain of arthritis, muscular aches, pains, sore throats, cramps, constipation, indigestion, vomiting, hypertension, dementia, fever and infectious diseases. It may also be used by those people who are suffering from gallstones.

Aloe vera has also been commonly used to treat first and second-degree burns, as well as sunburns and poison oak, poison ivy, and poison sumac infections and eczema (Mishra *et al.*, 2015). Aloe vera has the anti-bacterial property along with the anti-inflammatory property which helps to cure mouth and gum problems and severe gum diseases.

MATERIALS AND METHODS

Raw Materials

Pineapple (Local variety), ginger (Local variety) and aloe vera purchased from a local market near ITM University were used for the RTS preparation.

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Extraction of Pineapple juice, Ginger Juice and Aloe vera gel

The process adopted for the extraction of pineapple juice, ginger juice and aloe vera gel is given in Fig. 1, 2 and 3, respectively.

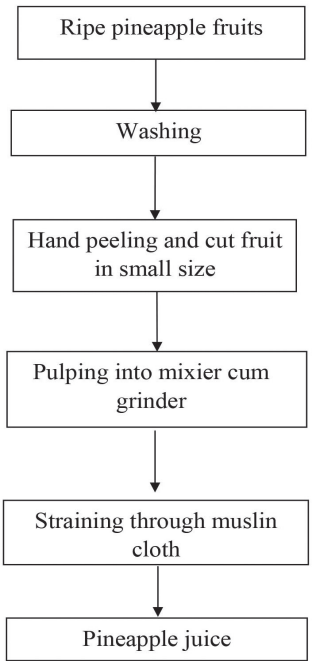

Fig. 1. Flow chart for extraction of pulp from pineapple fruit

Standardization of Blends for RTS

The following combinations of pineapple pulp, ginger juice and aloe vera were evaluated to standardize the blend for the development of palatable and quality RTS.

T1 10 % blend comprising 100 % pineapple + 0 % ginger + 0 % aloe vera and adjusted to 13 % TSS, 0.25 % acidity and 70 ppm SO_2.

T2 10 % blend comprising 0 % pineapple + 100 % ginger + 0 % aloevera and adjusted to 13 % TSS, 0.25 % acidity and 70 ppm SO_2.

T3 10 % blend comprising 0 % pineapple + 0 % ginger + 100 % aloe vera and adjusted to 13 % TSS, 0.25 % acidity and 70 ppm SO_2.

T4 10 % blend comprising 80% pineapple + 10 % ginger + 10 % aloe vera and adjusted to 13 % TSS, 0.25 % acidity and 70 ppm SO_2.

T5 10 % blend comprising 85 % pineapple + 7.5 % ginger + 7.5 % aloe vera and adjusted to 13 % TSS, 0.25 % acidity and 70 ppm SO_2.

T6 10 % blend comprising 90 % pineapple + 5 % ginger + 5 % aloe vera and adjusted to 13 % TSS, 0.25 % acidity and 70 ppm SO_2.

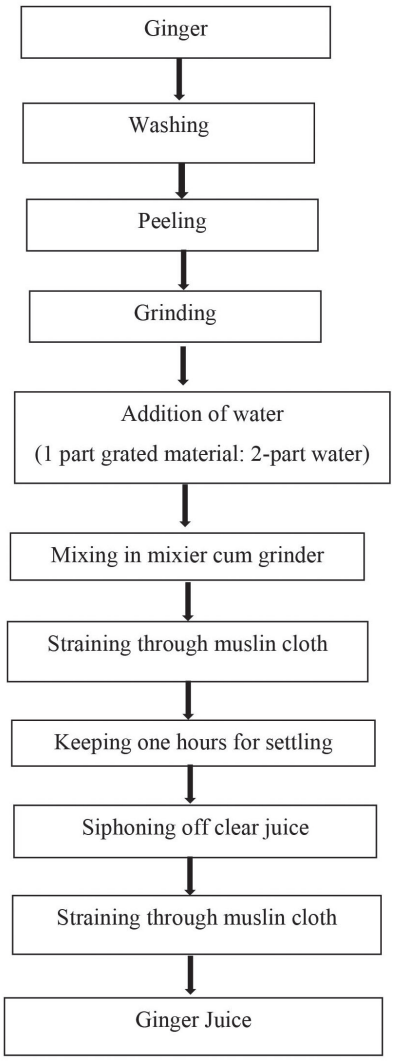

Fig. 2. Flow chart for extraction of juice from ginger

T7 10 % blend comprising 95 % pineapple + 2.5 % ginger + 2.5 % aloe vera and adjusted to 13 % TSS, 0.25 % acidity and 70 ppm SO_2.

Preparation of RTS

RTS consisting 10% blend, 13% TSS and 0.25% acidity were prepared from different treatments. The prepared RTS was organoleptically evaluated on 9-point hedonic scale to find out the best combination of blend for large scale preparation. The technique used for RTS making is shown in Fig. 4.

Finally, 5 liters of RTS was prepared with best combination of blend, and filled into 200 ml polypet bottels leaving 1.5 cm head space, capped and put for storage studies under ambient condition (23.1-

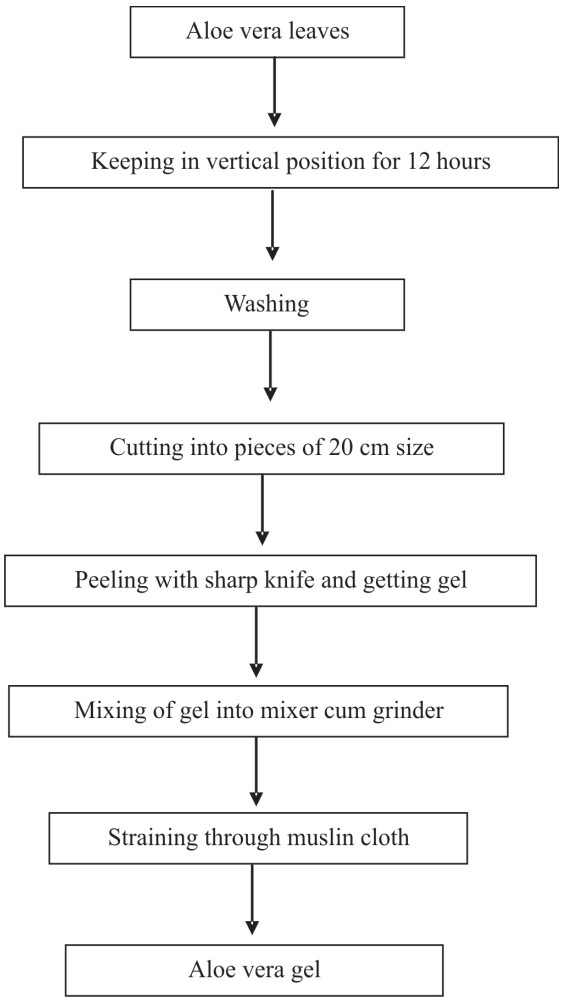

Fig. 3. Flow chart for extraction of aloe vera

28.7 ^{0}C). During storage, observation on changes in TSS, acidity, vitamin-A, vitamin-C, reducing sugars, non-reducing sugar, total sugars and organoleptic quality were recorded at monthly interval. Observations were recorded for changes in TSS, acidity and vitamin-C (Rangana, 2010), vitamin-A, sugars and organoleptic quality (Amerine *et al.*, 1965) at monthly intervals during 4 months of storage period and are described as follows.

The Total Soluble Solids of sample was determined with the help of model (ERMA INC. TOKYO JAPAN) hand refractometer (0-32%) in terms of percentage. The value of TSS recorded at ambient temperature were corrected at 20°C with the help of reference table and the mean value was expressed as % TSS content of the sample whereas, the acidity was determined by titrating known quantity of sample against 0.1 N sodium hydroxide solution using phenolphthalein as an indicator and expressed in percent anhydrous citric acid. Vitamin-A determined by preparing sample in acetone, then in petroleum ether and thereafter in sodium sulphate till the appearance of dark yellow-greenish colour and measured the optical density (OD) at 452 nm and 503 nm by Spectrophotometer whereas, Vitamin-C content was estimated by preparing sample in 3 percent metaphosphoric acid solution and titrating against 2, 6 dichloro phenol indophenols dye solution till the appearance of light pink colour. The reducing, non-reducing and total sugars were analysed by using Fehling's solution A and B and methylene blue as an indicator. A panel of 9 semi trained judges evaluated RTS for its colour, flavour, taste, appearance and overall acceptability on 9-point Hedonic scale.

Statistical Analysis

The experiments were conducted in 3 replications and the statistical analysis of the data was done by computer software "SPSS" on excel as the method described by Panse and Sukhatme, (1985) for CRD experiment.

RESULTS AND DISCUSSION

Chemical attributes of pineapple pulp, ginger juice and aloevera

The data pertaining to chemical attributes of fresh

Table 1. Chemical characteristics of pineapplepulp, ginger juice and aloevera

Chemical attributes	Mean values		
	Pineapple juice	Ginger juice	Aloe vera gel
TSS (%)	11.00	2.10	0.80
Acidity (%)	1.19	*0.25*	0.10
pH	4.43	6.46	4.21
Ascorbic acid (mg/100g)	35.06	1.88	2.19
Vitamin-A (I.U)	72.11	0.00	0.00
Reducing sugars (%)	6.13	0.61	0.53
Non-reducing sugar (%)	7.05	1.13	1.15
Total sugars (%)	13.18	1.74	1.78

pineapple juice, ginger juice and aloe vera gel is presented in Table 1 which revealed that the pineapple juice used in RTS making contained 11.00 % TSS, 1.19 % acidity, 4.43 pH, 35.06 mg/100 ml vitamin-C, 72.11 I. U vitamin-A, 6.13 % reducing sugars, 7.15 % non-reducing sugar and 13.18 % total sugars. Similar observations were recorded by Mansoor *et al.* (2017) 11.00 % TSS, 4.2 pH, 35.5 mg/100ml Ascorbic acid in pineapple. In ginger juice 2.10 % TSS, 0.25 % acidity, 6.46 pH, 1.88 mg/100g vitamin-C, 0.61 % reducing sugars, 1.13 % non-reducing sugar and 1.74 % total sugars. Similar obtained by Hedge *et al.* (2018) 1.50 % TSS, 0.24 % acidity, 5.20 % pH, 2.70 mg/100g vitamin-C, 0.64 % reducing sugars and 1.60 % total sugars in ginger juice. In Aloe vera gel 0.80% TSS, 0.10% acidity, 4.21 pH, 2.19 mg/100g vitamin-C, 0.53% reducing sugars, 1.15% non-reducing sugar and 1.68% total sugars. Whereas, Sudhindra *et al.* (2012) reported that Aloe vera gel contains 0.80-0.860 B TSS, 4.50-4.52 pH, 0.23-0.26 % acidity, 3.76-3.86 mg/100g vitamin-C, 0.026 % reducing sugars, 1.894 % non-reducing sugar, 1.92 % total sugars. The subtle difference in chemical attributes of raw materials might be due to variety, region, agro-climatic conditions and lab facilities.

Standardization of blends for RTS

A quality blended RTS with 10 % blend comprising 95 % pineapple juice, 2.5 % ginger juice and 2.5 % aloe vera gel with 13 % TSS and 0.25 % acidity and 70 ppm SO_2 was organoleptically found best for

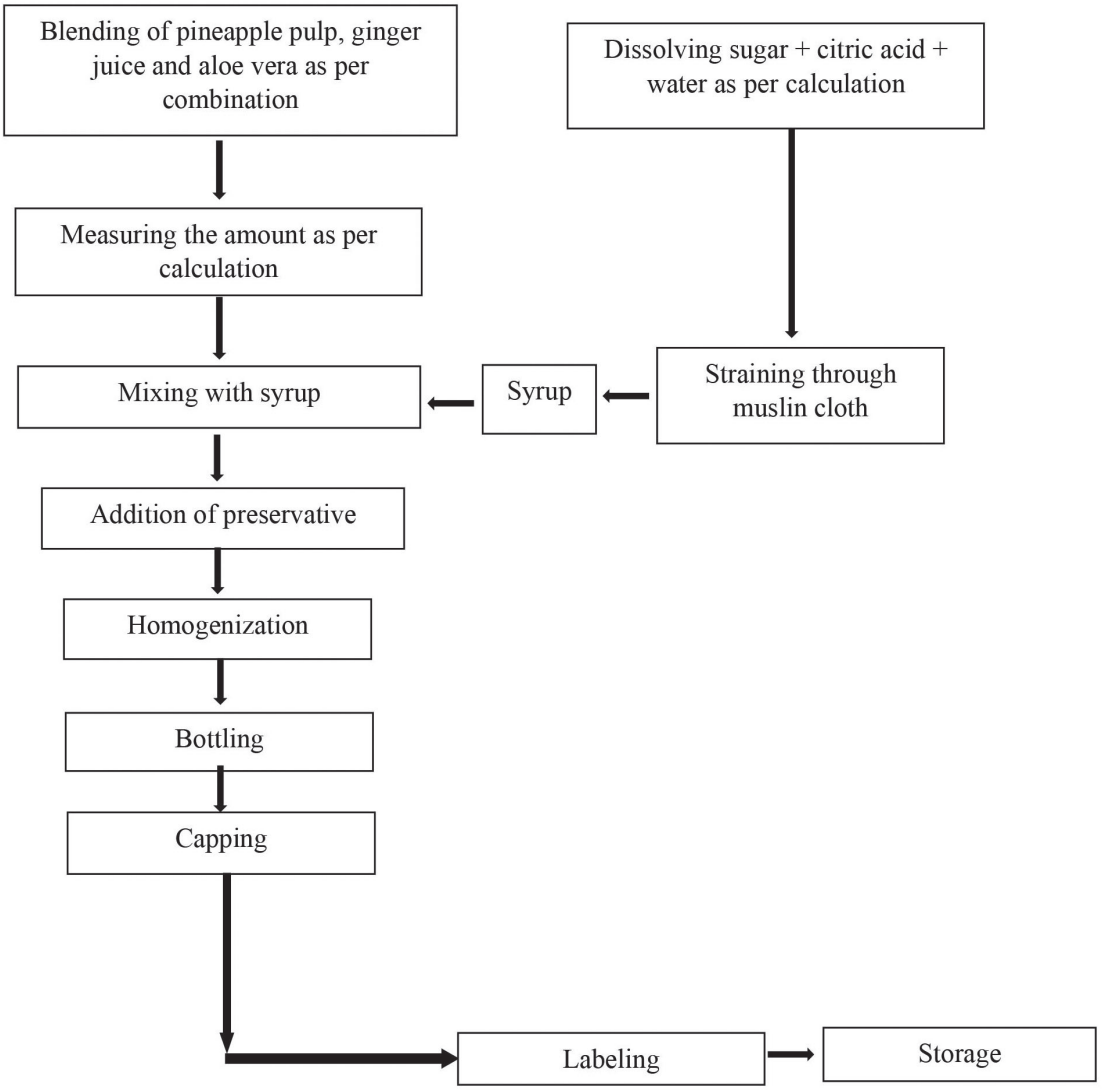

Fig. 4. Flow sheet for preparation of pineapple + ginger + aloe vera blended RTS.

preparation of blended RTS (Table 2). These finding was supported by Biswas *et al.* (2016) as they had taken 90 % pineapple juice and 10 % aloe vera gel and has secured maximum organoleptic score, which indicates that component of raw materials influenced the acceptability of the blend beverages.

Biochemical Changes during Storage

Data pertaining to biochemical changes during storage of RTS into polypet bottles is presented in Table 3 which indicates that the TSS of RTS increased gradually after 4 months of storage from 13.00 % to 13.57%. This change might be due to the conversion or hydrolysis of polysaccharides into simple sugars. These results are also in conformity with the findings of Sarkar and Bulo (2017) in RTS prepared from pineapple and guava, Harendra and Deen (2021) in mango based RTS and Deen and Harendra (2022) in rangpur lime based RTS. The acidity of RTS increased gradually from 0.25 % at initial day to 0.98 % at final day of storage. This might be probably due to degradation of pectic substances and formation of organic acid have been reported to increase the acidity of fruit products. Similarly, an increasing trend in acidity during storage was observed by Hirdyani (2015) on kinnow-basil-ginger blend RTS, Harendra and Deen (2021) on mango based RTS and Deen and Harendra (2022) in rangpur lime based RTS. The pH decreases from 2.01 to 1.42 during 4 months of storage. This might be due to increase in titrable acidity, as acidity and pH are inversely proportional to each other. As similarly shown by Kumar *et al.* (2009) in beverages prepared from pineapple and sugarcane and Nidhi *et al.* (2008) in bael and guava blend beverage. Vitamin-C content was continuously decreased from the first day (4.21 mg/100ml) to the end of storage (3.44 mg/100ml) throughout the storage period. This decrease in vitamin-C content might be due to the oxidation of ascorbic acid into dehydro-ascorbic acid in the presence of oxygen. The loss of vitamin C in RTS of different fruit-based beverages during storage is because of ascorbic acid being sensitive to oxygen, light and heat gets easily oxidized in presence of oxygen by both enzymatic and non-enzymatic catalyst. Similar observation was reported by Sarkar and Bulo (2017) in RTS prepared from pineapple and guava and Pathak *et al.* (2012) in RTS prepared from lichi and pomegranate. Vitamin-A content was continuously decreased from the first

Table 2. Organoleptic quality of RTS prepared from different blends of pineapple juice, ginger juice and aloe vera gel

Treatment	Blending combination			Organoleptic analysis	
	Pineapple juice	Ginger juice	Aloe vera gel	Score	Rating
T_1	100	0	0	7.00	Like moderately
T_2	0	100	0	7.50	Like moderately
T_3	0	0	100	8.00	Like very much
T_4	80	10	10	7.75	Like moderately
T_5	85	7.5	7.5	7.20	Like moderately
T_6	90	5	5	7.80	Like moderately
T_7	95	2.5	2.5	8.09	Like very much
SE(m)				0.01	
C.D. at 5%				0.02	

Table 3. Biochemical and organoleptic changes of RTS during storage into polypet bottles

Storage period (Months)	TSS (%)	Acidity (%)	pH	Vitamin-C (mg/100g)	Vitamin-A (I.U)	Reducing sugars (%)	Non-reducing sugar (%)	Total sugars (%)	Organoleptic	
									Score	Reading
0	13.00	0.25	2.01	4.21	7.00	1.00	1.12	2.12	8.09	LVM
1	13.06	0.33	1.89	4.11	6.98	1.12	1.08	2.20	8.00	LVM
2	13.14	0.47	1.75	3.93	6.90	1.27	1.01	2.28	7.82	LM
3	13.30	0.72	1.60	3.71	6.80	1.46	0.93	2.39	7.50	LM
4	13.57	0.98	1.42	3.44	6.65	1.63	0.81	2.44	7.16	LM
SE(m)	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	
C.D. at 5%	0.04	0.04	0.03	0.04	0.03	0.03	0.05	0.03	0.03	

LVM: Like very much, LM: Like moderatly

day (7.00 I.U.) to the end of storage (6.65 I.U.) throughout the storage period. This decrease in vitamin-A content might be due to the auto-oxidative degradation during storage or due to oxidative breakdown, isomerization or enzymatic destruction of the pigments. Similar finding by Sindumathi and Premlatha (2013) in RTS beverages based on papaya and pineapple and Harendra and Deen (2021). The reducing sugars and total sugars of blended RTS, increased from 1.00 to 1.63 and 2.12 to 2.44 %, respectively. This change might be due to the inversion of non-reducing sugar into reducing sugars. This is also shown by Sindumathi and Premlatha (2013) in RTS beverages based on papaya and pineapple and Malav *et al*. (2014) in orange based RTS beverages. Non-reducing sugar decreased continuously while storage upto 4 months at ambient conditions. This finding was supported by Sonker *et al.* (2018) in ready to serve RTS beverage by addition of amla and giloy and Singh *et al.* (2018) in mango and aloe vera blended (RTS). The blended RTS organoleptic score gradually decreased with increasing the storage period at room temperature (23.1-28.7 ^{0}C). RTS continued to be acceptable for four months. The score was significantly decreased from 8.09 to 7.16. This change might be due to the cause of temperature, because temperature plays an important role in biochemical changes that leads to development of off flavour as well as discolouration in the beverages. The reduction in organoleptic quality is also reported in previous studies performed by Biswas *et al.* (2016) on pineapple and aloe vera blended RTS and Harendra and Deen (2021) in blended RTS beverages of mango, kagzi lime, aloe vera and ginger.

CONCLUSION

It may be concluded from above findings that RTS prepared from 10 % blend comprising 95% pineapple juice, 2.5% ginger juice and 2.5% aloe vera gel containing 13% TSS, 0.25% acidity and 70 ppm SO_2 (T_7) was found best during organoleptic evaluation on 9-point hedonic scale. Results revealed that TSS, acidity, reducing sugars and total sugars were increased, whereas pH, vitamin-C, vitamin-A, non-reducing and organoleptic quality were decreased up to the termination period of storage. The RTS can be stored up to 4 months at ambient storage temperature (23.1-28.7 ^{0}C) into polypet bottles with acceptable quality.

ACKNOWLEDGEMENT

I am very thankful to ITM University Gwalior, Madhya Pradesh for providing all kinds of support and facilitate for conducting this experiment.

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