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EVALUATION OF QUALITY ATTRIBUTES AND STORABILITY OF POMEGRANATE BASED BLENDED DRINK

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ABSTRACT

The present investigation was carried out at Post Graduate Laboratory, Department of Horticulture, School of Agriculture, ITM University, Gwalior (M.P.) India. Fruit based blended RTS beverages and juices are not only rich in essential minerals, vitamins and other nutritive factors but also have a delicious and have a universal appeal. 10 per cent of blend comprising 80 per cent pomegranate juice, 10 per cent *Aloe vera* gel and 10 per cent ginger juice (T_6) was found best on 9- point hedonic scale for the preparation of RTS with 13.00 per cent TSS, 0.25 per cent acidity and 70 ppm sodium benzoate than other blend combinations. The TSS, acidity, reducing sugars and total sugars increased whereas, pH, vitamin-C, non-reducing sugar and organoleptic score decreased continuously up to the end of the storage period under ambient temperature (20-28°C). Moreover, it had been found that RTS organoleptically acceptable up to 4 months in polypet bottles without any deterioration.
Keywords **:** Pomegranate, Aloe vera, Ginger, RTS, Polypet Bottles, Organoleptic quality, Storage.

Introduction

Pomegranate (*Punica granatum* L.) is one of the important dessert fruit crops cultivated in tropical and subtropical regions of the world. The pomegranate belongs to the family of Punicaceae or Lythraceae. It is also known as the Chinese Apple or Apple of Carthage or Apple with many seeds. Pomegranate is known as a super fruit of next generation and is native to Iran. It is extensively grown in Iran, Spain, India and USA as well as in most Near and Far East countries (Schubert *et al.*, 1999) Pomegranate flesh contains 10 mg calcium, 44 mg magnesium, 70 mg phosphorus, 133 mg potassium, 1.79 mg Iron, 0.90 mg sodium, 0.82 mg zinc, 0.77 mg manganese, 0.44 mg copper, 16 mg vitamin C, 78 per cent moisture, 1.6 per cent protein, 14.6 per cent total sugars and 0.7 per cent ash per 100 g (Chavan *et al.,* 1995). The Pomegranate flesh is used as a base of various fruit products likes anardana and various type of juice product like minimally processed fresh arils, juice, squash, beverage, molasses, juice concentrates, frozen seeds, jam, jelly, marmalades, grenadine, wine, seeds in syrup, pomegranate spirits, pomegranate powder, pomegranate rind powder, anardana, confectionery, pomegranate seed oil etc. (Yadav *et al.*, 2006). Juice blending is one of the best methods to improve nutritional quality of a juice. It can improve the vitamin and mineral contents depending upon the kind and quality of fruits and vegetables used (De Carvalho *et al.,* 2007).

Aloe vera (*Aloe barbadensis* Miller) belongs to Liliaceae family traditional being utilized as contemporary folk remedy. There are over 250 species of aloe vera grown around the world; However only two species viz. *A. barbadensis* Miller and *A. aborescens* are considered the most importance one for processing point of view (Castillo *et al.,* 2005). The interest and use of gel has increased dramatically in the field of health care and cosmetics. It can be utilized as a valuable ingredient for food application due to its biological activities and functional properties (Kojo E, Qian H, 2010). Aloe vera gel has a bitter taste which can be unpleasant in raw state and its palatability could be enhanced with addition of some other fruit juices.

Ginger scientifically known as *Zingiber officinale* Rosc. belongs to the family of Zingiberaceae. Ginger is extensively used in ayurvedic medicines since long back, ginger has been used to cure dyspepsia, gastritis, blood circulation disturbance and inflammatory diseases. It displays potential antipyretic, antiallergenic, analgesic, antitussive and chemo-preventive activities (Sabulal *et al.,* 2007).

Ready-to-serve (RTS) beverages have been increasingly gaining popularity throughout the country due to their health and nutritional benefits apart from providing pleasing flavor and taste. Fruit based RTS beverages and juices are not only rich in essential minerals, vitamins and other nutritive factors but also have a delicious and have a universal appeal (Manan *et al.,* 1992).

Material and Method

Raw Materials

Pomegrnate (cv. Arakta), Aloe vera gel (Local variety) and ginger extract (Local variety) purchased from local market were used for the RTS preparation.

Extraction of pomegranate juice, Aloe vera gel and ginger Juice

The process adopted for the extraction of pomegranate, Aloe vera gel and ginger extract is given in Fig. 1, Fig. 2 and Fig. 3, respectively.

Standardization of blends for RTS

The following combinations pomegranate juice, Aloe vera and ginger extract were evaluated to standardize the blend for the development of palatable and quality RTS.

T1 10 per cent blend comprising 100 per cent pomegranate juice + 0 per cent Aloe vera gel + 0 per cent ginger juice and adjusted to 13 per cent TSS, 0.25 per cent acidity and 70 ppm SO_2.

T2 10 per cent blend comprising 0 per cent pomegranate juice + 100 per cent Aloe vera gel + 0 per cent ginger juice and adjusted to 13 per cent TSS, 0.25 per cent acidity and 70 ppm SO_2.

T3 10 per cent blend comprising 0 per cent pomegranate juice + 0 per cent Aloe vera gel + 100 per cent ginger juice and adjusted to 13 per cent TSS, 0.25 per cent acidity and 70 ppm SO_2

T4 10 per cent blend comprising 60 per cent pomegranate juice + 20 per cent Aloe vera gel + 20 per cent ginger juice and adjusted to 13 per cent TSS, 0.25 per cent acidity and 70 ppm SO_2.

T5 10 per cent blend comprising 70 per cent pomegranate juice + 15 per cent Aloe vera gel + 15 per cent ginger juice and adjusted to 13 per cent TSS, 0.25 per cent acidity and 70 ppm SO_2.

T6 10 per cent blend comprising 80 per cent pomegranate juice + 10 per cent Aloe vera gel + 10 per cent ginger juice and adjusted to 13 per cent TSS, 0.25 per cent acidity and 70 ppm SO_2.

T7 10 per cent blend comprising 90 per cent pomegranate juice + 5 per cent Aloe vera gel + 5 per cent ginger juice and adjusted to 13 per cent TSS, 0.25 per cent acidity and 70 ppm SO_2.

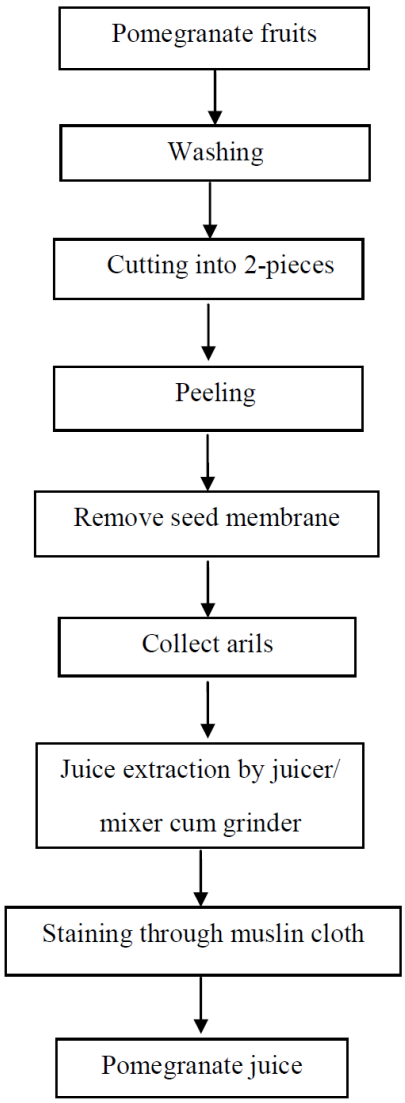

Fig. 1 : Flow chart for extraction of pomegranate juice

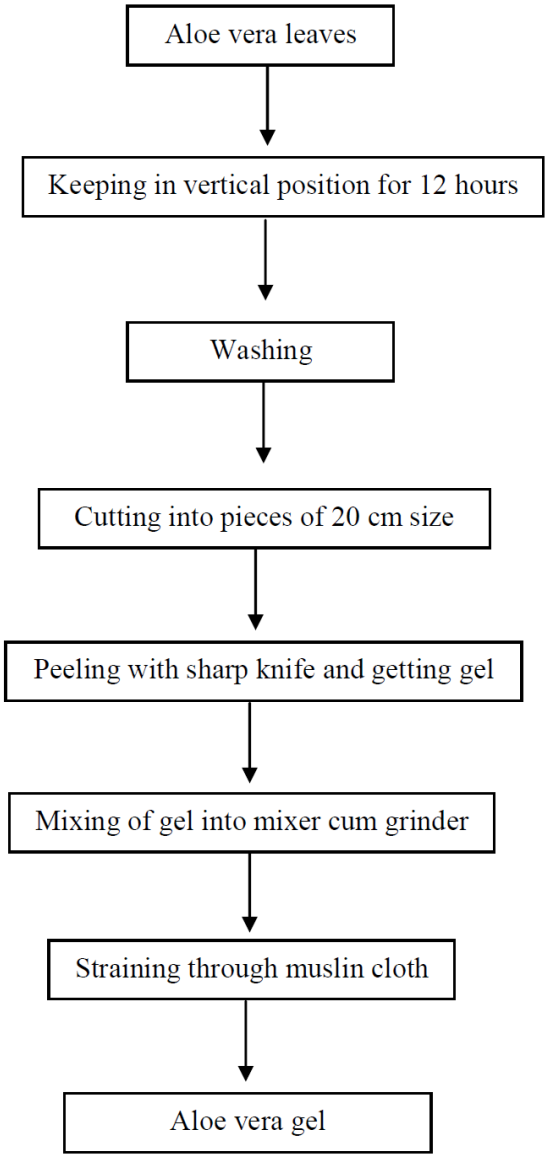

Fig. 2 : Flow chart for extraction of Aloe vera gel

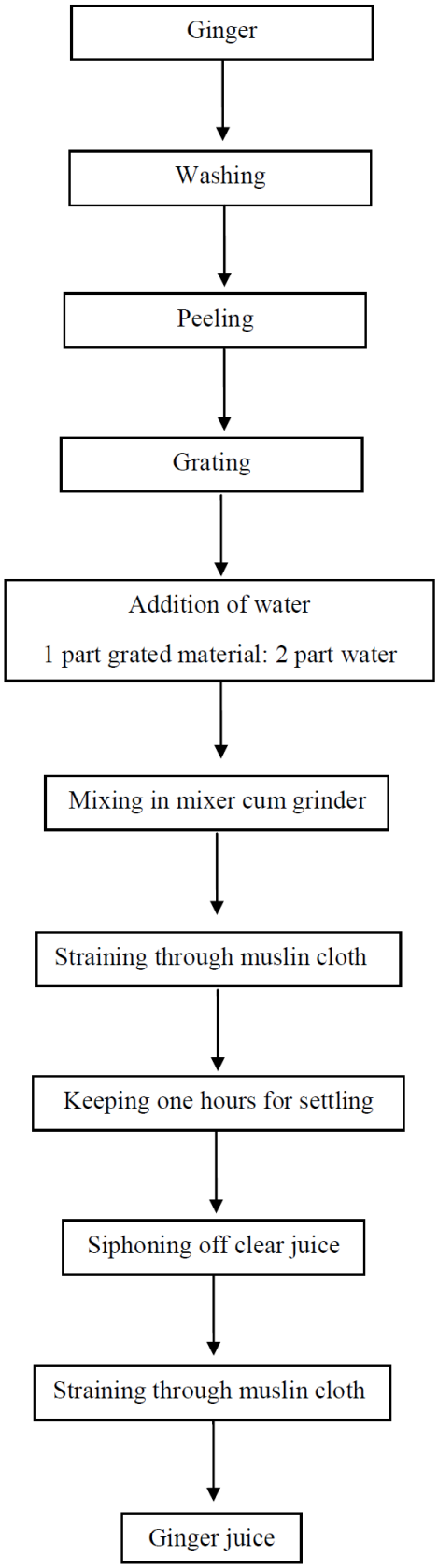

Fig. 3 : Flow chart for extraction of ginger juice

Preparation of RTS

RTS comprising 10 per cent blend, 13 per cent TSS and 0.20 per cent 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.

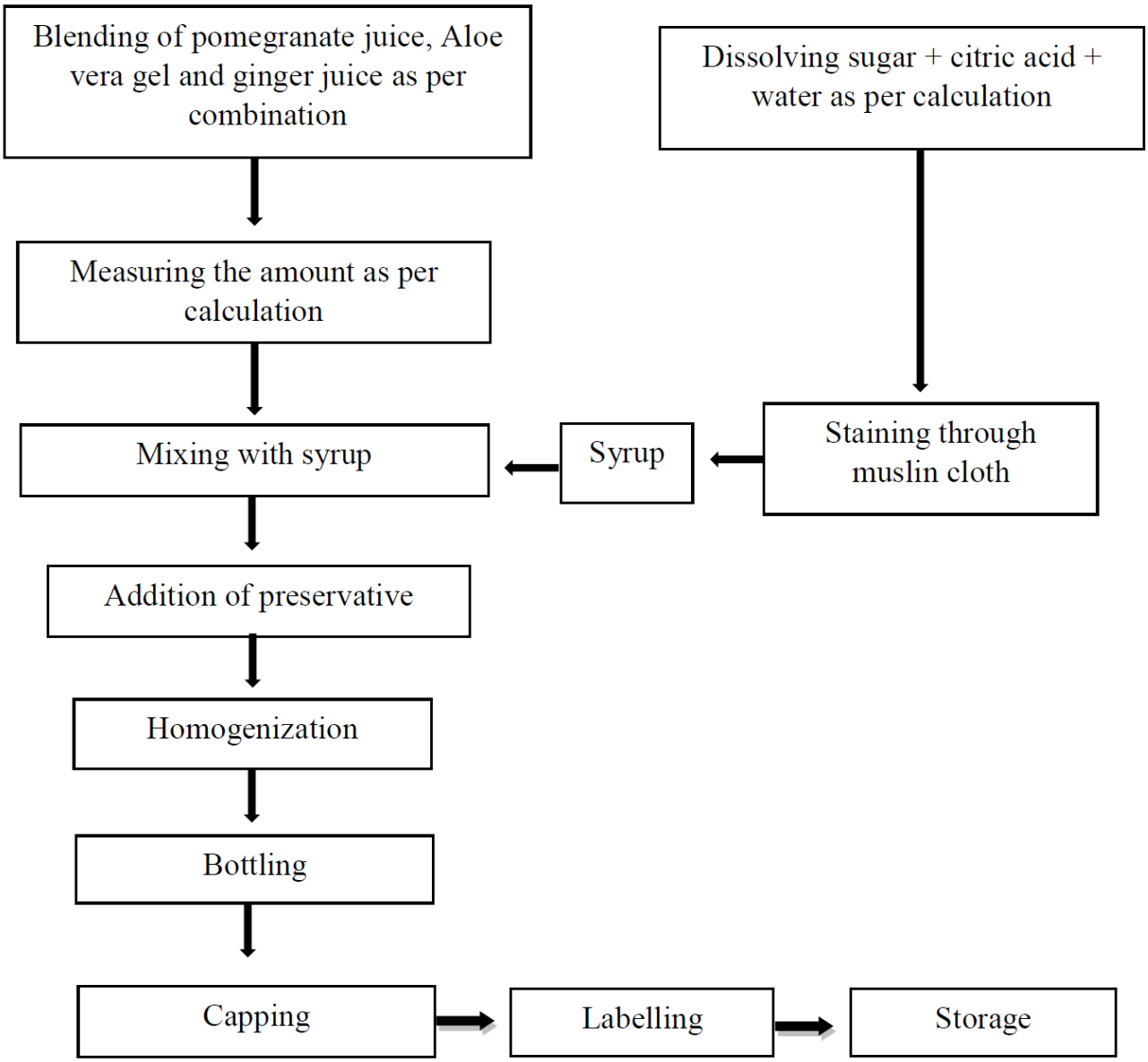

Fig. 4 : Flow sheet for preparation of pomegranate + Aloe vera + ginger blended RTS

Storage Studies

About 5 litres of RTS was prepared with best combination of blend, and filled into polypet bottles of 200 ml, capped and put for storage studies under ambient condition (20-28°C). During storage observation on changes in TSS, pH, acidity, vitamin-C, reducing sugars, non-reducing sugar, total sugars and organoleptic quality were recorded at monthly interval. Observations were recorded for changes in TSS, pH, acidity and vitamin-C, sugars and organoleptic quality at monthly intervals during 4 months of storage period and are described as follows. The TSS of the sample of determined by using hand refractometer (Model: ERMA INC. TOKYO JAPAN) having the range of 0-32 percent. The values of TSS recorded at ambient temperature were corrected at 20°C with the help of reference table and the mean value was expressed as per cent. (Ranganna, 2010) whereas the acidity was determined by titrating known quantity of sample against 0.1 N sodium hydroxide solution using phenolphthalein indicator and expressed in per cent anhydrous citric acid. Vitamin-C content was estimated by preparing sample in 3 per cent metaphosphoric acid solution and titrating against 2, 6 dichlorophenol indophenols dye solution till the appearance of light pink colour. The pH was determined by a digital pH meter using 4, 7 and 9.2 buffer solutions. The reducing, non-reducing and total sugars were analyzed by using Fehling's solution A and B and methylene blue indicator. A panel of 9 semi trained judges evaluated syrup 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 pomegranate, Aloe vera and ginger

The data pertaining to chemical attributes of fresh pomegranate juice, Aloe vera gel and ginger juice is presented in (Table-1) which revealed that the pomegranate used in RTS making contained 12.71 percent TSS, 0.88 per cent acidity, 3.46 pH, vitamin-C 14.63 mg/100g, 11.60 per

cent reducing sugars, 5.33 per cent non-reducing sugar and 16.93 percent total sugars. studies support by Bates *el al.* (2011) pomegranate contain 13.70 per cent TSS, 0.80 per cent acidity, 3.65 $P^{H,}$ 10.04 mg/100g vitamin-C, 09.11 per cent reducing sugars, 3.16 per cent non-reducing sugar and 12.27 per cent total sugars

Aloe vera gel contained 0.88 per cent TSS, 0.24 per cent acidity, 4.10 $P^{H,}$ 2.26 mg/100g vitamin-C, 0.54 per cent reducing sugars, 1.18 per cent non-reducing sugar and 1.72 per cent total sugars. Whereas, Sudhendra *et al.* (2012) reported that Aloe vera gel contains 0.80-0.86^0 B TSS, 4.50-4.52 pH, 0.23-0.26 per cent acidity, 3.76-3.86 mg/100g vitamin-C, 0.026 per cent reducing sugars, 1.894 per cent non-reducing sugar, 1.92 per cent total sugars,

Ginger contained 2.20 per cent TSS, 0.26 per cent acidity,6.30 $P^{H,}$ 1.93 mg/100 g vitamin-C, 0.61 per cent reducing sugars, 1.13 per cent non-reducing sugar and 1.74 per cent total sugars similarly Hegde *et al*. (2018) observed 1.50^{0}B TSS, 5.20 pH, 0.24 per cent acidity, 2.70 mg/100 g vitamin-C, 0.64 per cent reducing sugars and 1.60 per cent total sugars in ginger.

Standardization of blends for RTS

A quality blended syrup with 10 per cent blend comprising, 80 per cent pomegranate juice, 10 per cent Aloe vera gel and 10 per cent ginger juice with 13.00 per cent TSS and 0.25 per cent acidity was organoleptically found best for preparation of blend RTS (Table 2). Similarly, Debnath *et al.* (2022) reported that 80 % papaya pulp, 10 % ginger juice and 10 % honey was found best on 9- point hedonic scale for RTS making.

Biochemical changes during storage

Data pertaining to biochemical changes during storage of RTS into polypet bottles are presented in Table-3 and respectively which indicates that the TSS of RTS increased gradually after 4 months of storage from 13.00 per cent to 13.85 per cent into polypet bottles. 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 Dhineshkumar *et al.* (2016) in RTS prepared from papaya and aloe vera, Harendra and Deen (2021) in mango based RTS and Deen and Harendra (2022) in rangpur lime based RTS. The acidity of RTS increased gradually during storage period. Total acidity was increased from 0.25 per cent at initial day to 0.77 per cent at final day of storage into polypet bottles. Degradation of pectic substances and formation of organic acid have been reported to increase the acidity of fruit products (Conn and Stumf, 1976). Similarly, an increasing trend in acidity during storage was observed by Amin *et al.,* (2018) in blended RTS from pomegranate and grapes and Gill *et al.* (2020) in blended RTS beverage prepared from kagzi lime juice, aloe vera gel and rose extract. The pH also decreased from the first day 1.42 to the end of storage day 1.07 into polypet bottles. It was observed that with the addition of pomegranate the pH of the juice decreased significantly. This might be due to the comparative acidic nature of pomegranate which decreases the pH of the RTS. Similar finding was observed by Fadavi *et al.* (2006) and Manoj *et al.* (2014). Vitamin-C content was continuously decreased from the first day (2.05 mg/100 ml) to the end of storage (1.44 mg/100 ml) into polypet bottles throughout the storage period. This decrease in vitamin-C content might be due to the oxidation of ascorbic acid into dehydro-ascorbic acid by oxygen. The loss of vitamin C in RTS of different fruits-based beverages during storage at ambient temperature was also reported in previous studies. As also shown by Selvi *et al.* (2018) on guava-lime-ginger RTS beverage and Singh *et al.* (2018) on blend RTS prepared from mango and aloe vera. The reducing sugars and total sugars of blended RTS increased gradually and it was increased from 1.72 per cent to 2.48 per cent into polypet bottles. The increase in reducing and total sugars of processed fruit products could be due to inversion of non-reducing sugar into reducing sugars. These finding were supported by Byanna and Gowda (2013) in sweet orange and kokum blended RTS beverage and Khalid *et al.* (2019) in strawberry and dates blended ready to serve drink.

The non-reducing sugar of blended RTS decreased continuously throughout the entire period of storage and it was decreased from 0.80 per cent to 0.31 per cent into polypet bottles. The decrease in non-reducing sugar of processed fruit products might be due to inversion of non-reducing sugar. This finding was supported by published works of Singh *et al.,* (2018) in mango and aloe vera blended RTS and Mane *et al.* (2019) in turmeric-orange blend RTS beverage. Organoleptic score of blended RTS decreased gradually with the storage period at room temperature (20-28C) but the acceptability of RTS was maintained up to four months. The score was significantly decreased from 8.50 at first day to 7.01 at final day of storage into polypet bottles. The loss in organoleptic quality of beverages after certain period is obvious because of undesirable changes in the products. Temperature plays an important role in biochemical changes that leads to development of off flavour as well as discolouration in the beverages. Reduction in organoleptic quality is also reported by Harendra and Deen (2021) in blended RTS beverages of mango, kagzi lime, aloe vera and ginge and Khalid *et al.* (2019) in strawberry and dated blended RTS, These reported observations are in the support of the present finding.

Table 1 : Chemical characteristics of pomegranate, Aloe vera gel and ginger extract

Chemical attributes	Pomegranate juice	Aloe vera gel	Ginger juice
TSS (per cent)	12.71	0.88	2.20
Acidity (per cent)	0.88	0.24	0.26
pH	3.46	4.10	6.30
Ascorbic acid (mg/100g)	14.63	2.26	1.93
Reducing sugars (per cent)	11.60	0.54	0.61
Non-reducing sugar (per cent)	5.33	1.18	1.13
Total sugars (per cent)	16.93	1.72	1.74

Table 2 : Organoleptic quality of RTS prepared from different blends of pomegrante juice, Aloe vera gel and ginger juice

Treatment	Best blending combination			Organoleptic analysis	
	Pomegranate juice	Aloe vera gel	Ginger juice	Score	Ratting
T_1	100	0	0	7.00	LM
T_2	0	100	0	7.02	LM
T_3	0	0	100	7.38	LM
T4	60	20	20	7.05	LM
T5	70	15	15	7.58	LM
T6	**80**	**10**	**10**	**8.50**	**LVM**
T7	90	5	5	8.20	LVM
SE(m)				0.05	
C.D. @ 5 per cent				0.16	

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

Storage period in months	TSS (per cent)	Acidity (per cent)	pH	Vitamin-C (mg/100g)	Reducing sugars (per cent)	Non-reducing sugar (per cent)	Total sugars (per cent)	Organoleptic quality	
0	13.00	0.25	1.42	2.05	1.72	0.80	2.52	8.50	LVM
1	13.09	0.29	1.37	2.00	1.86	0.74	2.60	8.22	LVM
2	13.22	0.37	1.30	1.87	2.05	0.63	2.68	7.90	LM
3	13.43	0.50	1.20	1.62	2.22	0.50	2.72	7.42	LM
4	13.85	0.77	1.07	1.44	2.48	0.31	2.79	7.01	LM
SE(m)	0.02	0.03	0.06	0.04	0.14	0.11	0.26	0.16	
C.D. @ 5 per cent	0.06	0.09	0.19	0.13	0.43	0.35	0.83	0.49	

LVM: Like very much, LM: Like moderately

Conclusion

It may be concluded from above findings that RTS prepared from 25 per cent blend comprising 80 per cent pomegranate juice, 10 per cent Aloe vera gel and 10 per cent ginger juice containing 13.00 per cent TSS and 0.25 per cent acidity was best during organoleptic evaluation. The TSS, acidity, reducing sugars, total sugars were increased, whereas, pH, vitamin-C, non-reducing, and organoleptic quality were decreased during storage into polypet bottles. The RTS can be stored up to 4 months at ambient storage temperature (20-28^{0}C) into polypet bottles with acceptable quality.

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