

Development of Jackfruit-Aloe Vera Blended Ready to Serve (RTS) Functional Beverage at Refrigerated Condition

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Abstract – The functional ready-to-serve (RTS) beverage was prepared from jackfruit and aloe vera juice. The blended juice was made by using the different combination of jackfruit and aloe vera juice as T0 (100:0), T1 (90:10), T2 (80:20), T3 (70:30) and T4 (60:40) to improve the flavour and therapeutic properties. The blends were homogenized and filled into 200 ml colourless sterilized PET bottle and pasteurized at 85°C for 10 minutes, cooled and stored at refrigerated temperature. The blended RTS beverages were prepared to optimize the mixed ratio of jackfruit and aloe vera juice. The physico-chemical and sensory parameters of the mixed functional ready to serve (RTS) beverage were analyzed. Sensory evaluation was done by adopting 9 points hedonic scale after the one-month interval. Among the mixed samples the highest sensory score was (8.42 ± 0.06) obtained for overall acceptability in the T3 sample which has mixed ratio of (70:30). The mixed jackfruit and aloe vera functional RTS beverage was stored up to 5 months without notable change in chemical and sensorial parameters at refrigerated temperature.

Keywords – Functional Beverage, Juice, Jackfruit, Refrigeration.

I. INTRODUCTION

Jackfruit is botanically known as *Artocarpus heterophyllus* Lam. which belongs to the plant family Moraceae of the genus *Artocarpus* and widely grown in India, Bangladesh [11], [12] and in the different part of Southeast Asia [7], [9]. The fruit has some amount of vitamin-A and flavonoid pigments viz., β -carotene, xanthin, zeaxanthin, lutein, and β -cryptoxanthin. These compounds could play the important roles in antioxidant and eyesight function [4]. Fruits rich in vitamin-A and carotenes have been found to protect from chronic ailments, including lung and oral cavity cancers, cardiovascular diseases, and age-related macular degeneration [2]. Aloe vera (*Aloe barbadensis* Miller) is a member of Xanthorrhoeaceae family. Traditionally it is used as folk medicine. Aloe vera has more than 200 species and it is cultivated across the globe and among them only few species are edible and medicinally important. The Aloe vera leaves contain polysaccharides, amino acids, vitamins, minerals, plant steroids, anthraquinones, salicylic acid, and enzymes and these components can play a vital role in the maintenance of human health [17]. The aloe vera gel is bitter in test due presence of aloin component [19], and it could be improved with the addition of fruits juices.

Functional beverage is a non-alcoholic drink which contains non-traditional ingredient such as herbs, vitamin,

minerals, amino acid or added raw fruits or vegetables [20]. Recent trend shows the beverages based on therapeutic properties such as blended RTS beverage like Aloe vera-Aonla and ginger [8], Bael-Aloe vera [16], Aloe vera-Papaya [1] and Aloe vera-pineapple [15] juices are gaining importance. These drinks are rich in nutritional and pharmacological properties and could be useful to combat the malnutrition and hidden hunger among the people in the region, where there is scarcity food.

Jackfruit and aloe vera are widely available in rural parts of the country, and presently these are underutilized [7]. The blending of juices would help in the production of delicious, refreshing and delightful drinks. Blending improves the aroma, taste, nutrition and functional properties. A drink based on fruits and vegetable are considered as an excellent medium for the supplement of the bioactive compound.

Keeping in view of the nutritive and health benefits of jackfruit and aloe vera, the present investigation has been taken to study the optimization of jackfruit and aloe vera juice for the development of blended functional RTS with desirable characteristics to provide more nutritive beverages to the consumer.

II. MATERIAL AND METHODS

A. Extraction of Jackfruit Juice

Fully ripened jackfruits were procured from the local market and washed thoroughly in tap water, and bulbs were separated out carefully from the fruit. The seeds were removed manually from the bulb and pulped by using the mixer grinder (Phillips HL1646 Model) and strained with double layer muslin cloth and filtered juice was kept in the refrigerator.

B. Extraction of Aloe Vera Gel

The aloe vera leaves were harvested from the Central Institute of Horticulture, Medziphema, Farm and dipped in water containing 0.5g potassium metabisulphite (KMS) per liter solution then rinsed and cleaned in running tap water and stored in a cold chamber at a temperature $4 \pm 1^\circ\text{C}$ for stabilization of gel [10]. After that, bottom and top portion of aloe vera leaves were removed, and spine like structure across the margins were trimmed off. The stainless steel knives were used to slice the leaves thereafter sliced leaves were peeled to extract the gel. The extracted Aloe vera gel was grinded and homogenized in the mixer grinder (Phillips HL1646 Model) to obtain the Aloe vera juice. The juice was strained by using muslin cloth to remove the fibrous

substances from the final juice and kept in the refrigerator for further use.

C. Preparation for Blending of Jackfruit and Aloe Vera RTS

Functional ready to serve drink were prepared using 15% of mixed juices of jackfruit and aloe vera. The blended jackfruit and aloe vera juice were formulated in different ratios as given in the Table 1. The finished RTS beverages contains 14.86 ± 0.15 % of sugar, 0.28 ± 0.01 % of acidity and 70 ppm, potassium metabisulphite were added per liter of the product at the time of preparation. The flow chart for development of jackfruit and aloe vera RTS is given in figure 1.

D. Physico-Chemical Analysis

The moisture content of the juices was determined by the electric oven dry method. The total soluble solids (TSS) were estimated with the help of digital refractometer (ATAGO-4406 model), and the values were expressed as °Brix. To measure the titrable acidity of the ready to serve beverage combination, the 10 ml of the sample juice were taken and titrated against the standard alkali (0.1 N NaOH), and the results were expressed in the form of anhydrous citric acid percentage. pH of the blended beverages was measured by Digital pH meter (HANNA, UK). Vitamin C was determined as described by S. Rangana [6]. The total and reducing sugars were estimated by Lane and Eynon method (1923) as described in AOAC (1984). The analyses were replicated thrice.

E. Sensory Evaluation

The sensory score of the drinks were evaluated by the 10 semi-trained member of the institute and it was based on 9 point hedonic scale. The acceptability of the beverage was evaluated on the basis of appearance, colour, taste, flavor and overall acceptability.

F. Statistical Analysis

The obtained data were analyzed as described by Gomez et al., 1984 [3]. SPSS trial version 24 was used to analyze the data and comparison of means was done by Tukey's Post Hoc test.

III. RESULTS AND DISCUSSION

A. Recovery of Aloe Vera Gel

Aloe vera gel is an innovative component, and it is preferred to use in the processing of RTS drinks. Therefore, it was chosen to collect the information related to recovery percentage from different structures of leaf and obtained results are presented in Table 2. The data recoded in the table 2, indicates that the fully matured leaves of Aloe vera has the highest weight (757.40 ± 4.62 g) and gel recovery (38.07 ± 0.42 %); while the lowest weight of leaf (377.60 ± 2.50 g), the weight of gel (248.20 ± 2.10 g) and gel recovery (34.28 ± 0.34 %) was noticed in case of small developed leaves. The variation in the morphology of leaves and recovery percentage of the gel may be, because of variation in the stage of harvest and growing age of the aloe vera leaves. From the results, it is also indicates that the maximum gel recovery (40.42 ± 0.18 %) could be obtained from the Aloe vera leaves that are medium developed.

B. Physico-Chemical Properties of Jackfruit and Aloe Vera Juice

The physico-chemical properties of jackfruit and Aloe vera juice were analyzed and results are noted in the Table 3. The parameters used to measure the various physical as well as chemical attributes of jackfruit and aloe vera juice were the moisture content, total soluble sugar, acidity, reducing sugar, total sugar, Vitamin C and pH. In case of Aloe vera juice, reducing sugar and total sugar content were omitted due to presence of insignificant amount of total carbohydrates. From the Table 3, it could be observed that Aloe vera juice and jackfruit juice comes under the category of acidic food. In the jackfruit juice, the total soluble solid was 19.23 ± 0.15 °B recorded, while in case of Aloe vera juice it was observed that the TSS was very low (i.e. 2.03 ± 0.20 °B). From the above results, it could be forecasted that jackfruit juice are the main contributor of TSS in the final beverage.

C. Sensory Attributes of Blended Ready to Serve Beverage

Organoleptic traits of mixed ready to serve drinks were evaluated based on 9 Points Hedonic Scale and depicted in figure 2. From the result, it is observed that the appearance of mixed drink was improved; when the concentration of Aloe vera juice was increased up to 30%. It is also found that if the Aloe vera juice content was further increased than it reduces the taste of the beverages due to the presence of aloin content that causes the bitterness. The colour score was highest in the sample T3 whereas the lowest colour score was found in the controlled sample T0. Flavour score of the sample T2 (8.03 ± 0.18) and T3 (8.42 ± 0.15) found to be superior to that of the control sample (6.48 ± 0.10). The increase in flavour score may be attributable due to the addition of Aloe vera juice; further increase in the Aloe vera juice content in the beverages results decrease in flavour. The overall acceptability (OAA), observed in the sample T3 containing 30% Aloe vera juice was highest (8.42 ± 0.06) among the treatment.

D. Storage Studies

From the results, it was observed that the chemical changes of beverages take place during the storage. The sample T3 exhibits the changes in the total soluble solids (TSS) and significantly increased from 14.86 ± 0.15 °B to 15.88 ± 0.06 °B stored under refrigerated condition and similar findings was also reported by Yadav et al., [13]. During storage, the increase in TSS may be due to the conversion of polysaccharides and other ingredients of juice into sugar. The acidity of mixed jackfruit and Aloe vera ready to serve drinks was gradually increased and initially the acidity was 0.28 ± 0.01 % and it was increase up to 0.34 ± 0.005 % after 5 months of storage at refrigerated temperature. The present results agreed with the finding of investigators [13], [21]. The pH of beverage found to decrease from 4.87 ± 0.05 to 4.63 ± 0.01 during storage as reported by the investigators [1], [8]. The overall acceptability (OAA) and quality of the RTS functional beverages were slowly decreased during the storage period of 5 months. Although, it remains in the range of "Like very much" by the judges of panel and similar findings were reported by other investigators [1], [18].

IV. CONCLUSION

Jackfruit and Aloe vera juice were used to prepare the blended functional RTS beverages. For the extraction of Aloe vera gel, medium developed Aloe vera leaves were suitable and it received highest recovery percentage (40.42 ± 0.18%). The moisture content in Jackfruit and aloe vera juice were very high whereas the Jackfruit juice contains higher amount of TSS, reducing sugar and total sugar. Aloe vera juice could be successfully mixed up to 30% in the jackfruit for the development of blended ready to serve beverages to ameliorate the organoleptic quality. The blended functional RTS could be successfully stored up to five months without the remarkable change in chemical and sensorial attributes.

REFERENCES

[1] A.H. Boghani, A. Raheem, and S.I. Hasmi, 2012. "Development and storage studies of blended papaya-aloe vera ready to serve (RTS) beverage", *Food Processing & Technology*, volume 3, issue 10. Available at: <http://dx.doi.org/10.4172/2157-7110.1000185>.

[2] E. Giovannucci, "Tomatoes, tomato-based products, lycopene and cancer: review of the epidemiologic literature". *J Nat Cancer Inst* 91(4), 1999, pp.317-331.

[3] A.K. Gomez, and A.A. Gomez, "Statistical procedure for Agricultural Research" CA: Jhon Wiley and Sons, 1984.

[4] S.T. Mayne, "Beta-carotene, carotenoids and disease prevention in human", *J Fed Am Soc Exp Biol*, 10(7), 1996, pp. 690-71.

[5] C. Mondal, R.N. Remme, A.A. Mamun, S. Sultana, M.H. Ali, M.A. Mannan, "Product development from jackfruit (*Artocarpus heterophyllus*) and analysis of nutritional quality of the processed products", *ISOR Journal of Agriculture and Veterinary Science*. Vol.4 (1), 2013, pp. 76-84.

[6] S. Ranganna, "Handbook of analysis and quality control for fruits and vegetables products", CA: Tata McGraw Hill publ Co. Ltd. New Delhi.

[7] S.K. Roy, G.D. Joshi, "Minor fruits-tropical", In *Handbook of fruit science and technology*. Salunkhe, D.K., Ed. New York, USA: Marcel Dekker, 1995, pp.570-573.

[8] K.R. Sasi, R.C. Ray, P.K. Paul, and C.P. Suresh, 2013. "Development and storage studies of therapeutic ready to serve (RTS) made from blend of aloe vera, aonla and ginger", *Food Processing & Technology*, volume 4, issue 6, available at: <http://dx.doi.org/10.4172/2157-7110.1000232>

[9] SCUC, 2006. "Jackfruit *Artocarpusheterophyllus*. Field manual for extension workers and farmers", SCUC, Southampton, UK.

[10] B. Shubhra, S. Kapoor, R.P. Singh, S. Sharma, "Studies on aloe juice supplemented kinnow nectar", *Research journal of agriculture and Forestry Sciences*. Vol. 2 (8), 2014, pp.14-20.

[11] M. Ibrahim, M.S. Islam, M.O. H. Helali, A.K. M.S. Alam and M. Z. Shafique, "Morphological fruit characters and nutritional food value of different jackfruit (*Artocarpus heterophyllus* Lam.) cultivars in Rajshahi region of Bangladesh", *Bangladesh J. Sci. Ind. Res.* 48(4), 2013, pp. 287-292.

[12] M.A. Alam, M.S. Islam, M.Z. Uddin, M.M. Hossain, and M.M. Bashir, "Fruit characteristics of ten jackfruit genotypes grown in Chapai Nawabgonj condition", *J. Bangladesh Soc. Agric. Sci. Technol.* 8(1&2), 2011, pp. 189-192.

[13] R.B. Yadav, B.S. Yadav, and N. Kalia, "Development and storage studies on Whey-Based Banana Herbal (*Mentha arvensis*) Beverage". *American journal of food technology*, 5(2), 2010, pp.121-129.

[14] K. Banjare, M. Kumar, H.C. Nanda, S. Karthikeyan, and R. Lakpale, "Advances in herbal products processing and food products researches on aloe vera: a review". *International journal of food and nutritional sciences*, Vol.3, Iss.3, 2014, pp.28-34.

[15] R. Sasi kumar and K. Vivek, "Process Development of Therapeutic RTS Beverage from Blend of Aloe Vera and Pineapple", *J. Agric. Technol.*, 2(1 & 2), 2015, pp. 7-12.

[16] D.K. Tiwari, B. Deen, "Preparation and storage of blended ready-to-serve beverage from bael and aloe vera", *the bioscan* 10(1), 2015, pp.113-116.

[17] A. Surjushe, R. Vasani, and D.G. Saple, "Aloe vera: a short review", *Indian J Dermatol.* 53 (4), 2008, pp.163-166. [18] M.S. Jakhar, S. Pathak, "Studies on preparation and storage stability of blended ready to serve from ber (*Zizyphus mauritiana* lamk.) and Jamun (*Syzygium cumini* Skeels.) pulp", *Plant Archives* 12, 2012, pp. 533-536.

[19] K.S. Ahlawat, and, B.S. Khatka," Processing, food applications and safety of aloe vera products: a review. *J Food Sci. Technol.* (September–October 2011) 48(5), 2011, pp.525–533.

[20] www.wikipedia.org/wiki/Functional_beverage. Accessed on 22.06.2017.

[21] A. Panghal, N.D. Navnidhi, and B.S. Khatkar, "Whey Based Strawberry Ready to Serve (RTS) Beverage" *Beverage and Food World*, Vol. 36 No. 04, 2009, pp.28-30.

Table 1. Different formulation ratios of Jackfruit juice and Aloe vera juice RTS beverages

Name of the formulation ratios	Jackfruit juice (ml)	Aloe vera juice (ml)
T0	100	0
T1	90	10
T2	80	20
T3	70	30
T4	60	40

Table 2. Recovery of Aloe vera gel from different leaf morphology

Sl. No.	Leaf morphology	Physical parameters		
		leaf weight (g)	Gel weight (g)	Recovery (%)
1	fully matured	757.40±4.62	469.00±1.94	38.07±0.42
2	Medium and thick bottom	633.30±2.35	410.80±2.04	35.12±0.20
3	medium developed	507.60±2.22	302.40±1.96	40.42±0.18
4	Small developed	377.60±2.50	248.20±2.10	34.28±0.34

Value are means ± standard deviation of 10 replications.

Table 3. Physico-chemical characteristics of jackfruit and Aloe vera juice

Sl. No.	Constituents	Jackfruit juice	Aloe vera Juice
1	Moisture (%)	84.28±0.07	97.43±0.02
2	TSS (°B)	19.23±0.15	2.03±0.20
3	Acidity (% as citric acid)	0.28±0.01	1.24±0.02
4	Reducing Sugar	8.53±0.15	*
5	Total sugar	18.50±0.10	*
6	Vitamin C (mg)	5.85±0.12	6.49±0.15
7	pH	4.56±0.15	4.37±0.01

Values are means ± standard deviation of 3 replications, *Not determined.

Table 4. Changes in physio-chemical and overall acceptability (OAA) of Jackfruit-Aloe vera based mixed functional beverages T3 (70:30) during storage

Storage period (Months)	TSS (°B)	Acidity (%)	PH	OAA
0	14.86±.15 ^c	0.28±0.01 ^c	4.87±0.05 ^a	8.42±0.06 ^a
1	15.16±0.09 ^d	0.29±0.005 ^c	4.80±0.04 ^a	8.38±0.06 ^b
2	15.21±0.09 ^d	0.31±0.01 ^d	4.74±0.02 ^a	8.36±0.03 ^b
3	15.45±0.09 ^e	0.32±0.005 ^c	4.70±0.03 ^b	8.29±0.01 ^c
4	15.65±0.08 ^b	0.33±0.005 ^b	4.67±0.02 ^c	8.23±0.01 ^d
5	15.88±0.06 ^a	0.34±0.005 ^a	4.63±0.01 ^d	8.17±0.02 ^c

Values are means \pm standard deviation of 3 replication, means in the same column with different superscripts are significantly different as tested by Tukey's HSD.

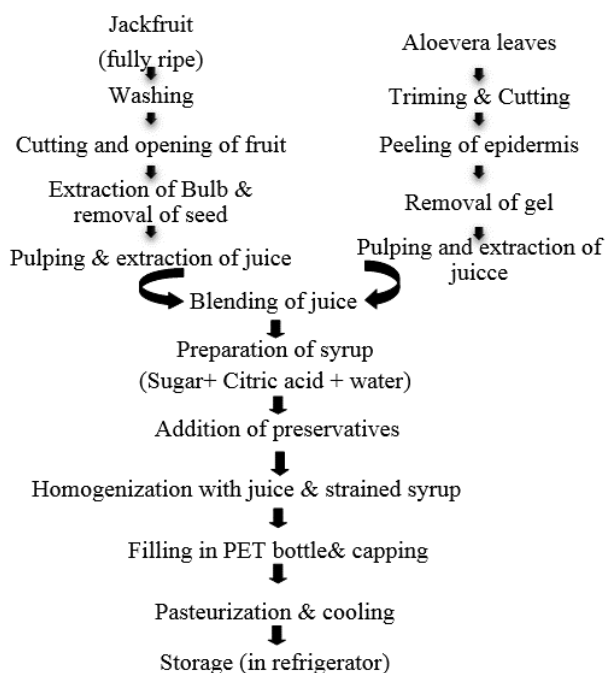


Fig. 1. Flow chart for production of ready to serve beverage made from Jackfruit and Aloe vera juices

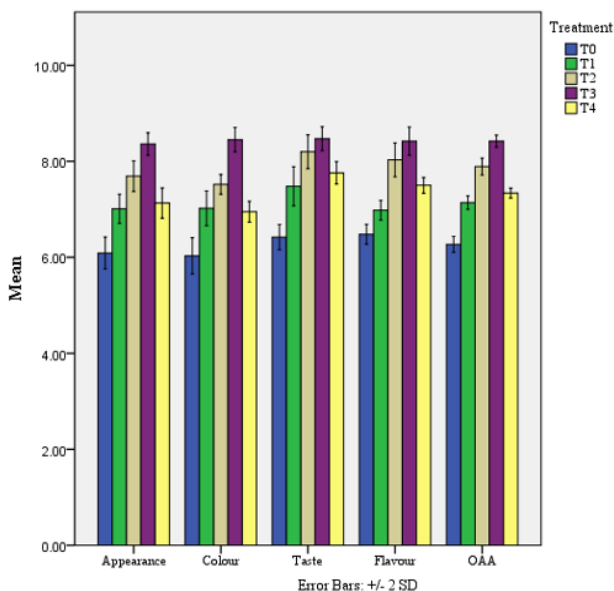


Fig. 2. Organoleptic quality of blended Jackfruit and Aloe vera RTS functional beverage

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