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Nutrient Content and Acceptability of RTS Punch Beverages Prepared using Amla Juice and Fermented Carrot Juice

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Abstract

Ready to serve beverage was prepared using Fermented vegetable juices with different combination of fruit juices [10:90 (V_1), 20:80 (V_2) and 30:70 (V_3)]. The control sample was prepared using unfermented vegetable juice and it was compared with variations over different storage periods. The prepared RTS beverage was analyzed for nutrient contents. The sensory acceptability was done every 15 days for a period of two months. The ascorbic acid content was decreased with the advancement of storage period due to its oxidation. Likewise β carotene also decreased over different storage periods. The results of organoleptic evaluation showed that the maximum score was obtained for a combination of 10:90 and 20:80.

Keywords: Amla Juice, Fermented Orange Juice, Organoleptic Evaluation, Ready To Serve (RTS) Beverage, Storage Stability

1. Introduction

Natural fermentation occurs when micro organisms are allowed to react with susceptible organic substrates [1]. Fermentation plays an important role in preservation of foods. Fermentation is one of the oldest forms of food preservation technologies in the world. Indigenous fermented foods such as bread, cheese and wine, have been prepared and consumed for thousands of years and strongly linked to culture and tradition, especially in rural household and village communities [2].

Fermenting fruits and vegetables can bring many benefits to people in developing countries. Fermented foods play an important role in providing food security, enhancing livelihoods and improving the nutrition and social well being of millions of people around the world, particularly the marginalized and vulnerable [3–5].

A beverage is basically a drink specifically prepared for human consumption. This does not include water as it is a natural resource. Beverages almost always largely consist of water as their main ingredient. Beverages are consumed by all age groups to quench their thirst, as a social drink and for improving health and medicinal value [6]. The demand for fruit beverages is increasing in India as well as in other countries due to the increasing trend towards fast foods and also to cater to the changing consumer taste [7].

Ready To Serve (RTS) beverage contains at least 10 percent fruit juice and 10 percent total soluble solids besides about 0.3 percent acid. These beverages are available diluted and ready to drink in cans or bottles [8]. Fruit based RTS beverages are not only rich in essential minerals, vitamins and other nutritive factors but also are delicious and have a universal appeal. Punch is a general term for a wide assortment of mixed drinks, especially fruit and its juices. Preparation of punches with vegetables and fruit juice combination is yet to become popular. Since vegetables are slightly lower in acid content, it is essential that the acidity is increased to make it suitable for the preparation of RTS beverages. This can be done in a natural way by the addition of suitable probiotic bacteria.

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Emblica officinalis (EO) enjoys a hallowed position in Ayurveda an Indian indigenous system of medicine. According to ancient Indian mythology, it is the first tree to be created in the universe. It belongs to family Euphorbiaceae. It is also named as Amla, *Phyllanthus Emblica* or Indian gooseberry.

Amla berries have the highest amount of naturally occurring vitamin C of any ripe fruit used as a traditional food. Numerous studies conducted on amla fruit suggest that it has anti-viral properties and also functions as an anti-bacterial and anti-fungal agent. The gelatinous plum-sized amla fruit contains naturally occurring vitamin, heat stable vitamin C [9]. In this study carrot is fermented with lactic acid bacteria and combined with amla juice for the preparation of RTS beverages.

The main objectives of the study are:

- To formulate RTS punch beverages using fermented vegetables and fruit juices
- To analyze the physico-chemical characteristics and nutrient content of the RTS beverages over different storage periods.
- To find out the organoleptic acceptability of the RTS beverages.
- To analyze the shelf life of the products.

2. Materials and Methods

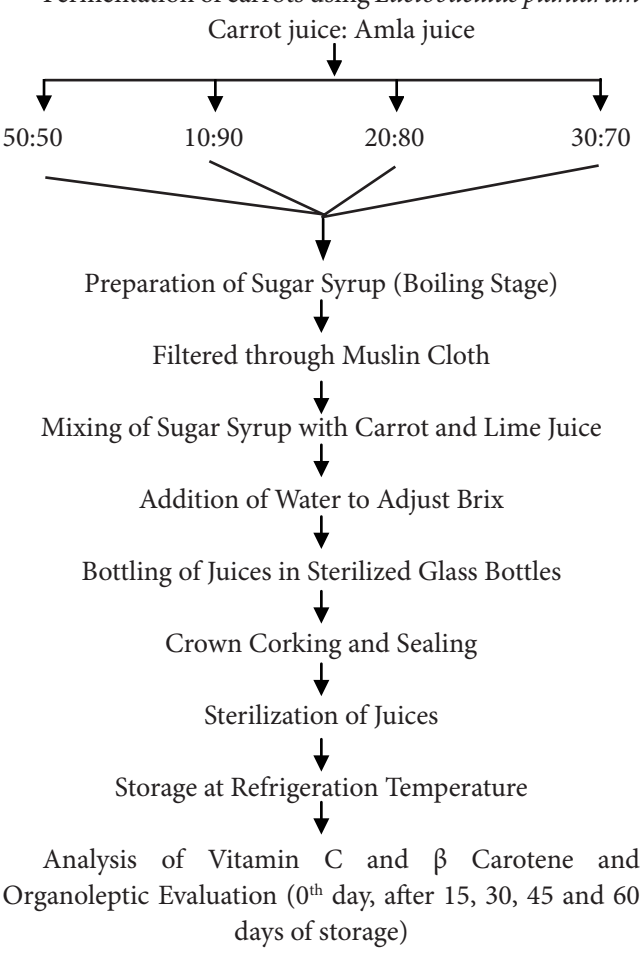
The bacterial species namely *Lactobacillus plantarum* (1407) were obtained in a lyophilized form from MTCC. They were grown in specific media and confirmed using standard microbiological and biochemical tests. The procured cultures were first activated in MRS (De Man, Rogosa and Sharpe) broth.

Carrots were washed and cleaned thoroughly and immersed in warm sterilized water for 15 minutes to kill the soil bacteria if any. They were mashed after peeling the skin to speed up the fermentation. The mashed carrots were mixed with dry salt (2.5%), and inoculated with *Lactobacillus plantarum* at the rate of 2 percent (6log cfu/ml). The fermentation was carried out in aerobic condition by covering the vessel using a muslin cloth for 24–48 hours to produce the acidity. The acidity of the fermented carrots was checked after 24 hours at 6 hour interval using a pH meter. On completion of fermentation (when no further increase in acidity was observed), the fermentation was stopped and the juice was extracted [10]. The juice was strained and filtered through a muslin cloth to obtain clarified, clear juice [11]. The obtained carrot juice was mixed with amla juice for the preparation of RTS.

The RTS beverage was prepared by using fermented carrot juice, freshly prepared amla juice, water, and sugar as per FPO specifications [12]. Carrot and amla juices were mixed in four different proportions i.e. 50:50, 10:90, 20:80 and 30:70 respectively. (The proportions were arrived at after conducting a pilot study). Sugar syrup was prepared separately up to the boiling stage, and strained through muslin cloth and added after cooling, to get the desired TSS of 14˚B-20˚B (FPO specifications). The combined carrot and amla juices were then mixed with the sugar syrup in the correct quantity to get the RTS beverage. Also a RTS beverage was prepared with unfermented carrot and amla juice for comparison.

The beverages were filled in pre-sterilized glass bottles of 200 ml capacity by leaving one inch head space and crown corked and sterilized for 30 minutes in boiling water bath followed by cooling. The bottles were stored under refrigeration conditions [13].

The methodology followed is shown in Figure 1.



3. Preparation and Analysis of RTS

The ascorbic acid was done by dye method [14] and β carotene by spectro-photometric method. The analysis was done soon after preparation and periodically (every 15 days) over a period of 60 days. The sensory evaluation of the RTS beverages was done by numerical scoring method using 9 point hedonic scale by 10 trained panel members soon after preparation, after 15, 30, 45 and 60 days of storage.

4. Results and Discussion

4.1 Nutrient Content of RTS beverages

Refer Table 1.

4.2 Ascorbic Acid

The ascorbic acid content of the RTS beverages shows a gradual decrease after 15, 30, 45 and 60 days of storage. Barwal et al., (2006) [13] reported that the ascorbic acid is decreased by pasteurization. Heat treatment during pasteurization might have degraded the ascorbic acid in bitter gourd based RTS beverages. Ascorbic acid is sensitive to heat and is quickly oxidized in the presence of oxygen. Hence, ascorbic acid has been destroyed during processing and subsequently during storage period. Krishnaveni et al. [15] has reported the initial ascorbic acid content to be 0.56 mg% which had decreased to 0.40mg% after 90 days of storage in their study on whey based jack fruit RTS beverages.

The percentage loss (Figure 2) of ascorbic acid in standard was 4.80% which was more than twice the loss observed between 15 and 30 days and 30 and 45 days (1.21% & 1.02%) of storage. The loss in ascorbic acid content between 0th day and 60 days was the highest (7.59%). On comparing the ascorbic acid content of the standard and the variations, it was seen that ascorbic acid content of V_1 was the maximum (1100.0 mg%) as the amount of amla juice in this variation was the greatest. Also it is clear that the percentage loss of ascorbic acid was the maximum in V_1 between 0 day and 60 days of storage (2.61%). The percentage loss of ascorbic acid of V_1 and V_2 between 30 and 45 days shows nil loss between 30 and 45 days of storage; however it was 0.69% in V_3, and 0.24% and 1.13% in V_2 and V_3 respectively when compared between 0th day and 45 days of storage. The percentage loss of standard shows a maximum loss between 0 day and 60 days and minimum loss in V_1 and V_2 between 0 day and 60 days of storage shows that there is a possibility of the ascorbic acid loss getting minimized on further storage.

4.3 β Carotene

The β carotene content of the standard and all the variations had reduced (Figure 3) gradually over the different

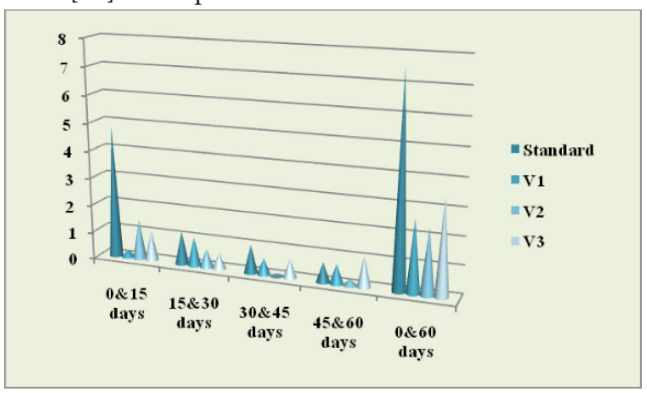


Figure 2. Percentage Loss of Ascorbic Acid.

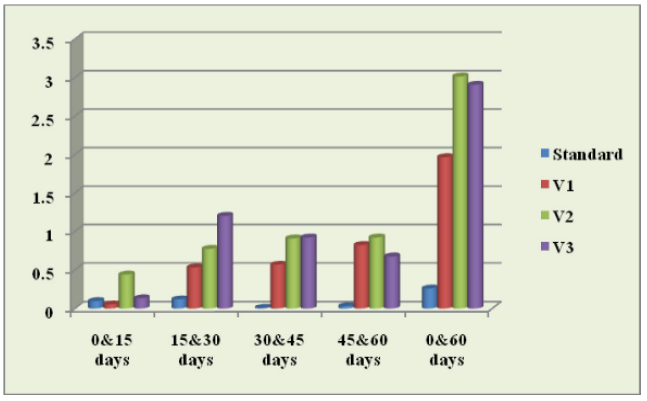


Figure 3. Percentage Loss of β carotene.

Table 1. Nutrient Content of RTS beverages

RTS Beverages	Vitamin C (mg)					β Carotene (mcg) or µg				
	0th day	15 days	30 days	45 days	60 days	0th day	15 days	30 days	45 days	60 days
Standard	520.0	495.0	489.0	484.0	480.5	4610.0	4605.5	4600.0	4599.0	4598.0
V1	1100.0	1097	1085.5	1079.0	1071.2	920.6	920.1	915.2	910.0	902.5
V2	990.0	975.5	969.0	969.0	966.6	3290.0	3275.5	3250.1	3220.5	3190.8
V3	840.0	830.6	825.7	820.0	810.7	4450.0	4444.0	4390.5	4350.0	4320.6

storage periods. The β carotene content of the standard was 4610.0 µg% which was the highest as the standard was prepared by using a 50:50 combination. In all the variations the amount present in the RTS beverages was as per the proportion of carrot juice used. On analyzing the percentage loss of β carotene it is clear that there has been a steady increase in the loss. The percentage loss between 0th day and 60 days was maximum in V_1, V_2 and V_3, while the percentage loss in the standard was almost the same between 0th day and 15 days and 15 and 30 days. V_2 showed a maximum loss of 3.01% between 0 day and 60 days of storage.

4.4 Organoleptic Evaluation

The changes in the sensory attributes of RTS beverages which were evaluated at regular intervals (15 days) are given in Table 2. The scores obtained by the standard for appearance was maintained up to 60 days while that of V_1 and V_3 was slightly elevated after 60 days and that of V_2 showed a decline. The scores obtained for body was the least for standard which could be due to the amount of carrot juice added, while that of V_3 was the highest 0th day. The score for body remained above 7.0 for all the variations thus showing the acceptability. The flavor of standard and V_1 was good soon after preparation but that of V_2 and V_3 was evaluated as fair upto 60 days of storage. The same increased in V_2 and V_3 after 60 days of storage. This could be due to the production of some flavour compounds during storage. The organoleptic scores obtained for taste remained almost the same after 45 days for standard and V_1. However it is increased in V_2 after 30 days of storage. In V_3 there was a reduction to 5.4 after 45 days and thereafter it increased to 5.7 after 60 days of storage. The RTS beverages showed a highly acceptable status upto 45 days of storage without much noticeable changes in overall acceptability.

Strong jack fruit flavor of the RTS beverages was maintained upto 60 days of storage in the refrigerated condition. The highest score value (4.0) for flavor was noted upto 60 days, there after a reduction was observed for the remaining period (3.9-3.8) due to the change of flavor. The highly acceptable status was noticed upto 45 days of storage and then changed to acceptable condition [15].

5. Conclusion

As per sensory evaluation, V1 was the most acceptable among the variations. The RTS beverages prepared by using probiotics, and fruits and vegetables are nutritious and also safe for consumption since there was no addition of artificial colour, flavour, acid or preservative. In the recent past, there is increasing consumer awareness throughout the globe on the potential influence of various foods stuff on health benefits. Consumers expect the food products to be healthy, tasty and functional. This has triggered the food industry to look for opportunities to improve the existing products as well as developing novel products which can contribute not only to a healthy balanced diet but also be more organoleptically acceptable.

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Table 2. Mean organoleptic scores for RTS beverages

Criteria	0th Day				15 Days				30 Days				45 Days				60 Days			
	Std	V1	V2	V3	Std	V1	V2	V3	Std	V1	V2	V3	Std	V1	V2	V3	Std	V1	V2	V3
Appearance	8.5	6.1	6.3	6.8	8.3	6.5	6.1	6.5	8.5	6.2	6.2	6.6	8.5	6.1	5.6	6.7	8.4	6.2	5.8	6.5
Body	7.0	8.1	6.9	7.7	7.1	7.7	7.8	7.5	7.0	7.8	7.2	7.5	7.7	8.3	7.4	7.2	6.8	8.5	7.4	7.8
Flavour	6.7	6.9	5.7	4.8	7.6	8.0	6.8	5.8	7.8	7.6	7.0	6.7	7.9	7.3	6.0	5.6	7.1	7.7	6.8	6.3
Taste	7.2	7.1	6.6	5.0	7.8	7.3	6.1	5.7	8.0	7.4	6.6	5.9	7.9	8.2	6.8	5.4	8.2	7.9	6.3	5.7
Overall Acceptability	8.0	8.2	7.4	6.9	8.2	8.0	7.1	7.3	8.3	7.8	7.0	6.8	8.0	7.8	7.1	7.4	8.6	8.2	7.0	6.8

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