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Sunil Mahnoori

Division of FST, Main campus
Chatha, SKUAST- Jammu and
Kashmir, India

Jagmohan Singh

Division of FST, Main campus
Chatha, SKUAST- Jammu and
Kashmir, India

Neeraj Gupta

Division of FST, Main campus
Chatha, SKUAST- Jammu and
Kashmir, India

Preparation and evaluation of litchi and beetroot blended ready to serve beverage

Sunil Mahnoori, Jagmohan Singh and Neeraj Gupta

Abstract

In the present study, the litchi and beetroot juice/pulp were blended in the ratios of 100:00, 95:05, 90:10, 85:15, 80:20, 75:25, 70:30 for the preparation of ready to serve beverage as per FPO specifications. The processed products were stored at ambient conditions and subjected to chemical, microbial and sensory evaluation at an interval of 30 days for a period of 90 days. With the increase in storage period, the total soluble solids and titratable acidity increased whereas, pH decreased. Sensory evaluation of RTS beverage revealed that treatment T₆(75:25::litchi:beetroot) recorded highest scores for colour (7.88), body (7.90) and taste (8.33), followed by treatment T₅(80:20::litchi:beetroot). Storability studies revealed that all the treatments could be kept for at least 90 days without affecting the quality attributes.

Keywords: Litchi, beetroot blended ready, serve beverage

Introduction

Litchi (*Litchi chinensis* Sonn.) belongs to the family Sapindaceae and is one of the most delicious, refreshing and perishable subtropical fruit of India. Litchi is a nourishing and flavourful fruit which grows in tropical and subtropical areas. All over the world, the major growing countries are India, China, Vietnam, Thailand, South Africa, Australia, USA and the Malagasy Republic, etc. (Menzel *et al.*, 1988) [17]. The maximum area and production of Litchi is reported from Muzaffarpur (Bihar) and Dehradun (Uttaranchal). The litchi fruit is a good source of food, nutrition and has good medicinal value. The fruit of the litchi comes to the market in May or early June when very few other fruits are available, thus they fetch remunerative price in the market and thus rules the domestic market as “Queen of fruits” during the season (Bhandari *et al.* 2018) [4]. The litchi pulp has milky white colour and contains pleasant aroma and flavour which makes it suitable for blending with other juices to improve their acceptability and make use of available nutrients (Khan *et al.*, 1988) [16].

Beta vulgaris (L.), commonly known as beetroot or beet which is the common American term for the vegetable, is a flowering plant species in the family Chenopodiaceae. Common four types of beet root family includes: ‘Garden’, ‘Swiss chard’ or ‘silver beet’, ‘Sugar beet’, ‘Fodder’ or ‘Stock beet’ (FHIS, 2011) [8]. Fresh beetroots are exposed to spoilage due to their high moisture content (Chibber *et al.* 2019) [7]. The beetroot, apart from consumption in its fresh form, is also a valuable vegetable used in the food industry to produce dried and frozen food, non-concentrated and concentrated juices as well as natural colorants (betalains) used as additives in food manufacturing. Due to high amount of natural dietary fibres in the juice, this is helpful to diabetic and obese people. However, beetroot juice consumption may not be as popular as other fruit and vegetable juices such as tomato, carrot, apple or mango, perhaps due to perceived issues of taste, texture and urinary colouration. Muddy flavour in fresh beetroot juice is due to presence of geosmin. A small increase in the habitual consumption of antioxidant and polyphenol-rich beverages such as beetroot juices blended with litchi juice may have significant positive effect on public health. Blended ready to serve beverage offer an opportunity for beetroot juice to be consumed with ease and convenience by the general public and may contribute positively towards increasing consumption of polyphenol rich produce.

Material and Methods

The defected and injured fruits of litchi and beetroot were sorted out and healthy ones for retained for extraction of pulp. The litchi and the beetroot juice were blended with each other in different ratios for developing RTS *i.e* T₁: 100:00, T₂:95:05, T₃:90:10, T₄:85:15, T₅:80:20, T₆:75:25, T₇:70:30.

Corresponding Author:

Sunil Mahnoori

Division of FST, Main campus
Chatha, SKUAST- Jammu and
Kashmir, India

The desired quantity of sugar and citric acid was added in warm water and the solution is strained through muslin cloth. The solution is added in litchi-beetroot blend so as to maintain its total soluble solids as 13⁰Brix and acidity of 0.25 per cent of the blended RTS. Litchi-beetroot blended ready to serve beverage was packed in pre-sterilized 200ml glass bottles. The bottles were then sealed air tight, pasteurized, labelled and stored at a cool and dry place. The RTS was stored at ambient condition to study the storage behaviour of the product with respect to the changes in chemical, microbial and sensory qualities during storage. The product was evaluated immediately after preparation and then at an interval of 30 days up to 90 days of storage. Total soluble solids and titratable acidity were determined as per the method suggested by Ranganna (1994)^[20] and AOAC,2000)^[2]. Total plate count of micro-organism was determined according to method given by Harrigan and McCance (1976). The samples were evaluated on the basis of sensory evaluation by semi-trained taste panels of 6-7 judges using 9 point hedonic scale. A score of 5.5 and above was considered acceptable (Amerine *et al.*, 1965)^[1]. The lab experiment was carried out in completely randomized design with factorial concept for the interpretation of results through analysis of variance (Gomez and Gomez, 1984)^[10].

Result and Discussion

Total soluble solids

A perusal of data in Table-1 indicated that treatments significantly influenced the total soluble solids of RTS (ready to serve) beverage. The data revealed that there was slight increase in TSS upto 90 days of storage in all treatments. After 90 days of storage, treatment T₁(100:00::litchi: beetroot) recorded highest value of (13.69 °Brix) and lowest value of (13.40 °Brix) was observed in treatment T₇(70:30::litchi: beetroot). The maximum overall mean value of total soluble solids (13.25°Brix) was recorded in treatment T₁(100:00::litchi: beetroot) whereas minimum total soluble solids of (13.16 °Brix) was recorded in treatment T₇(70:30::litchi: beetroot). Storage period also significantly affected the total soluble solids of RTS (ready to serve) beverage. The mean values of storage period showed an increase from initial value of 13.01 to 13.54 °Brix after 90 days of storage. It is also clear from the data that the interaction between treatments and storage period attained the level of significance in respect of total soluble solids of RTS (ready to serve) beverage. The increase in total soluble solids might be due to the conversion of polysaccharides into simple sugars. The increase might also be attributed to hydrolysis of starch in to sugars. Gupta *et al.* (2020)^[11], Sharma *et al.* (2017)^[21] also reported similar results in bael preserve and jamun-mango blended RTS beverage.

Titratable acidity

Table-2 illustrates the effect of various treatments and storage period on titratable acidity of litchi-beetroot blended RTS (ready to serve) beverage. The data revealed that there was slight increase in titratable acidity up to 90 days of storage in all treatments. The maximum titratable acidity (0.30) per cent was recorded in treatment T₁(100:00::litchi: beetroot) and minimum value of (0.26) per cent was observed in T₇(70:30::litchi: beetroot) after 90 days of storage. The highest treatment mean value (0.28) per cent was recorded in treatment T₁ whereas lowest treatment mean value of (0.25) per cent in treatment T₇. It is also clear from the table that

interaction between treatment and storage period could not affect the titratable acidity of ready to serve beverage significantly. Increase in acidity may be due to de-esterification of pectin molecules which decreases the level of methoxyl content. Soni *et al.* (2014)^[22] also reported increase in acidity of carrot, carrot-beetroot nectar during 90 days of storage. Similar findings have been reported by Gupta 2019^[12] in Karonda-beetroot RTS beverage.

pH

It is evident from Table-3 that treatments significantly influenced pH values of litchi beetroot blended beverage. At initial day of storage maximum value of 4.35 pH was recorded in treatment T₇ (70:30::litchi: beetroot) and minimum value of 4.25 was found in treatment T₁ (100:00::litchi:beetroot).The pH slightly decreased with the advancement of storage period. After 90 days of storage, the maximum pH of 4.25 was recorded in treatment T₇ (70:30::litchi:beetroot) whereas, minimum value of 4.05 in treatment T₁ (100:00::litchi:beetroot). The mean value of pH decreased from 4.30 at initial day of storage to 4.18 after 90 days of storage. Decrease was found statistically significant within treatments and during storage at 5% level of significance. This might be due to the reason that with the increase in acidity, pH correspondingly decreases. Decrease in acidity might be attributed to the production of organic acid and amino acids by the action of ascorbic acid on sugars of the beverage. Kenghe and Zambare (2009)^[23] also observed decrease in pH during storage period of blended bael RTS beverage

Microbial population

No signs of microbial growth were observed upto 60 days of storage Table-4. After 90 days of storage maximum growth of 1.70 cfu/ml was observed in treatment T₇(70:30::litchi:beetroot) and minimum growth of 1.0 cfu/ml in treatment T₁(100:30::litchi:beetroot). Presence of microbial population in the product was mainly dependent upon the quality and handling of raw material, method of preparation, conditions under which the product was prepared and stored as well as the type of container (Frazier and Westhoff., 1995)^[9]. Similar results have been reported by Hashmi *et al.* (2007)^[14] in mango pulp and Pandita and Gupta (2019)^[12] in flavoured laddoo. Pangotra *et al.* 2019 also reported that no microbial count was observed during three months of storage in phalsa-pear blended crush.

Colour

It is evident from Table-5 that colour score of litchi-beetroot blended RTS decreased significantly during entire storage period. At initial day the maximum score of 8.50 was observed in treatment T₆(75:25::litchi: beetroot) followed by 8.20 in T₅(80:20::litchi: beetroot). After 90 days of the storage period, scores decreased to 7.30 in T₆(75:25::litchi: beetroot) and 7.00 in T₅(80:20::litchi: beetroot) respectively. All treatments differed significantly as for treatments and storage periods are concerned. The highest overall mean score of 7.88 was recorded in T₆(75:25::litchi: beetroot) followed by treatment T₅(80:20::litchi: beetroot). The mean values of storage period showed decreasing trend from initial score of 7.69 to 6.54 after 90 days of storage period. The change in colour may be attributed to the loss of SO₂ in samples resulting in non-enzymatic browning to some extent and also some changes in other chemical constituents of the fruits

during the storage period. Similar results of decrease in colour score from 8.50 to 8.25 have been reported by Bafna, (2014) [3] in kokam fruit RTS beverage. Pangotra *et al.* 2018 also observed decrease in colour values in phalsa-pear blended beverage during three months of storage.

Body

Table-6 illustrates the average scores of litchi-beetroot blended RTS beverage at different intervals during the storage period. The data revealed that the maximum score of 8.40 was recorded in treatment T₆(75:25::litchi: beetroot) followed by 7.50 in treatment T₅(80:20::litchi: beetroot). After 90 days of the storage period, 7.50 was recorded in T₆(75:25::litchi: beetroot) and 6.90 in T₅(80:20::litchi: beetroot) respectively. The mean value of treatments varied significantly and the highest mean score of 7.90 was registered in T₆(75:25::litchi: beetroot) and lowest 6.83 in T₂(95:05::litchi: beetroot). During storage period, there was significant decrease in the mean score from 7.49 to 6.76 after 90 days of storage period. The change observed in texture during storage may be attributed to the degradation of pectin materials present in the fruits and also due to moisture pickup by the products. Similar

findings of decrease in body/texture score from 8.63 to 7.81 were reported by Bafna (2014) [3] in kokam ready to serve beverage. Punam *et al.* (2009) [19] reported decrease in body scores in bael mango ready to serve drink and squash.

Taste

A perusal of data in Table-7, it was found that the sensory scores of taste of litchi-beetroot blended RTS beverage showed a significant gradual decrease up to end of 90 days storage period. At initial day, the maximum score of 8.70 was recorded in treatment T₆(75:25::litchi: beetroot) followed by 8.30 in treatment T₅(80:20::litchi: beetroot), the values decreased to 8.0 and 7.90 in T₆(75:25::litchi: beetroot) and T₅(80:20::litchi: beetroot) during 90 days of storage, respectively. During storage period, there was significant decrease in mean score from 8.07 at initial day to 7.43 at end of 90 day of storage period. Reduction in taste scores with the advancement of storage may be due to loss of volatile flavouring compounds during storage or production of organic acids with storage. Similar observations of decrease in taste score was also reported by Zambare *et al.* 2009 [23] in wood apple RTS beverage.

Table 1: Effect of treatments and storage period on TSS (⁰Brix) of litchi - beetroot blended RTS beverage

Treatments	Storage period (days)				Mean
	0	30	60	90	
T ₁ (100:0 :: litchi: Beetroot)	13.02	13.08	13.20	13.69	13.25
T ₂ (95:05 :: Litchi: Beetroot)	13.01	13.06	13.18	13.62	13.22
T ₃ (90:10 :: Litchi: Beetroot)	13.03	13.08	13.17	13.57	13.21
T ₄ (85:15 :: Litchi: Beetroot)	13.00	13.04	13.15	13.53	13.18
T ₅ (80:20 :: Litchi: Beetroot)	13.02	13.05	13.13	13.52	13.18
T ₆ (75:25 ::Litchi: Beetroot)	13.02	13.07	13.14	13.45	13.17
T ₇ (70:30 ::Litchi: Beetroot)	13.00	13.07	13.15	13.40	13.16
Mean	13.01	13.06	13.16	13.54	

Factors	C.D.(P=0.05)
Treatment (A)	0.01
Storage (B)	0.02.
Treatment X Storage (A X B)	0.01

Table 2: Effect of treatments and storage period on titratable acidity (%) of litchi -beetroot blended RTS beverage

Treatments	Storage period (days)				Mean
	0	30	60	90	
T ₁ (100:0 :: litchi: Beetroot)	0.26	0.27	0.28	0.30	0.28
T ₂ (95:05 :: Litchi: Beetroot)	0.25	0.26	0.28	0.29	0.27
T ₃ (90:10 :: Litchi: Beetroot)	0.26	0.26	0.27	0.28	0.27
T ₄ (85:15 :: Litchi: Beetroot)	0.25	0.26	0.26	0.28	0.26
T ₅ (80:20 :: Litchi: Beetroot)	0.25	0.25	0.26	0.27	0.26
T ₆ (75:25 ::Litchi: Beetroot)	0.25	0.26	0.27	0.27	0.26
T ₇ (70:30 ::Litchi: Beetroot)	0.24	0.25	0.25	0.26	0.25
Mean	0.25	0.26	0.27	0.28	

Factors	C.D.(P=0.05)
Treatment (A)	0.01
Storage (B)	N.S.
Treatment X Storage (A X B)	N.S.

Table 3: Effect of treatments and storage period on pH of litchi - beetroot blended RTS beverage

Treatments	Storage period (days)				
	0	30	60	90	Mean
T ₁ (100:0 :: litchi: Beetroot)	4.25	4.14	4.10	4.05	4.14
T ₂ (95:05 :: Litchi: Beetroot)	4.30	4.22	4.14	4.14	4.20
T ₃ (90:10 :: Litchi: Beetroot)	4.26	4.21	4.16	4.16	4.20
T ₄ (85:15 :: Litchi: Beetroot)	4.32	4.25	4.20	4.19	4.24
T ₅ (80:20 :: Litchi: Beetroot)	4.32	4.29	4.24	4.22	4.27
T ₆ (75:25 ::Litchi: Beetroot)	4.32	4.27	4.25	4.24	4.27
T ₇ (70:30 ::Litchi: Beetroot)	4.35	4.33	4.30	4.25	4.31
Mean	4.30	4.24	4.20	4.18	

Factors	C.D.(P=0.05)
Treatment (A)	0.01
Storage (B)	0.02
Treatment X Storage (A X B)	0.03

Table 4: Effect of treatments and storage period on microbial population (cfu/ml) of litchi-beetroot blended RTS beverage

Treatments	Storage period (days)				
	0	30	60	90	Mean
T ₁ (100:0 :: Litchi: Beetroot)	N.D.	N.D.	N.D.	1.00	0.25
T ₂ (95:05 :: Litchi: Beetroot)	N.D.	N.D.	N.D.	1.66	0.41
T ₃ (90:10 :: Litchi: Beetroot)	N.D.	N.D.	N.D.	1.66	0.41
T ₄ (85:15 :: Litchi: Beetroot)	N.D.	N.D.	N.D.	1.33	0.33
T ₅ (80:20 :: Litchi: Beetroot)	N.D.	N.D.	N.D.	1.66	0.41
T ₆ (75:25 ::Litchi: Beetroot)	N.D.	N.D.	N.D.	1.33	0.33
T ₇ (70:30 ::Litchi: Beetroot)	N.D.	N.D.	N.D.	1.70	0.42
Mean				1.48	

Factors	C.D.(P=0.05)
Treatment (A)	0.00
Storage (B)	0.01
Treatment X Storage (A X B)	0.01

Table 5: Effect of treatments and storage period on mean score evaluation of color of litchi-beetroot blended RTS beverage

Treatments	Storage period (days)				
	0	30	60	90	Mean
T ₁ (100:0 :: litchi: Beetroot)	7.30	6.70	6.60	6.40	6.75
T ₂ (95:05 :: Litchi: Beetroot)	6.90	6.50	6.20	6.00	6.40
T ₃ (90:10 :: Litchi: Beetroot)	7.40	6.90	6.60	6.30	6.80
T ₄ (85:15 :: Litchi: Beetroot)	7.70	7.40	7.00	6.40	7.13
T ₅ (80:20 :: Litchi: Beetroot)	8.20	7.80	7.10	7.00	7.53
T ₆ (75:25 ::Litchi: Beetroot)	8.50	8.00	7.70	7.30	7.88
T ₇ (70:30 ::Litchi: Beetroot)	7.80	7.30	7.30	6.40	7.20
Mean	7.69	7.23	6.93	6.54	

Factors	C.D. (P=0.05)
Treatment (A)	0.01
Storage (B)	0.01
Treatment X Storage (A X B)	0.03

Table 6: Effect of treatments and storage period on mean score evaluation of body of litchi-beetroot blended RTS beverage

Treatments	Storage period (days)				
	0	30	60	90	Mean
T ₁ (100:0 :: Litchi: Beetroot)	7.70	7.30	6.70	6.40	7.03
T ₂ (95:05 :: Litchi: Beetroot)	7.00	6.90	6.80	6.60	6.83
T ₃ (90:10 :: Litchi: Beetroot)	7.15	7.00	6.80	6.50	6.86
T ₄ (85:15 :: Litchi: Beetroot)	7.30	7.10	6.80	6.60	6.95
T ₅ (80:20 :: Litchi: Beetroot)	7.50	7.30	7.10	6.90	7.20
T ₆ (75:25 ::Litchi: Beetroot)	8.40	8.00	7.70	7.50	7.90
T ₇ (70:30 ::Litchi: Beetroot)	7.40	7.20	7.00	6.80	7.10
Mean	7.49	7.26	6.99	6.76	

Factors	C.D.(P=0.05)
Treatment (A)	0.01
Storage (B)	0.01
Treatment X Storage (A X B)	0.03

Table 7: Effect of treatments and storage period on mean score evaluation of taste of litchi-beetroot blended RTS beverage

Treatments	Storage period (days)				
	0	30	60	90	Mean
T ₁ (100:0 :: litchi: beetroot)	7.80	7.40	7.00	6.70	7.23
T ₂ (95:05 :: Litchi: Beetroot)	7.50	7.50	6.80	6.70	7.13
T ₃ (90:10 :: Litchi: Beetroot)	8.00	7.80	7.60	7.70	7.78
T ₄ (85:15 :: Litchi: Beetroot)	8.10	7.70	7.60	7.40	7.70
T ₅ (80:20 :: Litchi: Beetroot)	8.30	8.10	8.00	7.90	8.08
T ₆ (85:25 ::Litchi: Beetroot)	8.70	8.40	8.20	8.00	8.33
T ₇ (70:30 ::Litchi: Beetroot)	8.10	7.90	7.70	7.60	7.83
Mean	8.07	7.83	7.56	7.43	

Factors	C.D.(P=0.05)
Treatment (A)	0.01
Storage (B)	0.01
Treatment X Storage (A X B)	0.03

Conclusion

On the basis of sensory evaluation (colour, body and taste) T₆ (75:25:: litchi: beetroot) was found to be the best treatment in litchi-beetroot RTS.

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