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## Standardization and preparation of litchi-beetroot blended leather

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**Abstract**

Litchi is a delicious juicy fruit of excellent quality. It is very delicate fruit and highly perishable in nature. The attractive bright red colour turns to unpleasant brown colour within 24-48 hours which drastically reduces marketability of fruit. In the present study, the litchi and beetroot pulp were blended in the ratios of 100:00, 95:05, 90:10, 85:15, 80:20, 75:25 and 70:30 for the preparation of leather, 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 advancement of storage, phosphorus and iron contents decreased. Sensory evaluation of leather revealed that treatment T<sub>6</sub> recorded the highest scores for colour (8.33), texture (8.25) and taste (8.15) followed by treatment T<sub>5</sub>(80:20: litchi: beetroot).

**Keywords:** Standardization, preparation, litchi-beetrootm blended, leather

**Introduction**

The Litchi (*Litchi chinensis* Sonn.) is the most important sub-tropical evergreen tree and belongs to the Soapberry family Sapindaceae and sub-family Nephelaceae which has 125 genere and nearly 1000 species. The genus, Litchi, has two species, *Litchi philippinensis* and *Litchi Chinensis*, usually known as Pearl of India. Litchi fruit is famous for its excellent quality, characteristic pleasant flavour and for attractive red colour (Mehta, 2017) [10]. In order to keep the fruit available round the year in the market several litchi based products are developed (Reyes *et al.*, 2016) [4]. Litchis are generally eaten fresh, but can also be consumed as other products like dried litchi, litchi juice, canned litchi, frozen litchi, litchi honey, litchi wine, litchi squash to name a few (Sarkar *et al.*, 2018) [15].

Beetroot juice contains a high level of biologically accessible antioxidants (Wootton-Beard *et al.*, 2011) [21] as well as many other health promoting compounds such as potassium, magnesium, folic acid, iron, zinc, calcium, phosphorus, sodium, biotin, vitamin B6 and soluble fibre. High potassium in it keeps the normal blood pressure according to the experimental proof conducted with beetroot juice (Kapil *et al.*, 2010) [7]. The beetroot juice is very powerful and an excellent purifier and effective in cleaning liver, kidney and arteries. Beetroot is a potential source of valuable water soluble nitrogenous pigments, called betalins. Betalins have been extensively used in the modern food industry. They are one of the most important natural colourant. Betalins have several applications in food items, such as desserts, confectionaries, dry mixes, dairy and meet products (Sri Vidhya and Radhai Sri, 2018; Gupta, 2019) [17, 4]. The litchi pulp has milky white colour and contains pleasant aroma and flavour which makes it suitable for blending with other pulp to improve their acceptability.

**Material and Methods**

Different treatment combinations of litchi and beetroot pulp *i.e* T<sub>1</sub>: 100:00, T<sub>2</sub>:95:05, T<sub>3</sub>:90:10, T<sub>4</sub>:85:15, T<sub>5</sub>:80:20, T<sub>6</sub>:75:25 and T<sub>7</sub>:70:30 were made by blending litchi pulp with beetroot pulp for the preparation of leather. The total soluble solids of the mixture were raised to 25 °Brix by addition of sugar and then pectin and citric acid were added. The mixture was heated to 90 °C for 3 minutes. The final mixture of pulp was spread on aluminum trays with thickness of 3 mm and dried in cabinet drier at 70 °C for 24 hours. After drying, blended leather was cut into small pieces, packed in butter paper and then kept in pouches. Blended leather pouches were stored under ambient conditions for three months and then analyzed at an interval of one month. The stored samples were analyzed for phosphorus and iron contents as per the method described by Singh *et al.* 1999 [16]. 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) [2].

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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).

## Results and Discussion

### Phosphorous

The data presented in Table 1 showed the effect of various treatments and storage period on phosphorous content of litchi-beetroot blended fruit leather. The data revealed that treatments significantly influenced the phosphorous content of litchi-beetroot blended fruit leather. At initial day of storage, the highest phosphorous content of (30 mg/100g) was recorded in treatment T<sub>7</sub> (100:0::litchi: beetroot) and lowest (16.20 mg/100g) in treatment T<sub>1</sub>(100:0::litchi: beetroot). After 90 days of storage the values decreased to (22.30 mg/100 g) in T<sub>7</sub> (70:30::litchi: beetroot) and (13.40 mg/100g) in T<sub>1</sub> (100:0::litchi: beetroot).

Phosphorous content was significantly affected by storage period. There was significant decrease in Phosphorous content of litchi-beetroot blended leather from 0 to 90 days of storage. The mean values of storage period showed a decrease from initial value of 23.21 to 17.59 (mg/100 ml) after 90 days of storage. Pandita *et al.* (2018) <sup>[11]</sup> also reported decrease in phosphorus content in aonla ladoo. Similar findings were also reported by Tanwar *et al.* (2014) <sup>[18]</sup> while working on the processing of guava products.

**Table 1:** Effect of treatments and storage period on phosphorous content (mg/100g) of litchi-beetroot blended fruit leather.

Treatments	Storage period (days)				
	0	30	60	90	Mean
T <sub>1</sub> (100:0:: Litchi: Beetroot)	16.20	15.40	14.90	13.40	14.98
T <sub>2</sub> (95:05:: Litchi: Beetroot)	17.90	16.30	15.70	14.00	15.98
T <sub>3</sub> (90:10:: Litchi: Beetroot)	20.35	18.15	17.75	15.90	18.04
T <sub>4</sub> (85:15:: Litchi: Beetroot)	23.40	21.05	19.00	17.60	20.26
T <sub>5</sub> (80:20:: Litchi: Beetroot)	25.10	22.40	20.10	18.30	21.48
T <sub>6</sub> (75:25:: Litchi: Beetroot)	29.50	25.05	23.40	21.65	24.90
T <sub>7</sub> (70:30:: Litchi: Beetroot)	30.00	25.50	24.00	22.30	25.45
Mean	23.21	20.55	19.26	17.59	

Factors CD (P=0.05)

Treatment (A) 0.01

Storage (B) 0.01

Treatment X Storage (A X B) 0.03

### Iron

The data presented in Table-2 showed the effect of various treatments and storage period on iron content of litchi-beetroot blended fruit leather. The data revealed that treatments significantly influenced the iron content of litchi-beetroot blended leather. At initial day of storage, the highest iron content of (0.36 mg/100g) was recorded in treatment T<sub>7</sub>(100:0::litchi: beetroot) and lowest (0.20 mg/100g) in treatment T<sub>1</sub>(100:0::litchi: beetroot). After 90 days of storage the values decreased to 0.26 mg/100g in T<sub>7</sub> (70:30::litchi: beetroot) and (0.16 mg/100g) in T<sub>1</sub> (100:0::litchi: beetroot). There was significant decrease in iron content of litchi-beetroot blended fruit leather from 0 to 90 days of storage. The mean values of storage period showed a decreasing trend from initial value of 0.27 to 0.21(mg/100g) after 90 days of storage. The interaction between treatments and storage period was not found significant. Wani *et al.* (2013) <sup>[20]</sup> also noticed decrease in iron content in karonda jam with the increase in storage period. Tanwar *et al.* (2014) <sup>[18]</sup> also reported similar findings in guava products.

**Table 2:** Effect of treatments and storage period on iron content (mg/100g) of litchi-beetroot blended fruit leather.

Treatments	Storage period (days)				
	0	30	60	90	Mean
T <sub>1</sub> (100:0:: litchi: Beetroot)	0.20	0.18	0.17	0.16	0.18
T <sub>2</sub> (95:05:: Litchi: Beetroot)	0.23	0.20	0.19	0.18	0.20
T <sub>3</sub> (90:10:: Litchi: Beetroot)	0.25	0.23	0.21	0.19	0.22
T <sub>4</sub> (85:15:: Litchi: Beetroot)	0.26	0.24	0.22	0.20	0.23
T <sub>5</sub> (80:20:: Litchi: Beetroot)	0.29	0.26	0.24	0.22	0.25
T <sub>6</sub> (75:25:: Litchi: Beetroot)	0.32	0.29	0.25	0.23	0.27
T <sub>7</sub> (70:30:: Litchi: Beetroot)	0.36	0.33	0.28	0.26	0.31
Mean	0.27	0.25	0.22	0.21	

Factors C D (P=0.05)

Treatment (A) 0.01

Storage (B) 0.02

Treatment X Storage (A X B) NS

### Microbial count

It is clear from the data in Table-3 that up to 60 days of storage there was no microbial growth. After 90 days of storage the maximum microbial count of  $1.70 \times 10^2$  cfu/g was recorded in treatment T<sub>5</sub> (85:15::litchi:beetroot) and minimum of  $1.30 \times 10^2$  cfu/g in treatments T<sub>1</sub> (100:00::litchi: beetroot) and T<sub>4</sub> (85:15::litchi: beetroot). There was an increase in mean values of microbial count from 0.00 to  $1.40 \times 10^2$  cfu/g during 90 days of storage period, which is considered as significantly low and safe for consumption. The reason for increase in microbial count might be due to the contamination during handling and packing as reported by Labuza *et al.* (1972) <sup>[9]</sup> in intermediate moisture foods. Similar results have been reported by Chibber *et al.* 2019 <sup>[4]</sup> in IMF beetroot cubes and Pandita and Gupta, 2019 <sup>[12]</sup> in aonla ladoo. Akhtar *et al.* (2014) <sup>[11]</sup> noticed an increase in the microbial population in apple-date fruit bar with the progress in the storage period.

**Table 3:** Effect of treatments and storage period on microbial population (cfu/g) of litchi-beetroot blended fruit leather.

Treatments	Storage period (days)				
	0	30	60	90	Mean
T <sub>1</sub> (100:0:: Litchi: Beetroot)	N.D.	N.D.	N.D.	1.30	0.32
T <sub>2</sub> (95:05:: Litchi: Beetroot)	N.D.	N.D.	N.D.	1.40	0.35
T <sub>3</sub> (90:10:: Litchi: Beetroot)	N.D.	N.D.	N.D.	1.40	0.35
T <sub>4</sub> (85:15:: Litchi: Beetroot)	N.D.	N.D.	N.D.	1.30	0.32
T <sub>5</sub> (80:20:: Litchi: Beetroot)	N.D.	N.D.	N.D.	1.70	0.42
T <sub>6</sub> (75:25:: Litchi: Beetroot)	N.D.	N.D.	N.D.	1.33	0.33
T <sub>7</sub> (70:30:: Litchi: Beetroot)	N.D.	N.D.	N.D.	1.40	0.35
Mean					

Factors CD (P=0.05)

Treatment (A) 0.00

Storage (B) 0.00

Treatment X Storage (A X B) 0.01

### Colour

It is evident from Table-4 that colour score of litchi-beetroot blended fruit leather decreased significantly during entire storage period. At initial day the maximum score of 8.50 was observed in T<sub>6</sub> (75: 25::litchi:beetroot) followed by 8.20 in T<sub>5</sub> (80:20::litchi:beetroot). After 90 days of the storage period, scores decreased to 8.10 in T<sub>6</sub> (75:25::litchi:beetroot) and 7.80 in T<sub>5</sub> (80:20::litchi:beetroot) respectively. All treatments differed significantly as for treatments and storage periods are concerned. The highest overall mean score of 8.33 was recorded in T<sub>6</sub> (75:25::litchi:beetroot) followed by treatment T<sub>5</sub> (80:20::litchi:beetroot). During storage period, there was

significant decrease in the mean score from 7.80 at initial day to 7.37 after 90 days of storage period. The decrease in colour appeal may be due to browning reactions occurred in leather during storage period. Similar findings have been reported by Gupta *et al.* 2020 [6] in bael preserve and (Vennilla, 2004) [19] in Guava-papaya fruit bar.

**Table 4:** Effect of treatments and storage period on mean score evaluation of color of litchi-beetroot blended fruit leather.

Treatments	Storage period (days)				
	0	30	60	90	Mean
T <sub>1</sub> (100:0:: litchi: Beetroot)	7.00	6.90	6.80	6.60	6.83
T <sub>2</sub> (95:05:: Litchi: Beetroot)	7.30	7.20	7.00	6.90	7.10
T <sub>3</sub> (90:10:: Litchi: Beetroot)	7.50	7.30	7.30	7.10	7.30
T <sub>4</sub> (85:15:: Litchi: Beetroot)	7.90	7.70	7.50	7.40	7.63
T <sub>5</sub> (80:20:: Litchi: Beetroot)	8.20	8.10	8.00	7.80	8.03
T <sub>6</sub> (75:25:: Litchi: Beetroot)	8.50	8.40	8.30	8.10	8.33
T <sub>7</sub> (70:30:: Litchi: Beetroot)	8.20	8.00	7.90	7.70	7.95
Mean	7.80	7.66	7.54	7.37	

Factors CD (P=0.05)

Treatment (A) 0.01

Storage (B) 0.01

Treatment X Storage (A X B) 0.03

### Texture

Table-5 illustrates the average scores of litchi-beetroot blended fruit leather at different intervals during the storage period. The data revealed that the maximum score of 8.40 was recorded in T<sub>6</sub> (75:25::litchi: beetroot) followed by 7.90 in T<sub>5</sub> (80:20::litchi: beetroot). After 90 days of the storage period, 8.10 was recorded in T<sub>6</sub> (75:25::litchi: beetroot) followed by T<sub>5</sub> (80:20::litchi: beetroot). The mean value of treatments varied significantly and the highest mean score of 8.25 was registered in T<sub>6</sub> (75:25::litchi: beetroot) and 7.68 in T<sub>5</sub> (80:20::litchi: beetroot). During storage period, there was a significant decrease in the mean score from 7.66 at initial day to 7.29 after 90 days of storage period. A gradual decrease in texture score is due to hardening effect resulting from loss of moisture during storage. A decreasing trend in the scores of texture was also observed by Chavan and Shaik, 2015 during storage period.

**Table 5:** Effect of treatments and storage period on mean score evaluation of texture of litchi-beetroot blended fruit leather.

Treatments	Storage period (days)				
	0	30	60	90	Mean
T <sub>1</sub> (100:0:: Litchi: Beetroot)	7.40	7.30	7.00	7.00	7.18
T <sub>2</sub> (95:05:: Litchi: Beetroot)	7.30	7.10	7.00	6.90	7.08
T <sub>3</sub> (90:10:: Litchi: Beetroot)	7.30	7.20	7.10	7.00	7.15
T <sub>4</sub> (85:15:: Litchi: Beetroot)	7.50	7.40	7.30	7.20	7.35
T <sub>5</sub> (80:20:: Litchi: Beetroot)	7.90	7.80	7.60	7.40	7.68
T <sub>6</sub> (75:25:: Litchi: Beetroot)	8.40	8.30	8.20	8.10	8.25
T <sub>7</sub> (70:30:: Litchi: Beetroot)	7.80	7.70	7.60	7.40	7.63
Mean	7.66	7.54	7.40	7.29	

Factors CD (P=0.05)

Treatment (A) 0.01

Storage (B) 0.01

Treatment X Storage (A X B) 0.03

### Taste

A perusal of data in Table-6, revealed that the sensory scores of taste of litchi-beetroot blended fruit leather showed a significant gradual decrease up to end of 90 days storage period. At initial day, the maximum score of 8.30 was recorded in T<sub>6</sub> (75:25::litchi:beetroot) followed by 8.10 in T<sub>5</sub> (80:20::litchi: beetroot). After 90 days of storage, the values

decreased to 8.00 in T<sub>6</sub> (75:25::litchi: beetroot) followed by 7.60 in T<sub>5</sub>(80:20::litchi: beetroot) respectively. In case of treatment the highest mean score of 8.15 was assigned to T<sub>6</sub> (75:25::litchi: beetroot) followed by 7.85 to T<sub>5</sub> (80:20::litchi: beetroot). During storage period, there was significant decrease in mean score from 7.74 at initial day to 7.21 at end of 90 day of storage period. This might be due to proper blending of sugar and acidity as well as consistency of the guava leather. A decreasing trend in the scores of taste was also observed by Kharchi (2012) [8] in tamarind leather and Pangotra *et al.* (2018) [13] in phalsa blended crush.

**Table 6:** Effect of treatments and storage period on mean score evaluation of taste of litchi-beetroot blended fruit leather.

Treatments	Storage period (days)				
	0	30	60	90	Mean
T <sub>1</sub> (100:0:: litchi: Beetroot)	7.90	7.70	7.40	7.00	7.50
T <sub>2</sub> (95:05:: Litchi: Beetroot)	7.20	7.10	6.90	6.80	7.00
T <sub>3</sub> (90:10:: Litchi: Beetroot)	7.20	7.00	6.90	6.60	6.93
T <sub>4</sub> (85:15:: Litchi: Beetroot)	7.50	7.30	7.10	7.00	7.23
T <sub>5</sub> (80:20:: Litchi: Beetroot)	8.10	7.90	7.80	7.60	7.85
T <sub>6</sub> (75:25:: Litchi: Beetroot)	8.30	8.20	8.10	8.00	8.15
T <sub>7</sub> (70:30:: Litchi: Beetroot)	8.00	7.90	7.70	7.50	7.77
Mean	7.74	7.59	7.41	7.21	

Factors CD (P=0.05)

Treatment (A) 0.01

Storage (B) 0.02

Treatment X Storage (A X B) 0.03

### Conclusion

On the basis of sensory evaluation (colour, texture and taste) T<sub>6</sub> (75:25:: litchi: beetroot) was found to be the best treatment followed by treatment T<sub>5</sub> (80:20:: litchi: beetroot).

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