

## QUALITY ANALYSIS OF VALUE ADDED LASSI

Dr. P. Indumathy<sup>1</sup> Dr.M.Raju<sup>2</sup> and K. Kanimozhi<sup>3</sup>

<sup>1</sup> Associate Professor and Head,  
Department of Foods and Nutrition, Vellalar College for Women, Erode,  
Tamil Nadu, India;  
indumathy@vcw.ac.in

<sup>2</sup> Associate Professor and Head, Department of Economics,  
Gobi Arts & Science College, Gobichettipalayam

<sup>3</sup> PG Student, Department of Foods and Nutrition, Vellalar College for  
Women.

### ABSTRACT

Lassi is a popular traditional yogurt-based drink from the Indian Subcontinent. It is a blend of yogurt, water, spices and sometimes fruits<sup>1</sup>. In the present study lassi was incorporated with carrot, beetroot and mint purees to increase the nutritional properties, flavour, taste and colour. Nutrients like vitamin – A, vitamin – C, potassium, iron and dietary fiber are higher in purees incorporated lassi while compared with standard lassi. Physicochemical properties like pH, total soluble solids, titrable acidity and ash content were analysed. The incorporated lassi were organoleptically evaluated by 25 semi trained panel members for appearance, colour, flavor, taste, consistency and overall acceptability by using nine-point hedonic rating test. Microbial analysis was done on 4<sup>th</sup> day in the lassi kept under refrigeration. Cost for preparing 100ml standard lassi and purees incorporated lassi were calculated and also compared with other brands. On the basis of findings, it was concluded that 30% carrot puree incorporated lassi, 20% beetroot puree incorporated lassi and 15% mint puree incorporated lassi were highly acceptable among the other variations and standard lassi. The cost of purees incorporated lassi was found to be affordable.

**Key words:** Lassi, carrot, beetroot, mint leaves, purees, organoleptic evaluation, nutrient content.

### 1. INTRODUCTION

Milk is a nutritious food secreted by the mammary glands of mammals<sup>2</sup>. Lassi prepared from milk is one of the most popular options all over the globe liked by people of all age groups. It resolves health problems and also provides enough nutrition at a low cost to a large population<sup>3</sup>. Utilization of fruits and vegetables in milk products for value addition is a great challenge to dairy processing industry. Now-a-days consumers prefer value added milk products which are rich in vitamins and minerals. There is a large scope in dairy processing industry for conversion of milk into innovative fruits and vegetable-based milk products<sup>4</sup>.

In human nutrition carrot (*Daucus carota L.*) is one of the commonly used vegetables. It is broadly accepted and easily obtainable vegetable, which is rich in  $\beta$  carotene, ascorbic acid, tocopherol and classified as vitaminized food<sup>5</sup>. All age groups can consume functional and healthy dairy products which are fortified with carrot. As carrot is affordable in cost as well, it serves as fruitful method for dairy fortification and also imparts an attractive colour to

the dairy product<sup>6</sup>. Also, carrots are good source of carbohydrate, calcium, phosphorous, potassium, iron, magnesium, copper, manganese and sulphur. It is an excellent source of vitamin A, B1, B2, C, E, thiamine, folic acid and riboflavin however lack protein and fat. It reduces the enzymes that promote the conversation of pre-carcinogens to carcinogens. On the other hand, lassi is rich in protein and fat but is deficient in iron and vitamin C<sup>7</sup>.

Like many modern vegetables, beetroot was first cultivated by the Romans. By the 19th century it held great commercial value when it was discovered that beets could be converted into sugar<sup>8</sup>. Beetroot juice is also known to be healthy for sports persons. Beetroot is rich in several other bioactive compounds that may provide health benefits, particularly for disorders characterized by chronic inflammation; it also significantly reduces systolic and diastolic blood pressure. Beetroot is a rich source of phytochemical compounds that includes ascorbic acid, carotenoids, phenolic acids and flavonoids. Several beetroot varieties exist; among those the most outstanding ones are the red (beetroot) and the white beet (sugar beet). Both are very rich in sugar which is much more assumable than that of the sugar cane. They are also very rich in starch. Both possess eatable roots, and their leaves can be used as a vegetable. Being much more flavourful, the red beet is the one that is generally dedicated to human feeding as while the white one is dedicated fundamentally to the production of sugar or the animal feeding<sup>9</sup>.

The use of herbs in combination with different food has become regular practice to conserve the functional as well as nutritional attributes from herb. Many food items in the market available by different company are popular due to their acceptability and functionality viz. Herbal beverages, Arjuna ghee, and yoghurt. Menthol (*Mentha arvensis*) belongs to the family Libeaceae is a common edible and aromatic perennial herb which is cultivated throughout India. Common name is pudina. The aromatic leaves widely used for flavouring foods and beverages. In beverages pudina is used as a cooling and flavouring agent<sup>10</sup>.

## 2. MATERIALS AND METHODS

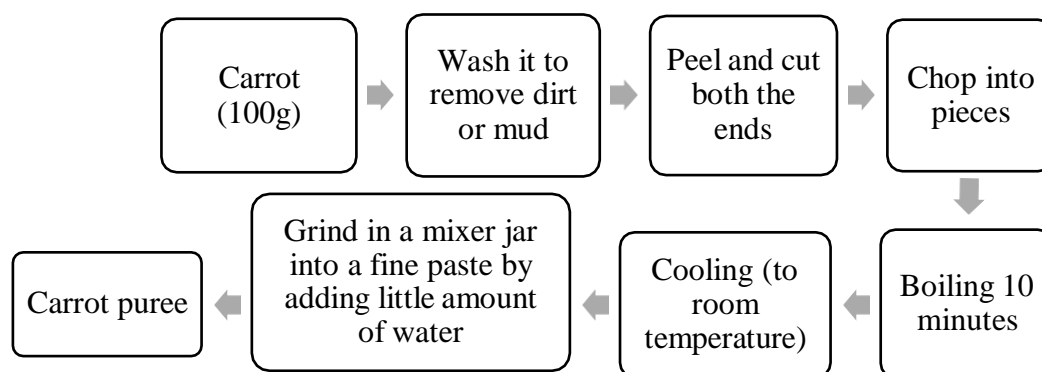
### 2.1 Selection and Screening of Raw Materials

The raw materials such as buffalo milk and curd were procured from dairy farm in Erode. Other raw materials like carrot, beetroot, mint leaves and sugar were bought from vegetable market and grocery in Erode.

### 2.2 Processing of Puree from Carrot, Beetroot and Mint Leaves

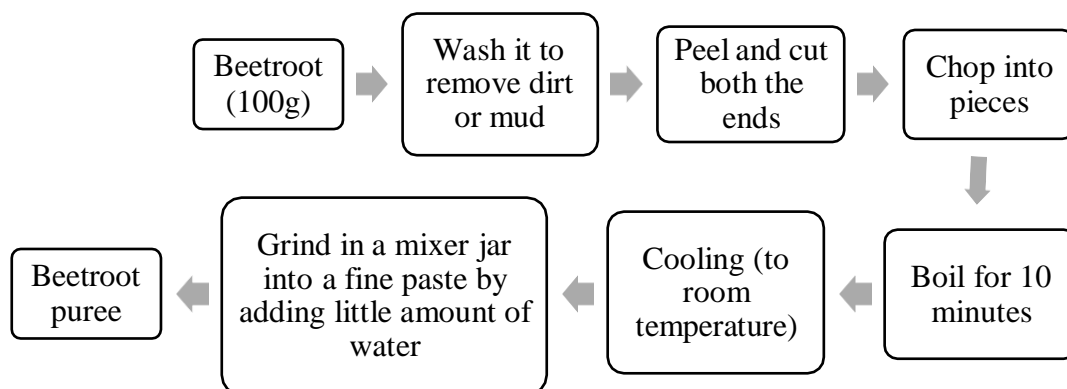
#### 2.2.1 Carrot Puree

100 g carrot was washed thoroughly, and both ends were removed, peeled further using a peeler and cut into pieces. The carrot pieces were boiled for 10 minutes to tenderize the pulp. After cooling these pieces were blended in a mixer to obtain a fine puree. The flow chart for preparation of beetroot puree is given in Figure 1.

**Figure 1: Flow Chart for Preparation of Carrot Puree**

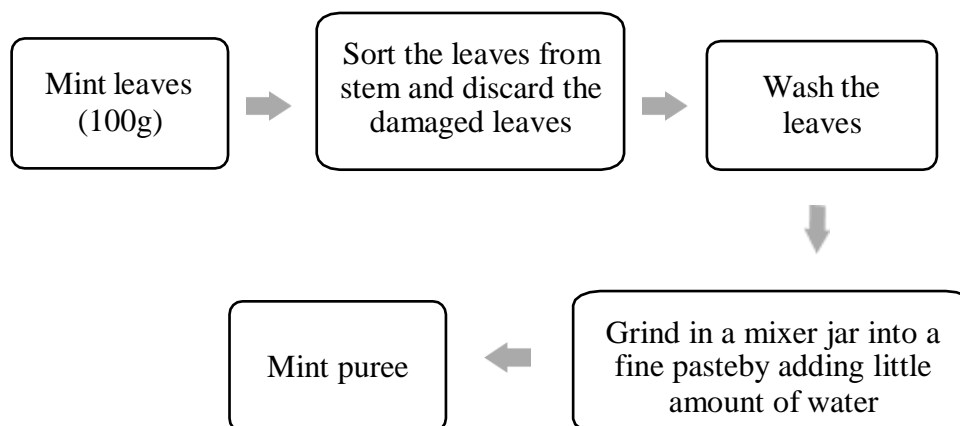
### 2.2.2 Beetroot Puree

100g beetroot was washed thoroughly, and both ends were removed, peeled further using a sharp knife or a peeler and cut into pieces. Boil the beetroot pieces for 10 minutes to tenderize the pulp. These pieces were blended in a mixer to obtain a fine puree. The flow chart for preparation of beetroot puree is given in Figure 2.

**Figure 2: Flowchart for Preparation of Beetroot Puree**

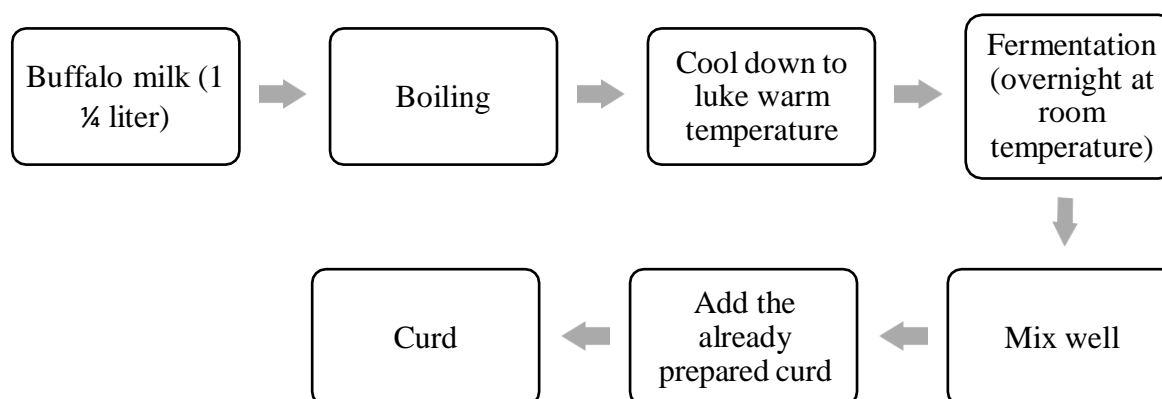
### 2.2.3 Mint Puree

100g mint leaves was sorted from stem without any damaged leaves and wash it. Put it in a mixer jar, add little water and grind it into a fine puree. The flow chart for preparation of mint puree is given in Figure 3.

**Figure 3: Flowchart for Preparation of Mint Puree**

### 2.3 Preparation of Curd

Boil 1¼ liter buffalo milk and cool down to luke-warm temperature and add little amount of curd that is already fermented and stir well. Cover and allow it to ferment overnight at room temperature without disturbing it. The flow chart for preparation of curd is given in Figure 4.

**Figure 4: Flow Chart for Preparation of Curd**

### 2.4 Preparation of Lassi

#### 2.4.1 Standard Lassi

Take already prepared curd (70g) in a bowl, add little amount of water (20ml) and powdered sugar (10g). Beat well and refrigerate it for an hour.

#### 2.4.2 Carrot Lassi

Take 70g of curd in four separate bowls and beat well. To all the bowls add 10g of powdered sugar and 10ml water. Add prepared carrot puree in three different proportions of 10%, 20% and 30%. Mix well and refrigerate for one hour.

### 2.4.3 Beetroot Lassi

Take 70g of curd in four separate bowls and beat well. To all the bowls add 10g of powdered sugar and 10ml water. Add prepared beetroot puree in three different proportions of 10%, 20% and 30%. Mix well and refrigerate for one hour.

### 2.4.4 Mint Lassi

Take 70g of curd in four separate bowls and beat well. To all the bowls add 10g of powdered sugar and 10ml water. Add prepared mint puree in three different proportions of 5%, 10%, and 15%. Mix well and refrigerate for one hour.

## 2.5 Organoleptic Evaluation of Purees Incorporated Lassi

The standard lassi and purees incorporated lassi were organoleptically evaluated by 25 semi trained panel members for appearance, colour, texture, flavour, taste and overall acceptability using nine – point hedonic rating test score card.

## 2.6 Physico Chemical Properties of Purees Incorporated Lassi

The total soluble solids, titrable acidity and pH were analysed for 100ml standard lassi and for the best variations of purees incorporated lassi.

## 2.7 Nutrient Analysis of Purees Incorporated Lassi

Nutrients like vitamin – C and vitamin - A by UV spectrophotometer method, iron by AAS method, dietary fibre by frosky method and potassium by flame photometry method were analysed for standard lassi and purees incorporated lassi.

## 2.8 Microbial Analysis of Purees Incorporated Lassi

Microbial analysis was done on 4<sup>th</sup> day for standard lassi and purees incorporated lassi which were kept under refrigeration.

## 3. RESULTS AND DISCUSSION

### 3.1 Yield of Puree after Processing

The weight of carrot, beetroot and mint leaves used for puree before and after processing are presented in Table 1.

**Table 1: Yield of Puree after Processing**

Ingredients	Before Processing (g)	Puree (g)
Carrot	100	130
Beetroot	100	110
Mint leaves	100	65

The total weight of carrot and beetroot before and after peeling, cutting and boiling process were found to be increased from 100g to 130g and 110g respectively. The weight of mint leaves was reduced from 100g to 65g after sorting and grinding process.

Table 2 represents the different varieties of lassi prepared and the level of incorporation of the different purees.

**Table 2: Varieties of lassi prepared**

S.No.	Type of lassi	Variations
1	Carrot lassi	C <sup>0</sup> - Standard lassi
2		C <sup>10</sup> – 10% carrot puree incorporated lassi
3		C <sup>20</sup> – 20% carrot puree incorporated lassi
4		C <sup>30</sup> – 30% carrot puree incorporated lassi
5	Beetroot lassi	B <sup>0</sup> - Standard lassi
6		B <sup>10</sup> – 10% beetroot puree incorporated lassi
7		B <sup>20</sup> – 20% beetroot puree incorporated lassi
8		B <sup>30</sup> – 30% beetroot puree incorporated lassi
9	Mint lassi	M <sup>0</sup> - Standard lassi
10		M <sup>5</sup> – 5% mint puree incorporated lassi
11		M <sup>10</sup> – 10% mint puree incorporated lassi
12		M <sup>15</sup> – 15% mint puree incorporated lassi

### 3.2 Acceptability of Purees Incorporated Lassi

With the formulated puree, three products like carrot lassi, beetroot lassi and mint lassi were prepared and subjected to organoleptic evaluation by 25 semi trained panel members with standard recipes along with structured 9-point hedonic rating test score card. The data obtained from the overall acceptability of organoleptic evaluation of purees incorporated lassi were also analyzed statistically using ‘t’ test. The mean scores of standard lassi, carrot, beetroot, mint puree incorporated lassi are given in Tables 3, 4 and 5.

**Table 3: Mean Acceptability Scores of Carrot Lassi**

Criteria	Mean ± Standard deviation			
	Carrot puree incorporated Lassi			
	C <sup>0</sup>	C <sup>10</sup>	C <sup>20</sup>	C <sup>30</sup>
Appearance	8.44 ± 0.50	8.48 ± 0.65	8.56 ± 0.65	8.96 ± 0.2
Colour	8.64 ± 0.48	8.48 ± 0.58	8.8 ± 0.40	9 ± 0
Flavour	8.44 ± 0.65	8.4 ± 0.70	8.44 ± 0.58	8.64 ± 0.63
Taste	8.4 ± 0.81	8.48 ± 0.58	8.6 ± 0.5	8.76 ± 0.52
Consistency	8.8 ± 0.5	8.84 ± 0.37	8.88 ± 0.33	8.92 ± 0.27
Overall acceptability	8.54 ± 0.17	8.53 ± 0.17	8.65 ± 0.18	<b>9.05 ± 0.41</b>
Groups compared		C <sup>0</sup> & C <sup>10</sup>	C <sup>0</sup> & C <sup>20</sup>	C <sup>0</sup> & C <sup>30</sup>
‘t’ value		0.0917 <sup>NS</sup>	0.9897 <sup>NS</sup>	3.6207 <sup>**</sup>

\*\* - Significant at 1% level NS – Not Significant

The overall acceptability of C<sup>30</sup> received the highest scores followed by C<sup>20</sup>, C<sup>0</sup> and C<sup>10</sup>. C<sup>30</sup> received the highest scores for all the criteria of organoleptic evaluation like appearance, color, flavor, taste and consistency. The statistical analysis of ‘t’ value between

C<sup>0</sup> & C<sup>30</sup> showed that the difference was significant at 1% level. However, the differences between C<sup>0</sup> & C<sup>10</sup> and C<sup>0</sup> & C<sup>20</sup> were not significant. C<sup>30</sup> was selected as the best carrot lassi.

**Table 4: Mean Acceptability Scores of Beetroot Lassi**

Criteria	Mean ± Standard deviation			
	Beetroot puree incorporated Lassi			
	B <sup>0</sup>	B <sup>10</sup>	B <sup>20</sup>	B <sup>30</sup>
Appearance	7.96 ± 0.97	8.12 ± 0.6	8.52 ± 0.58	8.28 ± 0.79
Colour	7.96 ± 0.78	8.24 ± 0.66	8.56 ± 0.71	8.56 ± 0.50
Flavour	7.64 ± 1.07	8.2 ± 0.64	8.24 ± 0.72	8.16 ± 0.94
Taste	7.64 ± 1.03	8.04 ± 0.84	8.28 ± 0.89	8.04 ± 1.01
Consistency	8.08 ± 0.86	8.04 ± 0.97	8.6 ± 0.70	8.28 ± 0.89
Overall acceptability	7.85 ± 0.20	8.12 ± 0.09	<b>8.44 ± 0.16</b>	8.26 ± 0.19
Groups compared		B <sup>0</sup> & B <sup>10</sup>	B <sup>0</sup> & B <sup>20</sup>	B <sup>0</sup> & B <sup>30</sup>
't' value		2.7102*	5.0118**	3.2684*

\* - Significant at 5 % level      \*\* - Significant at 1% level

The overall acceptability of B<sup>20</sup> received the highest scores followed by B<sup>30</sup>, B<sup>10</sup> and B<sup>0</sup>. B<sup>20</sup> received the highest scores for all the criteria of organoleptic evaluation like appearance, color, flavor, taste and consistency. The statistical analysis of 't' value between B<sup>0</sup> & B<sup>10</sup> and B<sup>0</sup> & B<sup>30</sup> showed that the difference was significant at 5% level. But B<sup>0</sup> & B<sup>20</sup> showed significant difference at 1% level. Therefore B<sup>20</sup> was selected as the best variation.

**Table 5: Mean Acceptability Scores Of Mint Lassi**

Criteria	Mean ± Standard deviation			
	Mint puree incorporated Lassi			
	M <sup>0</sup>	M <sup>5</sup>	M <sup>10</sup>	M <sup>15</sup>
Appearance	8.44 ± 0.50	8.52 ± 0.50	8.56 ± 0.50	8.52 ± 0.65
Colour	8.52 ± 0.50	8.52 ± 0.71	8.76 ± 0.43	8.68 ± 0.62
Flavour	8.4 ± 0.70	8.56 ± 0.50	8.52 ± 0.65	8.64 ± 0.7
Taste	8.44 ± 0.65	8.4 ± 0.5	8.24 ± 0.77	8.44 ± 0.82
Consistency	8.88 ± 0.43	8.72 ± 0.45	8.88 ± 0.33	8.96 ± 0.2
Overall acceptability	8.53 ± 0.19	8.54 ± 0.11	8.59 ± 0.24	<b>8.64 ± 0.19</b>
Groups compared		M <sup>0</sup> & M <sup>5</sup>	M <sup>0</sup> & M <sup>10</sup>	M <sup>0</sup> & M <sup>15</sup>
't' value		0.0954 <sup>NS</sup>	0.4207 <sup>NS</sup>	0.8643 <sup>NS</sup>

<sup>NS</sup> – Not Significant

The overall acceptability of M<sup>15</sup> received the highest scores followed by M<sup>10</sup>, M<sup>5</sup> and M<sup>0</sup>. M<sup>15</sup> received the highest scores for all the criteria of organoleptic evaluation like appearance, color, flavor, taste and consistency. M<sup>15</sup> was selected as the best mint lassi.

### 3.3 Physicochemical Properties of Purees Incorporated Lassi

The physicochemical properties such as ash content, total soluble solids, titrable acidity

and pH for standard lassi, 30% carrot puree incorporated lassi, 20% beetroot puree incorporated lassi and 15% mint puree incorporated lassi per 100 ml were determined and are presented in the Table 6.

**Table 6: Physicochemical Properties of Purees Incorporated Lassi**

Physicochemical parameters	Standard lassi	C <sup>30</sup>	B <sup>20</sup>	M <sup>15</sup>
TSS (%)	6.6	5.2	8.8	9.1
Titration acidity (%)	0.62	0.65	0.73	0.71
pH	8.9	9.4	8.8	5.7

Total soluble solids of standard lassi, C<sup>30</sup>, B<sup>20</sup> and M<sup>15</sup> are 6.6%, 5.2%, 8.8% and 9.1% respectively. Then the titration acidity of standard lassi, C<sup>30</sup>, B<sup>20</sup> and M<sup>15</sup> is 0.62%, 0.65%, 0.73% and 0.71%. pH was higher in C<sup>30</sup> (9.4) followed by standard lassi (8.9), B<sup>20</sup> (8.8) and M<sup>15</sup> (5.7).

### 3.4 Nutrient content of Purees Incorporated Lassi

The nutrient content of 100ml standard lassi, C<sup>30</sup>, B<sup>20</sup> and M<sup>15</sup> were analyzed using standard procedures and they are presented in Tables 7.

**Table 7: Nutrient Content of formulated Lassi**

Nutrients	Nutrient content per 100ml			
	Standard lassi	C <sup>30</sup>	B <sup>20</sup>	M <sup>15</sup>
Vitamin A/ Carotene (mcg)	160	1300	160	365
Potassium (mg)	32.4	37.6	45.8	33.5
Iron (mg)	1.1	1.4	1.8	2.6
Vitamin – C (mg)	6.2	8.9	8.1	9.2
Dietary fiber (g)	0.14	2.6	1.6	1.2

When compared to standard lassi, the formulated varieties had greater amount of nutrients like Vitamin A/Carotene (Standard lassi – 160 mcg, C<sup>30</sup> - 1300 mcg, B<sup>20</sup> - 160 mcg and M<sup>15</sup> - 365 mcg), Potassium (Standard lassi – 32.4 mg, C<sup>30</sup> - 37.6 mg, B<sup>20</sup> - 45.8mg and M<sup>15</sup> – 33.5 mg), Iron (Standard lassi – 1.1 mg, C<sup>30</sup> - 1.4 mg, B<sup>20</sup> - 1.8 mg and M<sup>15</sup> – 2.6 mg), Vitamin – C (Standard lassi – 6.2 mg, C<sup>30</sup> - 8.9 mg, B<sup>20</sup> - 8.1 mg and M<sup>15</sup> – 9.2 mg) and Dietary fiber (Standard lassi – 0.14 g, C<sup>30</sup> - 2.6 g, B<sup>20</sup> - 1.6g and M<sup>15</sup> – 1.2 g).

### 3.5 Microbial Analysis of Purees Incorporated Lassi

The microbial count of standard lassi and best variations of purees incorporated lassi kept under refrigeration for four days are given in Table 8.



**Table 8: Microbial Analysis of Standard Lassi and Purees Incorporated Lassi**

Microbial count (per ml)	Standard lassi	C <sup>30</sup>	B <sup>20</sup>	M <sup>15</sup>
Total Plate Count (TPC)	90X10 <sup>1</sup> CFU	21X10 <sup>2</sup> CFU	14X10 <sup>2</sup> CFU	12X10 <sup>2</sup> CFU

The total microbial count of standard lassi on the 4<sup>th</sup> day of refrigeration was 90X10<sup>1</sup> CFU. C<sup>30</sup> had 21X10<sup>2</sup> CFU, B<sup>20</sup> had 14X10<sup>2</sup> CFU and M<sup>15</sup> had 12X10<sup>2</sup> CFU and all of them were safe for human consumption.

### 3.6 Cost of Purees Incorporated Lassi

The cost of standard lassi, purees incorporated lassi and its comparison with other brands are given in Table 9.

**Table 9: Cost of Standard Lassi, Purees Incorporated Lassi and its Comparison with other Brands**

Criteria	Cost per 100ml (Rs.)
Standard lassi	17.00
Carrot lassi	18.00
Beetroot lassi	19.00
Mint lassi	21.00
Brand A	12.00
Brand B	13.00

The cost of 100ml standard lassi, 30% carrot puree incorporated lassi, 20% beetroot puree incorporated lassi and 15% mint puree incorporated lassi is Rs. 17, Rs. 18, Rs. 19 and Rs. 21. The cost of purees incorporated lassi produced was slightly high when compared with standard lassi (brand A - Rs. 12.00 and brand B – Rs. 13.00) available at the market commercially. The increase in the rate of lassi can be attributed to incorporation of vegetable purees which had different nutritional properties and improved flavour and taste.

## 4. CONCLUSION

On the basis of findings, it was concluded that 30% carrot puree incorporated lassi, 20% beetroot puree incorporated lassi and 15% mint puree incorporated lassi were found to be highly acceptable when compared to the other variations and standard lassi. They were also better in nutritional quality than the standard lassi. The cost of purees incorporated lassi was found to be affordable.

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