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## Sensory analysis of probiotic functional kulfi by using Indian blackberry (*Syzygium cumini* L.)

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### Abstract

Kulfi is defined as an indigenous product which resembles ice-cream or milk ice. Kulfi is the foremost Indian frozen desert which helps to develop small scale industry and generate sizeable employment and income. It's origin is uncertain, but it could have become widely used only after artificial ice became available. Kulfi is a nut ice-cream, frozen in small containers of conical shape. Sweetened milk, containing 20-25 percent added sugar is concentrated to about half of its volume and malai, crushed almonds, pistachio and flavouring materials such as vanilla and essence of rose are added after cooling. The present study was made with an attempt to develop a probiotic functional kulfi by using Indian blackberry (*Syzygium cumini* L.). Studied for its sensory properties such as color and appearance, flavour and taste, consistency and over all acceptability by trained panelist using 9 point hedonic scale. In the present investigation treatment K<sub>0</sub> is the control kulfi that doesn't contain any probiotic culture and powder of Indian blackberry and treatments K<sub>a</sub> to K<sub>r</sub> are the experimental kulfi which contain various proportion of sugar (10%, 15% and 20%), Indian blackberry powder (2%, 4% and 6%) and probiotic culture (1%, *Lactobacillus acidophilus* and *Bifidobacterium bifidus*). After sensory evaluation it was found that among all treatments K<sub>k</sub> scored higher in sensory evaluation and was considered as optimized product. The overall acceptability score of this treatment K<sub>r</sub> was (8.80) as compared to control K<sub>0</sub> (7.02).

**Keywords:** *Lactobacillus acidophilus*, *Bifidobacterium bifidum*, Jamun, Indian dairy product, functional foods, probiotic culture

### Introduction

Indian frozen dairy products are liked the most by most of the consumers, as it is quite cheap, palatable and nutritious. It is widely accepted and its demand is increasing day by day next to ice-cream. It is a typical frozen dessert sold by small milk vendors, halwais, sweet makers etc, in many parts of our country, specially in the summer season. Kulfi is the foremost Indian frozen desert which helps to develop small scale industry and generate sizeable employment and income. According to Warner (1976) [8] Kulfi is defined as an indigenous product which resembles ice-cream or milk ice. It's origin is uncertain, but it could have become widely used only after artificial ice became available. Kulfi is a nut ice-cream, frozen in small containers of conical shape. Sweetened milk, containing 20-25 percent added sugar is concentrated to about half of its volume and malai, crushed almonds, pistachio and flavouring materials such as vanilla and essence of rose are added after cooling (Parikh, 1977) [4]. In recent years, growing health consciousness has led to the development of novel dairy products, having therapeutic and nutritive value. Given this, Indian kulfi, the most commonly consumed Indian frozen dairy product, if enriched with probiotic culture and Indian blackberry (*Syzygium cumini* L.) powder, could result in increased acceptability, value addition and therapeutic value of the product.

### Use of powder of Indian blackberry in kulfi

Various fruit powder is used in kulfi to prepare functional kulfi with high potential health benefits. Indian blackberry powder contains high amount of dietary fibre and vitamin C and because of their antiproliferative, anti-inflammatory activities and antioxidant. The coloured fruits, specially berries, are highly chemo protective, so kulfi with Indian blackberry powder is good for human health (Aqil *et al.*, 2012) [1].

### Use of probiotics in kulfi

Probiotics in simple terms can be defined as living microorganisms which are consumed and have potent health benefits, these microbes include LAB (lactic acid bacteria), *Saccharomyces boulardii* etc. Probiotics are safe to consume and promote good microbial building in our body. They generally increases gut health and also increases vitamin synthesis.

Collins and Gibson, (1999) [3] noted that Probiotics, specially *Lactobacillus* and *Bifidobacteria*, are one of the most common methods for improving the balance of the intestinal micro flora. Probiotic microorganism also helps to increase blood metabolic activities, they create healthy microbial (bacterial) balances and helps to boost immunity as well.

Parker (1974) [5] Introduced the term “Probiotic” to describe “organisms and substances contributing to intestinal microbial balance.” In addition to this, they perform beneficial role against severe diseases such as constipation, hypertension, colitis, inflammatory bowel disease, cancer and food allergies etc. (Ashwell, 2002; Teitlbaum, 2005 and Thomsen, 2006) [2, 6, 7]. The following microorganisms are used in food.

Kulfi is traditionally prepared by evaporating sweetened and flavoured milk via slow cooking, it is a milk product which is widely consumed in India, if enriched with probiotic culture and Indian blackberry (*Syzygium cumini* L.) powder, could result in increased acceptability, value addition and therapeutic value of the product. The Indian blackberry is also known as jamun, jambul, jamblang, jambolan, black plum, Damson plum, Duhat plum, Jambolan plum, or Portuguese plum. The botanical name is *Syzygium cumini* L. Jamun, also known as black plum, is a popular summer fruit with numerous health and medical benefits. The Indian black plum is a carminative, anti-scorbutic, and diuretic that helps to ease stomach pain. Jamun is beneficial for reducing spleen enlargement, diarrhea, and urinary retention. Jamun's polyphenolic chemicals have been shown to be useful in the treatment of cancer, heart disease, diabetes, asthma, and arthritis. Jamun is used to treat a variety of digestive issues such as gas, bowel spasms, stomach ailments, and dysentery. Probiotic culture (*Lactobacillus acidophilus* and *Bifidobacterium bifidum*) is also beneficial to intestinal health in humans. The main objective of this study is to evaluate the sensory properties of optimized kulfi.

### Materials and Methods

The research, entitled “Process optimization for manufacturing probiotic functional kulfi by using Indian blackberry (*Syzygium cumini* L.)” was carried out in the laboratory of Warner College of Dairy Technology (WCDDT), Sam Higginbottom University of Agriculture Technology and Sciences (SHUATS), Allahabad, U.P., India.

### Procurement and collection of ingredients

For preparation of probiotic kulfi, the raw ingredients like

Buffalo's milk, sugar, Indian blackberry were bought from local shop of Allahabad, U.P., India.

#### ▪ Buffalo's milk

Buffalo's milk was bought from local shop of Allahabad. 8.5 per cent SNF, 13.00 per cent total solids and 0.13 per cent acidity.

#### ▪ Sugar

Commercial grade clean, white crystalline sugar was obtained from the local shop of Allahabad.

#### ▪ Stabilizers and emulsifier

Soy Lecithin and Soy Alginate was bought from local shop of Allahabad.

#### ▪ Indian blackberry

Natural Indian blackberry powder was procured from the local shop of Allahabad, U.P., India.

#### ▪ Probiotic cultures

Freeze-dried cultures viz., *Lactobacillus acidophilus* (14) and *Bifidobacterium bifidus* (232) were procured from The National Collection of Dairy Cultures, NDRI, Karnal (Haryana). These were sub cultured and maintained in the laboratory of Microbiology, WCDDT, SHUATS, Allahabad. The working cultures, maintained in plain skim milk were subculture once in a week.

### Sensory analysis

Sensory study was conducted out using Lawless and Heymann's method (2010). Sensory assessment was performed in the laboratory under environmental conditions using a 9-point hedonic rating scale. A total of ten trained panelists were chosen. They were stable postgraduate students in food technology (M. Tech and Ph.D. Research Scholars) between the ages of 23 and 30, with no medical conditions. Different parameters such as appearance, color, texture, flavor, taste, and overall acceptability were graded and scored by sensory panelists.

### Treatment combination of probiotic functional kulfi

#### Control or normal kulfi (k<sub>0</sub>)

K <sub>0</sub> – Buffalo milk + 10% sugar and without Indian blackberry powder and culture (Normal kulfi)
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#### Experimental kulfi (k<sub>a</sub> to k<sub>r</sub>)

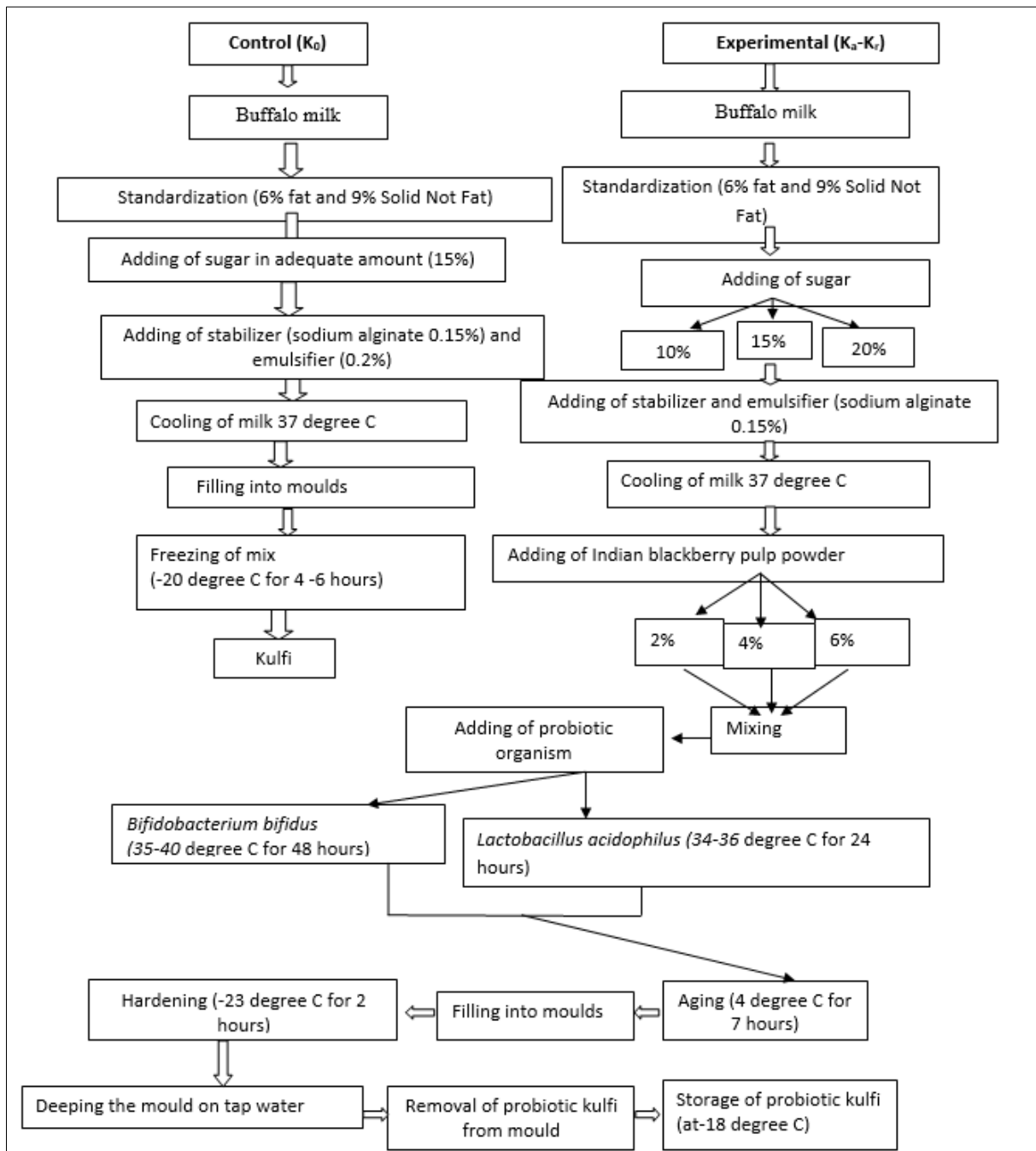
K <sub>a</sub> – Buffalo milk + 10% sugar +2% Indian blackberry powder +1% <i>Bifidobacterium bifidus</i>
K <sub>b</sub> – Buffalo milk + 10% sugar +4% Indian blackberry powder +1% <i>Bifidobacterium bifidus</i>
K <sub>c</sub> – Buffalo milk + 10% sugar +6% Indian blackberry powder +1% <i>Bifidobacterium bifidus</i>
K <sub>d</sub> – Buffalo milk + 10% sugar +2% Indian blackberry powder +1% <i>Lactobacillus acidophilus</i>
K <sub>e</sub> – Buffalo milk + 10% sugar +4% Indian blackberry powder +1% <i>Lactobacillus acidophilus</i>
K <sub>f</sub> – Buffalo milk + 10% sugar +6% Indian blackberry powder +1% <i>Lactobacillus acidophilus</i>
K <sub>g</sub> – Buffalo milk + 15% sugar +2% Indian blackberry powder +1% <i>Bifidobacterium bifidus</i>
K <sub>h</sub> – Buffalo milk + 15% sugar +4% Indian blackberry powder +1% <i>Bifidobacterium bifidus</i>
K <sub>i</sub> – Buffalo milk + 15% sugar +6% Indian blackberry powder +1% <i>Bifidobacterium bifidus</i>
K <sub>j</sub> – Buffalo milk + 15% sugar +2% Indian blackberry powder +1% <i>Lactobacillus acidophilus</i>
K <sub>k</sub> – Buffalo milk + 15% sugar +4% Indian blackberry powder +1% <i>Lactobacillus acidophilus</i>
K <sub>l</sub> – Buffalo milk + 15% sugar +6% Indian blackberry powder +1% <i>Lactobacillus acidophilus</i>
K <sub>m</sub> – Buffalo milk + 20% sugar +2% Indian blackberry powder +1% <i>Bifidobacterium bifidus</i>
K <sub>n</sub> – Buffalo milk + 20% sugar +4% Indian blackberry powder +1% <i>Bifidobacterium bifidus</i>
K <sub>o</sub> – Buffalo milk + 20% sugar +6% Indian blackberry powder +1% <i>Bifidobacterium bifidus</i>
K <sub>p</sub> – Buffalo milk + 20% sugar +2% Indian blackberry powder +1% <i>Lactobacillus acidophilus</i>
K <sub>q</sub> – Buffalo milk + 20% sugar +4% Indian blackberry powder +1% <i>Lactobacillus acidophilus</i>

**K<sub>f</sub>**– Buffalo milk + 20% sugar +6% Indian blackberry powder +1% *Lactobacillus acidophilus*

No of treatment – 18+1

No of replications: 5

Total no of trials: 95



**Fig 1:** Flow chart for manufacturing probiotic functional kulfi

**Result and Discussion**

**Table 1:** Showing colour and appearance score of final prepared kulfi

Treatments	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>	R <sub>5</sub>	Mean
K <sub>0</sub>	6.66	7.00	6.95	7.31	6.97	6.98
K <sub>a</sub>	7.33	7.37	7.32	7.38	7.34	7.35
K <sub>b</sub>	7.55	7.59	7.54	7.60	7.56	7.57
K <sub>c</sub>	7.68	7.72	7.67	7.73	7.69	7.70
K <sub>d</sub>	7.39	7.43	7.38	7.44	7.40	7.41
K <sub>e</sub>	7.50	7.54	7.49	7.55	7.51	7.52
K <sub>f</sub>	7.80	7.84	7.79	7.85	7.81	7.82
K <sub>g</sub>	7.18	7.22	7.17	7.23	7.19	7.20
K <sub>h</sub>	7.40	7.44	7.39	7.45	7.41	7.42

K <sub>i</sub>	7.58	7.62	7.57	7.63	7.59	7.60
K <sub>j</sub>	8.48	8.52	8.47	8.53	8.49	8.50
K <sub>k</sub>	9.08	9.12	9.07	9.13	9.09	9.10
K <sub>l</sub>	8.08	8.12	8.07	8.13	8.09	8.10
K <sub>m</sub>	7.48	7.52	7.47	7.53	7.49	7.50
K <sub>n</sub>	7.59	7.63	7.58	7.64	7.60	7.61
K <sub>o</sub>	7.98	8.02	7.97	8.03	7.99	8.00
K <sub>p</sub>	8.08	8.12	8.07	8.13	8.09	8.10
K <sub>q</sub>	8.19	8.23	8.18	8.24	8.20	8.21
K <sub>r</sub>	8.28	8.32	8.27	8.33	8.29	8.30
Mean						7.79
Minimum						6.98
Maximum						9.10
F- test				S		
S. Ed. (±)				0.308		
C. D. (P = 0.05)				0.613		

Inoculating probiotics and use of Indian blackberry powder in kulfi had a significant effect on colour and appearance score. Table 1 showing the colour and appearance score of final prepared kulfi. Control kulfi has colour and appearance score 6.98 and at different levels of Indian blackberry powder with 1% inoculation levels of probiotic culture (*Lactobacillus*

*acidophilus* and *Bifidobacterium bifidus*), the colour and appearance score in kulfi of different treatments was ranges from 7.20 - 9.10.

#### Flavour score of final prepared kulfi

**Table 2:** Table showing flavour score of final prepared kulfi

Treatments	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>	R <sub>5</sub>	Mean
K <sub>0</sub>	7.09	7.07	7.08	7.13	7.12	7.10
K <sub>a</sub>	7.27	7.55	7.46	7.51	7.6	7.48
K <sub>b</sub>	7.81	7.79	7.8	7.85	7.84	7.82
K <sub>c</sub>	7.7	7.68	7.69	7.74	7.73	7.71
K <sub>d</sub>	7.44	7.82	7.63	7.68	7.67	7.65
K <sub>e</sub>	7.8	7.78	7.79	7.84	7.83	7.81
K <sub>f</sub>	7.91	7.89	7.9	7.95	7.94	7.92
K <sub>g</sub>	7.39	7.37	7.38	7.43	7.42	7.40
K <sub>h</sub>	7.94	7.92	7.93	7.98	7.97	7.95
K <sub>i</sub>	7.59	7.57	7.58	7.63	7.62	7.60
K <sub>j</sub>	8.2	8.18	8.19	8.24	8.23	8.21
K <sub>k</sub>	8.89	8.87	8.88	8.93	8.92	8.90
K <sub>l</sub>	8.14	8.12	8.13	8.18	8.17	8.15
K <sub>m</sub>	7.69	7.67	7.68	7.73	7.72	7.70
K <sub>n</sub>	7.79	7.77	7.78	7.83	7.82	7.80
K <sub>o</sub>	7.49	7.47	7.48	7.53	7.52	7.50
K <sub>p</sub>	7.49	7.47	7.48	7.53	7.52	7.50
K <sub>q</sub>	7.7	7.68	7.69	7.74	7.73	7.71
K <sub>r</sub>	7.49	7.47	7.48	7.53	7.52	7.50
Mean						7.76
Minimum						7.10
Maximum						8.90
F- test				S		
S. Ed. (±)				0.284		
C. D. (P = 0.05)				0.566		

Inoculating probiotics and use of Indian blackberry powder in kulfi had a significant effect on flavour score. Table 2 showing the flavour score of final prepared kulfi. Control kulfi has flavour score 7.10 and at different levels of Indian blackberry powder with 1% inoculation levels of probiotic

culture (*Lactobacillus acidophilus* and *Bifidobacterium bifidus*), the flavour score in kulfi of different treatments was ranges from 7.40- 8.90.

#### Body and texture score

**Table 3:** Table showing body and texture score of final prepared kulfi

Treatments	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>	R <sub>5</sub>	Mean
K <sub>0</sub>	7.02	7.03	6.99	6.98	6.97	7.00
K <sub>a</sub>	7	7.25	7.09	7.08	7.07	7.10
K <sub>b</sub>	7.52	7.53	7.49	7.48	7.47	7.50
K <sub>c</sub>	7.32	7.33	7.29	7.28	7.27	7.30
K <sub>d</sub>	7.22	7.23	7.19	7.18	7.17	7.20
K <sub>e</sub>	7.63	7.64	7.6	7.59	7.58	7.61

K <sub>f</sub>	7.44	7.45	7.41	7.4	7.39	7.42
K <sub>g</sub>	7.02	7.33	7.29	7.18	7.17	7.20
K <sub>h</sub>	7.42	7.43	7.39	7.38	7.37	7.40
K <sub>i</sub>	7.12	7.13	7.09	7.08	7.07	7.10
K <sub>j</sub>	8.12	8.13	8.09	8.08	8.07	8.10
K <sub>k</sub>	8.52	8.53	8.49	8.48	8.47	8.50
K <sub>l</sub>	8.42	8.43	8.39	8.38	8.37	8.40
K <sub>m</sub>	7.92	7.93	7.89	7.88	7.87	7.90
K <sub>n</sub>	8.12	8.13	8.09	8.08	8.07	8.10
K <sub>o</sub>	7.82	7.83	7.79	7.78	7.77	7.80
K <sub>p</sub>	7.72	7.73	7.69	7.68	7.67	7.70
K <sub>q</sub>	7.82	7.83	7.79	7.78	7.77	7.80
K <sub>r</sub>	7.62	7.63	7.59	7.58	7.57	7.60
Mean						7.62
Minimum						7.00
Maximum						8.50
F- test				S		
S. Ed. (±)				0.240		
C. D. (P = 0.05)				0.478		

Inoculating probiotics and use of Indian blackberry powder in kulfi had a significant effect on body and texture score. Table 3 showing the body and texture score of final prepared kulfi. Control kulfi has body and texture score 7.00 and at different

levels of Indian blackberry powder with 1% inoculation levels of probiotic culture (*Lactobacillus acidophilus* and *Bifidobacterium bifidus*), the body and texture score in kulfi of different treatments was ranges from 7.10- 8.50.

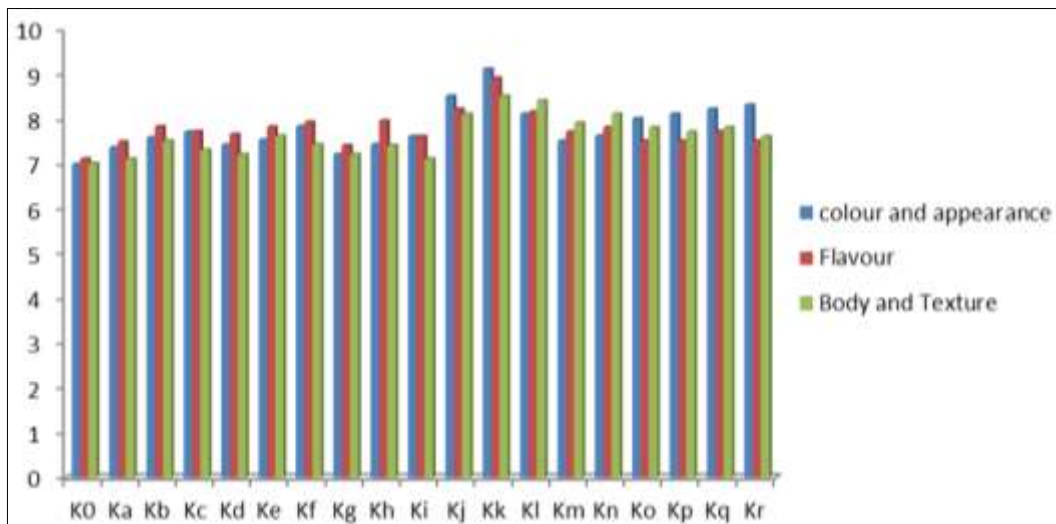


Fig 2: Graphical representation of colour and appearance, flavour and body and texture of final prepared kulfi

**Overall acceptability score of final prepared kulfi**

Table 4: Table showing overall acceptability score of final prepared kulfi

Treatments	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>	R <sub>4</sub>	R <sub>5</sub>	Mean
K <sub>0</sub>	6.99	7	7.05	7.04	7.01	7.02
K <sub>a</sub>	7.28	7.29	7.34	7.33	7.3	7.31
K <sub>b</sub>	7.3	7.71	7.86	7.65	7.62	7.63
K <sub>c</sub>	7.47	7.48	7.53	7.52	7.49	7.50
K <sub>d</sub>	7.39	7.4	7.45	7.44	7.41	7.42
K <sub>e</sub>	7.61	7.62	7.67	7.66	7.63	7.64
K <sub>f</sub>	7.69	7.7	7.75	7.74	7.71	7.72
K <sub>g</sub>	7.17	7.18	7.23	7.22	7.19	7.20
K <sub>h</sub>	7.56	7.57	7.62	7.61	7.58	7.59
K <sub>i</sub>	7.37	7.38	7.43	7.42	7.39	7.40
K <sub>j</sub>	8.17	8.18	8.23	8.22	8.19	8.20
K <sub>k</sub>	8.77	8.78	8.83	8.82	8.79	8.80
K <sub>l</sub>	8.18	8.19	8.24	8.23	8.2	8.21
K <sub>m</sub>	7.57	7.58	7.63	7.62	7.59	7.60
K <sub>n</sub>	7.8	7.81	7.86	7.85	7.82	7.83
K <sub>o</sub>	7.67	7.68	7.73	7.72	7.69	7.70
K <sub>p</sub>	7.73	7.74	7.79	7.78	7.75	7.76



K <sub>q</sub>	7.87	7.88	7.93	7.92	7.89	7.90
K <sub>r</sub>	7.77	7.78	7.83	7.82	7.79	7.80
Mean						7.70
Minimum						7.02
Maximum						8.80
F- test				S		
S. Ed. (±)				0.281		
C. D. (P = 0.05)				0.560		

Inoculating probiotics and use of Indian blackberry powder in kulfi had a significant effect on overall acceptability. Table 4 showing the overall acceptability score of final prepared kulfi. Control kulfi has overall acceptability score 7.02 and at different levels of Indian blackberry powder with 1%

inoculation levels of probiotic culture (*Lactobacillus acidophilus* and *Bifidobacterium bifidus*), the overall acceptability score in kulfi of different treatments was ranges from 7.20- 8.80.

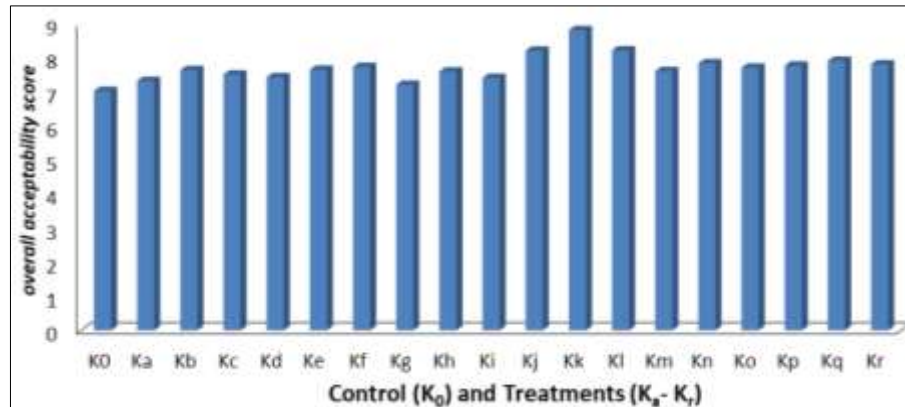


Fig 3: Graphical representations of overall acceptability score of final prepared kulfi

## Conclusion

According to the findings, the final probiotic functional kulfi K<sub>k</sub> (Buffalo milk + 15% sugar + 4% Indian blackberry powder + 1% *Lactobacillus acidophilus*) had the best organoleptic characteristics, including flavor, color and appearance, body and texture, and overall acceptability. Previously, product optimization was done solely by sensory assessment. Consumers found the final prepared probiotic functional kulfi to be appropriate.

Ltd. New Delhi 1976, 260.

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