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Assessment of Physico-Chemical and Sensory Qualities of *Lassi* sold in Kolhapur city

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Abstract: *It was observed that the sensory qualities of lassi in terms of colour and appearance, body and texture, flavour, consistency and overall acceptability were significantly ($p<0.05$) affected by the brands of lassi sold in Kolhapur city. For colour and appearance the highest mean score (8.44) was obtained by KS_1 brand lassi sample fallowed by KS_4 (8.02). The mean score for body and texture were ranged from 7.20 to 8.19 whereas, the average flavour score of the lassi were ranged from 7.32 to 8.30. The minimum and maximum flavour score for lassi was obtained for brand KS_3 and KS_1, respectively. The maximum score (8.22) for consistency was allotted to the sample KS_1 lassi fallowed by sample KS_4 (8.21). Lassi of KS_1 brand recorded maximum overall acceptability score (8.29) followed by KS_4 (8.09), KS_6 (8.06), KS_2 (7.73), KS_5 (7.56) and KS_3 (7.42). All the samples were acceptable and the rated in between liked moderately (Score 7) to liked extremely (score 9) when judged on 9 point hedonic scale. Significant ($P<0.05$) difference were also recorded in all the physico-chemical quality of lassi sold in Kolhapur city. The average acidity (% LA) lassi of brand KS_1, KS_2, KS_3, KS_4, KS_5, KS_6 were 0.95, 0.78, 0.79, 0.92, 0.83 and 0.67, respectively whereas, the pH in lassi sample was ranged from 3.83 to 4.3. The highest viscosity was recorded to the lassi from KS_4 brand (381.50 cP) fallowed by KS_6 (247.00 cP) and KS_1 brand (243.33 cP). Sample of lassi with too low viscosity was rated minimum sensory score for body and texture and consistency by the panel of judges. The fat content in lassi samples were 4.24, 3.00, 2.10, 3.62, 2.46 and 4.03 whereas, the average protein content were 3.60, 3.15, 3.18, 2.79, 2.78 and 3.28 in KS_1, KS_2, KS_3, KS_4, KS_5 and KS_6, respectively. The overall lactose content (%) ranged in between 3.84 to 4.45 and overall sucrose content was ranged from 8.24 to 10.54 per cent in lassi samples. The TS content in brands of lassi samples in were in range from 19.82 to 21.43 per cent. The mean TS content in lassi of brand KS_1 was highest followed by in KS_2.*

Keywords: *Lassi, Organoleptic Property, Physico-chemical quality.*

INTRODUCTION

A newly born infant is unable to ingest and assimilate nutrient from any food source other than milk. Consequently, milk has to provide all the growth promoting nutrients in an easily acceptable form. Breast milk is the sole food for humans during the first part of lives, and even animal milk carries many nutrients that the infants need for growth and development. Forchildren, adolescent, elderly people, pregnant and nursing mothers, milk play an important role in meeting the requirements of many essential nutrients, and hence milk is considered as protective food. Milk helps to balance human diet by supplementing good quality protein, calcium and vitamins. Cow milk has been mentioned as a provider of health and savior of human life. It provides energy especially lost due to disease or reproductive function. It is tasty, cool in nature (Acharya, 2013). Such milk is also utilized in the form of various milk products by applying various processes to milk, including fermentation, heat desiccation, heat acid coagulation, fat concentration, freezing, etc. Amongst these process, fermentation of milk by suitable starter culture is economical and having several health benefits. It is estimated that about 9.1 per cent of the total milk

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produced in India is converted in to various fermented milk products (Chauhan *et al.,* 2013). According to a study by global market analyst Euromonitor, the manufacture of cultured dairy products represents the second most important fermentation industry (after the production of alcoholic drinks). A dynamic category, fermented dairy drinks were reported to grow at 6 times the rate of total dairy growth between 1998 and 2003 in value term (Hati *et al.*, 2012).

The fermentation can be broadly defined as the process in which the carbohydrate like compounds is broken down, under anaerobic or aerobic conditions. The fermentation is accompanied by gelling of solids, particularly the protein. In some fermentation alcohol is produced along with acids due to yeast or lactic fungi. Fermentation may also lead to detoxification, destruction of undesirable factors present in raw foods and removal of lactose. Fermented or cultured dairy products constitute a vital component of the human diet in India as in many other regions of the world. Dahi, *lassi*, mishtidahi and shrikhand like milk products figure prominently in people's diet in different parts of India.

Besides imparting nutrition and novelty, these products help preserve the precious nutrients in fluid milk which is prone to quick deterioration. There are numerous references to dahi in the ancient Vedas. Milk was fermented with green leaves, palasha bark and putica creeper. Fermented milk and milk products have occupied a place of satisfaction in satisfying the palate. Churning of dahi to make butter at home and utilize the refreshing buttermilk with leftover grains of butter in it, as a refreshing drink, has been practiced for several centuries. Lord Krishna as a child was fond of dahi and makhan (indigenous cultured white butter). In other words cultured dairy products find a very prominent position in the Indian culture, food habit and religious ethos (Gupta *et al.*, 2014). These products were traditionally prepared at small scale in each household, now the industrial production of some of these products has become a big commercial activity industry. Around 9.0 per cent of the total milk produced in India is converted into fermented milk products and this sector is showing an annual growth rate more than 20.0 per cent per annum (Singh, 2006).

MATERIAL AND METHODS

Selection of brands of *lassi*

Preliminary survey was conducted in the local market of Kolhapur city to know the availability of *lassi.* At the end of survey it was came to known that, there were several types of *lassi* sold in Kolhapur city. It was flavoured either with salt, sugar, mint, cumin, fruit or fruit juice and spicy additions, such as ground chilies, fresh ginger or garlic. Some *lassi* sold in Kolhapur city were garnished with icecream or cream or dry fruits or gulkand. Most of the *lassi* sold in the Kolhapur city had limited sale with limited area. Considering the large variation in types of *lassi* and feasibility of work, it was decided to select only branded plain type of *lassi* sold in Kolhapur city for study. On the basis of survey, most popular six brands of *lassi* have been selected for this study purpose.

Collection of *lassi* samples

Packed *lassi* samples of selected brands were collected from the local market of Kolhapur city and brought to the laboratory under chilled condition for further analysis.

Sample Details

KS_1 - Market *lassi* sample-1
KS_2 - Market *lassi* sample- 2
KS_3 - Market *lassi* sample- 3
KS_4 - Market *lassi* sample- 4
KS_5 - Market *lassi* sample- 5
KS_6 - Market *lassi* sample- 6

Organoleptic quality of *lassi*

Sensory evaluation of lassi samples were carried out by a trained panel of six judges from the Division of Animal Husbandry and Dairy Science and Division of Horticulture, College of Agriculture, Kolhapur by using 9-point hedonic scale described by Amerine *et al.,* (1965) for sensory parameters i.e. Colour and appearance, body and texture, flavour,

consistency and overall acceptability sensory parameter were included for study. Samples were served in three-digit number coded container and water was provided in between two samples to clean the palate.

Physico-chemical analysis of *lassi*

Lassi samples were analyzed for its chemical parameters by adopting standard procedure as listed below.

Acidity

Acidity (% Lactic acid) of *lassi* samples was analyzed as per procedure stated in IS: 1479, Part-I (1960).

pH

The pH of *lassi* samples were measured by using Single electrode pH meter following the procedure stated in IS: 1479, Part-II, (1961).

Viscosity

The viscosity of *lassi* samples determined by using Brookfield viscometer

Fat

Fat content in l*assi* was determined by Gerber method as per procedure stated in IS: 1224, Part-I (1977).

Total protein

The protein content of *lassi* samples was estimated by semi-Micro-Kjeldhal method as described by Menefee and Overman, (1940). This was multiplied by 6.38 to get protein per cent.

Total carbohydrate

Total carbohydrate of *lassi* samples were estimated as per procedure of Lane and Eynon (1923) as suggested by Ranganna (1977).

Lactose

Lactose was estimated as per Lane-Eynon's method given in IS: 1479, Part-II, (1961).

Sucrose

Sugar (Sucrose) per cent contained in *lassi* samples was worked out by subtracting lactose from total sugar of *lassi*.

Total solids

Total solids were estimated as per procedure given in IS: 1166, Part-II (1973).

Total Ash

Total ash were determined as per procedure given in IS: 1479, Part-II (1961).

Statistical Analysis

Complete Randomized Design (CRD) with six replication was used for analysis of data (Panse and Sukhatme, 1985).

RESULTS AND DISCUSSION

Organoleptic evaluation of *lassi*

Most famous six branded *lassi* samples sold in Kolhapur city were procured periodically from pre-identified shops within two to three hrs of receiving the products from producer/ manufacturer. The *lassi* sachets were kept in ice boxes during transportation until evaluated. The samples were offered at refrigerated temperature to the judges for organoleptic evaluation. The organoleptic evaluation of *lassi* samples was conducted by six judges. To minimize the differences, the panelists were acquainted with quality attributes and the defects generally associated with *lassi* samples. Nine point hedonic scale was provided to the panelists to evaluate the *lassi* samples. Each sample was given code number which was changed from trial to trial so as to avoid its identity. The samples were evaluated for flavour, body and texture, colour and appearance, consistency and overall acceptability. The results for organoleptic quality of *lassi* are discussed here as under.

Colour and appearance score

The colour is an important parameter from aesthetic point of view and variations were observed in

colour and appearance of market samples of *lassi*. Score allotted by the judges for colour and appearance of market *lassi* samples is presented in Table 1.

Table 1
Colour and appearance score of *lassi* samples sold in Kolhapur city

Particular	*Market Lassi Samples*					
	KS_1	KS_2	KS_3	KS_4	KS_5	KS_6
Score*	8.44^d	7.66^b	7.31^a	8.02^c	7.62^b	7.93^c
SE	±0.05	±0.12	±0.04	±0.06	±0.05	±0.04
SEm				0.08		
CV				1.96		
CD (p<0.05)				0.18		

* Means of six replications within row followed by the same letter are not significantly different at p < 0.05

The data depicted in table indicate that the colour and appearance score of *lassi* collected from market showed a significant (P<0.05) difference among the samples. The highest mean score (8.44 ±0.05) for colour and appearance was obtained by KS_1 brand *lassi* sample fallowed by KS_4 (8.02 ±0.06). The scores for colour and appearance between KS_2 and KS_5 and between KS_4 and KS_6 were at par with each other. The lowest score was obtained to sample KS_3 (7.31 ±0.04). All the samples were recorded score more than 7.0 on 9-point Hedonic scale which indicate that samples were liked moderately. The highest score for sample KS_1 may be due to sample had white to creamy white, viscous liquid consistency. Whereas, sample of *lassi* from brand code KS_3 had thin watery and curdy appearance.

Body and Texture score

Score allotted by the judges for body and texture of market *lassi* samples is presented in Table 2. All the samples showed a significant difference (P<0.05) in body and texture quality. The mean score of body and texture score of *lassi* samples of brands under study were ranged from 7.20 to 8.19 (Table 4.2). The highest mean score (8.19 ±0.04) for body and texture was obtained by KS_1 samples whereas, minimum score (7.20 ±0.10) was recorded to KS_3 sample. The highest score for body and texture of *lassi* of KS_1 might be because of sample was homogeneous showing no signs of wheying off or grains or curd particles.

Table 2
Body and Texture score of *lassi* samples sold in Kolhapur city

Particular	*Market lassi Samples*					
	KS_1	KS_2	KS_3	KS_4	KS_5	KS_6
Score*	8.19^d	7.54^b	7.20^a	8.17^c	7.58^b	7.89^c
SE	±0.04	± 0.05	± 0.10	± 0.03	± 0.04	± 0.03
SEm				0.07		
CV				2.06		
CD (p<0.05)				0.19		

* Means of six replications within row followed by the same letter are not significantly different at p < 0.05

The overall scores for body and texture for KS_2, KS_4, KS_5 and KS_6 market *lassi* samples were 7.54, 8.17, 7.58 and 7.89, respectively. It appeared that the body and texture was not uniform for market *lassi* samples. According to scores allotted, these *lassi* samples in respect to body and texture it could be arranged as $KS_1 > KS_4 > KS_6 > KS_5 > KS_2 > KS_3$ in descending order.

Flavour Score

The quality of any product is greatly determined by its flavour, which in turn determines its acceptability. The assessment of flavour of different brands of *lassi* under study is presented in the Table 3.

Table 3
Flavour score of *lassi* samples sold in Kolhapur city

Particular	*Market lassi Samples*					
	KS_1	KS_2	KS_3	KS_4	KS_5	KS_6
Score*	8.30^d	7.58^b	7.32^a	7.92^c	7.54^b	8.15^d
SE	±0.03	±0.08	±0.12	±0.05	±0.05	±0.08
SEm				0.06		
CV				2.01		
CD (p<0.05)				0.19		

* Means of six replications within row followed by the same letter are not significantly different at p < 0.05

The mean flavour score of the *lassi* ranged from 7.32 ± 0.12 to 8.30 ± 0.03. The minimum and maximum score for *lassi* was obtained for brand KS_3 and KS_1, respectively. The mean value of flavour score for other market *lassi* samples were 7.58 ±0.08, 7.92 ±0.05, 7.54 ±0.05 and 8.15 ±0.08 for KS_2, KS_4, KS_5 and KS_6 brands, respectively.

Overall the flavour quality of the *lassi* was significantly (P<0.05) affected for the various brand, however the flavour score sample KS_1 and KS_6 were not statistically differ. Similar trend was also observed between KS_2 and KS_5 *lassi* sample. 6.50 to 7.25.

Consistency Score

Consistency property of fluid dairy product is most important for enhancing the richness of product. The score allotted by the judges for consistency of market *lassi* samples of various brand under study is presented in Table 4.

Table 4
Consistency score of *lassi* samples sold in Kolhapur city

Particular	*Market lassi Samples*					
	KS_1	KS_2	KS_3	KS_4	KS_5	KS_6
Score*	8.22^c	7.73^b	7.10^a	8.21^c	7.63^b	7.78^b
SE	±0.04	±0.11	±0.10	±0.05	±0.07	±0.05
SEm	0.07					
CV	2.14					
CD (p<0.05)	0.20					

* Means of six replications within row followed by the same letter are not significantly different at p < 0.05

The average scores obtained for consistency of market samples of *lassi* showed variation and differed significantly (P<0.05). The maximum score (8.22 ±0.04) was allotted to the sample KS_1 *lassi* fallowed by sample KS_4 (8.21 ±0.05) and the difference was non-significant. Statistically the consistency of sample KS_2, KS_5 and KS_6 were similar and the score recorded were 7.73 ±0.11, 7.63 ±0.07 and 7.78 ±0.05, respectively.

According to score allotted, these samples could be placed as KS_1> KS_4> KS_6> KS_2> KS_5 > KS_3 in descending order. The minimum score to sample KS_3 was also confirmed with the lowest viscosity i.e. 101.50 Cp (vide section 4.2.3).

Overall acceptability score

The overall acceptability of market *lassi* samples of various brands sold in Kolhapur city is presented in above Table 5.

Table 5
Overall acceptability score of *lassi* samples sold in Kolhapur city

Particular	*Market lassi Samples*					
	KS_1	KS_2	KS_3	KS_4	KS_5	KS_6
Score*	8.29^e	7.73^b	7.42^a	8.09^b	7.56^b	8.06^d
SE	±0.02	±0.05	±0.08	±0.03	±0.02	±0.04
SEm	0.04					
CV	1.33					
CD (p<0.05)	0.12					

* Means of six replications within row followed by the same letter are not significantly different at p < 0.05

On an average the overall acceptability scores of market *lassi* sample were significantly (p<0.05) affected by the different brands under study. *Lassi* of KS_1 brand recorded maximum overall acceptability score (8.29 ±0.02) followed by KS_4 (8.09 ±0.03), KS_6 (8.06 ±0.04), KS_2(7.73 ±0.04), KS_5 (7.56 ±0.02) and KS_3 (7.42 ±0.02). From these data, it was observed that all the samples were acceptable and rated in between liked moderately (Score 7) to liked extremely (score 9) when judged on 9 point hedonic scale.

Physico-chemical quality of *lassi*

The market *lassi* samples were also analyzed chemically for its acidity, pH, viscosity and also determined its constituents viz. fat, protein, lactose, sucrose, total sugar, ash, total solids and moisture by using standard analytical procedures and results thereof are showed and discussed as below.

Acidity

The average acidity (% Lactic Acid) of market *lassi* samples sold in Kolhapur city is presented in Table 6. Significantly (P<0.05) wide range of acidity was

observed in samples of *lassi* (Table 6) of brands under study of Kolhapur market. The average acidity of *lassi* of brand KS_1, KS_2, KS_3, KS_4, KS_5, KS_6 were 0.95, 0.78, 0.79, 0.92, 0.83 and 0.67, respectively. All the *lassi* samples (products) were acceptable. The highest acidity was observed in *lassi* sample of KS_1 (0.95 % LA) and lowest was in *lassi* sample KS_6 (0.67 % LA).

Table 6
Acidity (% LA) of *lassi* samples sold in Kolhapur City

Particular	*Market lassi Samples*					
	KS_1	KS_2	KS_3	KS_4	KS_5	KS_6
Mean vales*	0.95^d	0.78^b	0.79^b	0.92^d	0.83^c	0.67^a
SE	±0.01	±0.02	±0.01	±0.01	±0.02	±0.01
SEm				0.01		
CV				3.14		
CD (p<0.05)				0.03		

* Means of six replications within row followed by the same letter are not significantly different at p < 0.05

The values of acidity of sample of KS_2 and KS_3 were at par with each other this might be due to controlled incubation and use of direct vat culture for its manufacturing.

pH

The average pH of market *lassi* samples sold in Kolhapur city is presented in Table 7. It is observed from table 7 that the pH in *lassi* sample was ranged from 3.83 ±0.01 to 4.34 ±0.02. The minimum pH was recorded for the *lassi* of KS_1 and maximum was recorded to KS_6. The significant (p<0.05) variation was noted in case of pH as like that of acidity. The *lassi* samples arranged in descending order as $KS_6 > KS_2 > KS_3 > KS_5 > KS_4 > KS_1$.

Table 7
pH of *lassi* samples sold in Kolhapur City

Particular	*Market lassi Samples*					
	KS_1	KS_2	KS_3	KS_4	KS_5	KS_6
Mean values*	3.83^a	4.27^c	3.99^b	3.94^b	3.98^b	4.34^c
SE	±0.01	±0.03	±0.03	±0.07	±0.01	±0.02
SEm				0.03		
CV				2.00		
CD (p<0.05)				0.10		

* Means of six replications within row followed by the same letter are not significantly different at p < 0.05

The difference of pH between KS_3, KS_4 and KS_5 were non-significant. Kumar (2004) also reported 4.24 pH for *lassi*-like beverage and the value was accordance with the present findings. pH between 4.18 to 4.42 was also recorded by Bhoir *et al.,* (2012) for *lassi* sold in Akola market of Maharashtra. Similar findings were also reported by Khan *et al.,* (2008) with the samples of dahi sold in Lahore city of Pakistan.

Viscosity

The resistance offered by liquid towards flow is determined by measuring the property of viscosity. Being a fluid beverage the viscosity of *lassi* samples sold in Kolhapur city was measured and presented in Table 4.8. The average value of viscosity of *lassi* samples showed significant (p<0.05) variation (Table 8). The highest viscosity was recorded to the *lassi* from KS_4 brand (381.50±12.99 cP) fallowed by KS_6 (247.00 ±8.40 cP) and KS_1 brand (243.33±1.06 cP), however the difference between viscosity of KS_1 and KS_6 were at par with each other. Significantly poorest viscosity was observed with the *lassi* of KS_3 brand (viscosity 101.50±7.24). Sample of *lassi* with too low viscosity was rated minimum sensory score for body and texture and consistency by the panel of judges (vide section 4.1.2 and 4.1.4).

Table 8
Viscosity (cP) of *lassi* samples sold in Kolhapur City

Particular	*Market lassi Samples*					
	KS_1	KS_2	KS_3	KS_4	KS_5	KS_6
Mean values*	243.33^d	196.83^c	101.50^a	381.50^e	141.17^b	247.00^d
SE	±1.06	±5.92	±7.24	±12.99	±8.75	±8.40
SEm				10.33		
CV				11.57		
CD (p<0.05)				30.10		

* Means of six replications within row followed by the same letter are not significantly different at p < 0.05

Fat content

Fat is an important constituted and which improves the taste and richness of the products. It is also a substance which determines the cost of production of products and as a result dairy industry always

looking in saving the fat for running the dairy business more profitable. The average fat content (%) of market *lassi* samples sold in Kolhapur city is presented in Table 9.

Table 9
Fat content (%) of *lassi* samples sold in Kolhapur City

Particular	*Market lassi Samples*					
	KS_1	KS_2	KS_3	KS_4	KS_5	KS_6
Mean values*	4.24^f	3.00^c	2.10^a	3.62^d	2.46^b	4.03^e
SE	± 0.03	± 0.06	± 0.04	± 0.07	± 0.08	± 0.04
SEm	0.06					
CV	4.36					
CD (p<0.05)	0.17					

* Means of six replications within row followed by the same letter are not significantly different at p < 0.05

The fat content of six brands of market *lassi* samples i.e. KS_1, KS_2, KS_3, KS_4, KS_5 and KS_6 were 4.24 ±0.03, 3.00 ±0.06, 2.10 ±0.04, 3.62 ±0.07, 2.46 ±0.08 and 4.03 ±0.04, respectively. Average values of fat content of market *lassi* samples showed significant (P<0.05) variation. The maximum fat (4.24%) was observed in the KS_1 *lassi* sample. Further, it was observed that there is a wide range in the fat per cent (range from 2.10 to 4.24%) of *lassi* sold in Kolhapur city. According to fat content, the samples could be placed as $KS_1 > KS_6 > KS_4 > KS_2 > KS_5 > KS_3$ in descending order.

Protein content

The average protein content of market *lassi* samples sold in Kolhapur city is presented in Table 10.

Table 10
Protein content (%) of *lassi* samples sold in Kolhapur City

Particular	*Market lassi Samples*					
	KS_1	KS_2	KS_3	KS_4	KS_5	KS_6
Mean values*	3.60^c	3.15^b	3.18^b	2.79^a	2.78^a	3.28^b
SE	±0.03	±0.06	±0.04	±0.07	±0.08	±0.04
SEm	0.07					
CV	5.67					
CD (p<0.05)	0.21					

* Means of six replications within row followed by the same letter are not significantly different at p < 0.05

The average protein content was 3.60 ±0.03, 3.15 ±0.06, 3.18 ±0.04, 2.79 ±0.07, 2.78 ±0.08, 3.28 ± 0.04 in KS_1, KS_2, KS_3, KS_4, KS_5 and KS_6, respectively. The overall difference in protein content of *lassi* sold in Kolhapur city was significant (p<0.05). However, the difference between the protein content of *lassi* of KS_2, KS_3, and KS_6 were at par with each other. Mean separation reveals that KS_1 brand *lassi* contained significantly (p<0.05) more protein over the others brands.

Lactose content

The average lactose content of market *lassi* samples sold in Kolhapur city is presented in Table 11.

Table 11
Lactose content (%) of *lassi* samples sold in Kolhapur City

Particular	*Market lassi Samples*					
	KS_1	KS_2	KS_3	KS_4	KS_5	KS_6
Mean value*	4.45^c	3.98^a	4.06^b	3.95^a	3.84^a	4.09^b
SE	±0.07	±0.03	±0.02	±0.05	±0.07	±0.02
SEm	0.05					
CV	2.91					
CD (p<0.05)	0.14					

* Means of six replications within row followed by the same letter are not significantly different at p < 0.05

Average values of lactose content of *lassi* sold in Kolhapur city showed significant (P<0.05) variation. The highest lactose (4.45 ±0.07%) was found in samples from KS_1 brand. The overall lactose content (%) ranged in between 3.84 to 4.45. The lowest lactose content was found in KS_5 sample (3.84 ±0.07) however, it was at par to KS_2 (3.98 ±0.03) and KS_4 (3.95 ±0.05).

Sucrose content

The data regarding sucrose content in market *lassi* samples of brand under study is presented in Table 12. From the data (Table 12) it is observed that sucrose content was significantly (P<0.01) varied between various brand of *lassi* sold in the Kolhapur city.

Table 12
Sucrose content (%) of *lassi* samples sold in Kolhapur City

Particular	*Market lassi Samples*					
	KS_1	KS_2	KS_3	KS_4	KS_5	KS_6
Mean values*	8.24[a]	9.54[b]	9.89[c]	8.52[a]	10.54[d]	8.22[a]
SE	±0.05	±0.17	±0.17	±0.07	±0.01	±0.10
SEm	0.12					
CV	3.00					
CD (p<0.05)	0.34					

* Means of six replications within row followed by the same letter are not significantly different at p < 0.05

The sucrose content in *lassi* samples collected from Kolhapur city was ranged from 8.24 to 10.54 per cent. The maximum sucrose (10.54 ±0.01 %) was found in the market lassi sample KS_5, followed by in *lassi* of brand KS_3 (9.89 ± 0.17), KS_2 (9.54 ±0.17), KS_3 (8.52 ±0.07), KS_1 (8.24 ±0.05) and lowest was recorded in KS_6 (8.22 ±0.10).

Total carbohydrate content

The samples of different brands of *lassi* obtained from Kolhapur city were analyzed for total carbohydrate content and is presented in Table 13.

Table 13
Total carbohydrate content (%) of *lassi* samples sold in Kolhapur City

Particular	*Market lassi Samples*					
	KS_1	KS_2	KS_3	KS_4	KS_5	KS_6
Mean values*	12.69[b]	13.52[c]	13.94[d]	12.47[a]	14.30[e]	12.31[a]
SE	±0.07	±0.18	±0.17	±0.06	±0.07	±0.08
SEm	0.12					
CV	2.25					
CD (p<0.05)	0.35					

* Means of six replications within row followed by the same letter are not significantly different at p < 0.05

The data presented in Table 13 revealed that the total sugar content in the branded *lassi* was ranged from 12.31 to 14.30 per cent. Overall significant (P<0.05) variation was observed in the values of carbohydrate content in *lassi* sold in Kolhapur city. However, the carbohydrate content in *lassi* of brand KS_4 and KS_6 was at par with each other. On the basis of total carbohydrate content in *lassi*, the samples could be arranged in ascending order as $KS_5 < KS_3 < KS_2 < KS_1 < KS_4 < KS_6$.

Ash content

The average ash content of market *lassi* samples sold in Kolhapur city presented in Table 14.

Table 14
Ash content (%) of *lassi* samples sold in Kolhapur City

Particular	*Market lassi Samples*					
	KS_1	KS_2	KS_3	KS_4	KS_5	KS_6
Mean values*	0.90[d]	0.47[a]	0.65[b]	0.77[c]	0.38[a]	0.53[b]
SE	±0.04	± 0.03	± 0.02	± 0.03	± 0.03	± 0.03
SEm	0.03					
CV	12.56					
CD (p<0.05)	0.09					

* Means of six replications within row followed by the same letter are not significantly different at p < 0.05

The values for total ash content of market *lassi* samples sold in Kolhapur city was varied significantly (p<0.05). The highest total ash content (0.90 ±0.04%) was observed in the market sample of *lassi* KS_1. This might be because of highest total solid content in the respective sample (vide section 4.3.10). The average values for total ash content in market *lassi* were ranged from 0.38 to 0.90 per cent. Significantly (p<0.05) lowest ash content (0.38 ±0.03) was found in sample KS_5 however, it was at par to KS_2.

Total Solids content

The total solids (TS) content of *lassi* samples of various brands was also determined and results obtained there was presented in 15. It is observed from the results presented in Table 4.15 that the TS content in *lassi* samples were varied in narrow range from 19.82 to 21.43 per cent and the overall effect of different brands of *lassi* under study was significant. (p<0.05).

The mean TS content in *lassi* of brand KS_1 was maximum (21.43 ±0.09) followed by *lassi* of brand KS_2 with mean TS content of 20.13 ±0.23 %. The

Table 15
Total solids content (%) of *lassi* samples sold in Kolhapur City.

Particular	*Market lassi Samples*					
	KS_1	KS_2	KS_3	KS_4	KS_5	KS_6
Mean values*	21.43[b]	20.13[a]	19.87[a]	19.93[a]	19.93[a]	19.82[a]
SE	±0.09	±0.23	±0.15	±0.08	±0.09	±0.09
SEm				0.14		
CV				1.72		
CD (p<0.05)				0.41		

* Means of six replications within row followed by the same letter are not significantly different at p < 0.05

lowest TS content was found in market *lassi* sample KS_6 which was at par with KS_3, KS_4, KS_5 and KS_2 the mean values of TS for these brands were 19.82 ±0.09%, 19.87 ±0.15%, 19.93 ±0.08%, 19.93 ±0.09% and 20.13 ±0.23%, respectively. According to total solids content, the *lassi* sample studied here could be placed in descending order as $KS_1 > KS_2 > KS_4 = MS_5 > KS_3 > KS_6$.

CONCLUSIONS

1. From the result it is concluded, that on the basis of organoleptic evaluation, KS1 lassi sample was significantly superior over the other brand under study.
2. There was significant variation in respect of fat, protein, sucrose, total sugar and total solids content in all of the lassi samples examined.

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