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Sensory and Microbiological Quality of Buttermilk Sold in and Around Greater Hyderabad Municipal Corporation

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Abstract:

The present study was carried out to evaluate sensory and microbiological quality of buttermilk sold in and around Hyderabad city, India. The overall sensory score of buttermilk samples collected from organized, semi-organized and Hawkers was 8.42, 8.06 and 6.65 respectively under 10 point Headonic scale. The standard plate count were 3.52×10^4CFU/g, 8.56×10^4CFU/g, and 2.56×10^5 CFU/ml, the *lactobacillus* count were 2.48×10^4 CFU/ml, 6.52×10^4 CFU/ml and 8.95×104 CFU/ml, the *coliform*s count 2.51×10^1 CFU/ml, 3.52×10^2 CFU/ml, 8.58×10^2 CFU/ml and the *yeast and mould* were 3.58×10^2 CFU/ml, 6.58×10^2 CFU/ml and 1.52×10^3 CFU/ml for the samples from organized, Semi-organized and Hawkers respectively. The incidence of *E.coli* was 40%, 56% and 100%, *Salmonella* was 8%,12% and 36%, *Staphylococcus* 48%,60% and 100% and *Campylobacter* 8%,16% and 28% and counts of *E.coli* were 2.8CFU/ml, 8.5 CFU/ml and 32 CFU/ml, *Salmonella* were 4.2 CFU/ml, 6.5 CFU/ml and 8.8 CFU/ml and *Staphylococcus* were 8.58×10^2 CFU/ml, 2.86×10^3 CFU/ml and 3.52×10^4 CFU/ml and *Campylobacter* 1.2 CFU/ml, 2.8 CFU/ml and 4.8 CFU/ml for the samples from Organized, Semi-organized and Hawkers sectors respectively. The microbiological incidence and counts were high in Hawkers, least in Organized sector and in between in Semi-organized sector.

Keywords **— Buttermilk, Sensory quality, Microbiological quality.**

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I. INTRODUCTION

Buttermilk traditionally known as majjiga (AP, TS), Mattha (UP, Delhi), Tak (Maharastra), Ghol (West Bengal), chhash (Madya pradesh, Gujarat) and sour buttermilk in several parts of world. Buttermilk is a popular fermented milk beverage having mild pleasing flavour resulting from a blend of clean acid taste and delicate aromatic free from off flavours. It should be uniform thick consistency and free from churned particles [6]. It is one of the best among milk products due to its nutritional value and therapeutic value in jaundice and alcoholic liver patients to regain normal appetite and digestion [5]. It is having anticholesterolaecmic effect [7] besides stimulating natural activity of cells and strengthening immune system.

In India presently the use of buttermilk has been increased substantially and exceed 6.5 % of fluid milk sales but a fairy large portion of

commercial buttermilk has less than ideal quality and it is the poorest in quality among all cultured dairy products. The buttermilk available in the markets are not satisfying the requirements as per FSSAI, 2006. Buttermilk in India is manufactured by branded producers, unorganized sector and hawkers selling samples openly without packing in commercial centers. Much work was not published in India about the quality of buttermilk available in the markets. Keeping in view, the present study was undertaken to evaluate the sensory, physicochemical and microbiological qualities of the buttermilk sold in and around greater Hyderabad municipal corporation India.

II. MATERIALS AND METHOD:

Twenty five Buttermilk samples each were collected from organized, Semi-organized and Hawkers selling without packing. The samples were collected from the markets and kept in icebox, transported to the department of Veterinary Public Health and Epidemiology and kept in refrigerated till analysis is undertaken. The sensory evaluation was conducted by a panel of five trained judge using 9 points headonic scale for flavour, body, colour and appearance and overall acceptability. pH of the samples was measured by using electronic pH meter, acidity was estimated using titration method and Free fatty acids content in the buttermilk samples was determined by the method recommended[10]. For microbiological analysis (*lactobacillus count, SPC, Coliform, yeast and mould* and pathogens), 11g of samples was diluted in 99ml of phosphate buffer according to the method described in IS:1497(1961). Further serial dilutions were prepared in 9 ml phosphate buffer and so on. One ml each from 2 or 3 suitable dilutions was poured in petri dish. Specified liquid media lactobacillus selective agar for *Lactobacillus*, Nutrient agar for SPC, MacConkey agar for *Coliform*, Potato dextrose agar for *Yeast & mold*, EMB agar for *E.coli*, Muller Hinton for *Campylobacter*, Baird parker and mannitol salt for *staphylococcus* and xylose lysine for *salmonella* in sufficient quantity was poured on the sample in petri dish and uniformly spread. The method of plating was done as per BIS 18 (part) 1989. After solidification of media the petri dish were kept in incubator, incubated at 37° Celsius for 1-2 days except for *yeast and mould* 5-7 days. The colonies we counted using colony counter and multiplied by dilution factor to get particular counts.

III. RESULTS AND DISCUSSION:

The sensory evaluation of buttermilk samples from different sources was presented in table 1

Table 1: Sensory evaluation of Buttermilk from different sources

Characteristic	**Organized**	**Semi-organized**	**Hawkers**
Flavour	8.53	7.85	7.12
Body& Texture	8.28	8.12	6.32
Colour &Appearance	8.47	8.22	6.53
Overall acceptability	8.42	8.06	6.65

The flavour score was highest (8.53) for the organized sector samples, least in the samples from Hawkers (7.12) and in between with the samples from Semi-organized (7.85). The flavour

score (8.52) reported from Gujarat in the commercial Buttermilk samples was similar to the score observed in the present study [22]. The flavour score of 3.22 out of 5 points reported from USA [26] was almost similar to the flavour score (7.12) in the present study for the hawkers samples. A trend of decreasing flavour score as storage period is increased was reported [22].

The body and Texture scores were 8.28, 8.12, and 6.32 for the Buttermilk samples from organized, Semi-organized and Hawkers samples respectively. The body and texture score was good for the samples from organized, Semi-organized which be due to proper homogenization of product and maintenance of standard levels of solids [19]. The low body and texture score in hawkers samples might be due high level of water addition and also absence of homogenization of product, where such facilities are not available. Culture contamination will decrease the activity of organisms and if the product is having low acidity that effects the viscosity and finally the body and texture of the buttermilk [23].

The colour and appearance score was least (6.53) in the samples from the hawkers, high for the organized sector samples (8.47) and moderate for the Semi-organized Sector samples (8.22). The colour and appearance score of cultured Buttermilk is associated with physicochemical changes taking place during processing and storage [22]. The colour and appearance of buttermilk from hawkers is less due to more water addition.

The overall acceptability of the buttermilk samples was 8.42, 8.06 and 6.65 for the samples of organized, Semi-organized and Hawkers respectively. The overall acceptability of the buttermilk samples from organized was high, might be due to higher flavour, Body and texture, colour and appearance scores which are affecting overall acceptability of buttermilk. Similarly the overall acceptability of the buttermilk samples from hawkers was less due to low scores of flavour, body and texture, colour and appearance. The overall acceptability of 7.9 was reported from the samples from Germany [11] which was almost similar to the overall acceptability of the buttermilk samples from semi-organized sector in the present study. The overall acceptability of 8.0 [9] from Brazil was almost similar to the acceptability of buttermilk samples from Semi-organized sector in the present study.

Table 2: Physicochemical analysis of buttermilk from different sources

Character	**Organized**	**Semi-organized**	**Hawkers**
pH	4.72	4.83	4.98
Titratable acidity (%LA)	0.33	0.36	0.31
Free fatty acids(μeq/g)	0.125	0.130	0.138

The pH of buttermilk samples were 4.72, 4.83 and 4.98 of organized, semi-organized and Hawkers samples respectively. A pH of 4.74 to 4.79 in the buttermilk samples sold in Gujarat [22] was almost similar to the values observed in the samples from organized sector in the present study. They also observed decrease in pH during storage. A study in USA reported less pH values (4.29 to 4.39) which is lower than the values observed in the present study from all the three sources. Very low pH of 4.11 was observed in the buttermilk samples collected from Anand. Lower pH of 4.13 from Germany [11] and 4.3 from Tripoli [14] were reported compared to the pH values of the buttermilk samples in the present study in all three sources. Higher pH of 6.58 [9] in buttermilk sample was reported from Brazil compared to the pH of the three sources in the present study. Higher pH of 6.19 [13] from Egypt and 6.61 from Ghana [4] was reported.

The Titratable acidity of buttermilk samples was high (0.36% LA) in Semi-organized sector followed by (0.33% LA) in organized sector and least (0.31% LA) in hawkers samples. A titratable acidity of (0.36% LA) was reported from Gujarat in market samples, was similar to the

Titratable acidity observed in the semi-organized samples in the present study.

Higher Titratable acidity (0.60% LA) was observed in the samples from Anand [23], 0.67% LA from Kolhapur [17], very high acidities (0.81%LA) in the samples collected in USA [16] and (0.79% LA) in the samples from Georgia [26]. Higher titratable acidity of 0.90 [13], 1.0% LA [4] in the samples from Ghana, 1.04% LA from Germany [11] and very high titratable acidity of 2.7% LA from Sudan [1] was reported. The titratable acidity will be increased in the buttermilk samples even stored at refrigeration temperature due to action of starter culture organism and residues of carbohydrates [22]. In general the titratable acidity of buttermilk samples mainly depends on the initial acidity of Dahi, from which buttermilk was prepared and also certain ingredients added for different purposes.

Free fatty acids Content in the buttermilk samples were 0.125, 0.130 and 0.138 µeq/g. of organized, Semi-organized, Hawkers respectively. The FFA content of 0.125 µeq/g reported from Gujarat state [22] was same as observed in the organized sector samples in present study. Lower FFA content of 0.120µeq/g was observed in the samples collected from Anand [23]. The FFA in the present study was high in Hawkers samples which might be due to changes in the fat in the buttermilk samples stored at ambient temperature.

Table 3: Microbiological analysis of buttermilk from different sources (CFU/ml)

Type of count	**Organized**	**Semi-organized**	**Hawkers**
SPC	3.52×10^{4}	8.56×10^{4}	2.56×10^{5}
LAB	2.48×10^{4}	6.52×10^{4}	8.95×10^{4}
Coliform	2.51×10^{1}	6.52×10^{4}	8.58×10^{2}
Yeast &mould	3.58×10^{2}	6.58×10^{2}	1.52×10^{3}

The Standard Plate Count in the buttermilk were 3.52×10^{4}, 8.56×10^{4} and 2.56×10^{5} cfu/ml in the samples from organized, Semi-organized and Hawkers sectors respectively. The SPC count observed in the samples from organized sector in present study was similar to the counts observed in Maharashtra [24] and from Gujarat [22]. Lower counts were observed in the samples collected from Greece [26]. The total viable count observed in buttermilk samples from Egypt [13] was almost similar to the counts observed in the Semi-organized sector samples in the present study. A total plate count of 7.37 log 10 Cfu/ml from Ghana [15] reported, which was very high compared to the buttermilk samples collected from all the three sources in the present study.

The *lactobacillus* count was 2.48×10^{4}, 6.52×10^{4} and 8.95×10^{4} of organized, Semi-organized and Hawkers sector respectively. The LAB count of log 4.26cfu/g [22] was slightly higher than the counts observed in the organized sector in the present study. A count of 7.15×10^{5} Cfu/g observed in the samples from Karnataka [20] was almost similar to the counts observed in the samples from Hawkers sector. The *lactobacillus* count mainly depend upon the amount of culture, incubation temperature, time of incubation and rate of dilution of buttermilk [20]. Higher lab counts of 7.37 log 10Cfu/ml from Ghana ([4] and 8.78 log10 Cfu/ml from Germany [11] were reported. The *lactobacillus* count in the buttermilk samples was high from Brazil [9] than the counts in the buttermilk samples in present study from all three sources. The lactobacillus counts in the samples from organized sector in the present study was almost similar to the counts observed from Egypt [13].

The *Coliform* count was high (8.58×10^{2} Cfu/ml) in the samples from hawkers, low (2.51×10^{1}Cfu/ml) from organized sector and in

between (3.52×10^2 Cfu/ml) in the Semi-organized sector. Absence of *coliforms* in the buttermilk samples collected from Gujarat state was reported [22]. Higher counts (log10 3.14 Cfu/ml) in the buttermilk samples collected from Greece [26], $>5\times10^4$ log Cfu/ml from Zimbabwe (gran et al 2001) and 6.22 log 10 Cfu/ml from Sudan [10] were reported. *Coliforms* are pathogens which generally indicate hygiene and post treatment contamination [19]. *Coliforms* can't survive in acidic products and also the antagonistic effect of starter culture don't permit them to survive [8].

The *yeast and mould* were least (3.58×10^2Cfu/ml) in organized sector followed by semi-organized (6.58×10^2Cfu/ml) and high (1.52×10^3Cfu/ml) in the samples from Hawkers. Absence of *yeast* and *mould* in buttermilk samples sold in Gujarat state [22] which indicated good hygienic condition, no aerial contamination. Higher *yeasts* and *mould* count of (log 10 4.5 Cfu/ml) was reported in the samples from Jharkhand[24], 6.63 log 10 Cfu/ml from Ghana [4], 6 to 8 log Cfu/ml from Tanzania [15] and 10^7 log Cfu/ml from Sudanese Rob [2]. Lower counts were reported [28], whereas no *yeast* and *mould* was detected in buttermilk samples [13] from Egypt.

Table 4: Incidence of pathogenic microorganisms in buttermilk from different sources

Pathogen	**Organized**	**Semi- organized**	**Hawkers**
E.coli	10(40%)	14(56%)	25(100%)
salmonella	2(8%)	3(12%)	9(36%)
staphylococcus	12(48%)	15(60%)	25(100%)
campylobacter	2(8%)	4(16%)	7(28%)

Table 5: Counts of pathogenic micro organisms in buttermilk from different sources (Cfu/ml)

Pathogen	**organized**	**Semi- organized**	**Hawkers**
E.coli	2.8	8.5	3.2
salmonella	4.2	6.5	8.8
staphylococcus	8.58×10^2	2.86×10^3	3.52×10^4
campylobacter	1.2	2.8	4.8

The *E.coli* incidence was 40%, 56% and 100% and the counts were 2.5, 8.5 and 32 Cfu/ml in the samples from organized, semi-organized and Hawkers samples respectively. *E.coli* was detected in the buttermilk samples and certain fermented milks at Kolhapur [17], Zimbabwe [12], Chicago [18], Tripoli [14], Iran [25], Egypt [21] and Tripoli [3], whereas no *E.coli* was reported at Netherlands [29]. An incidence of 20% was reported from Ghana [4], which was less than the

incidence of *E.coli* observed in the present study from all the Three sources and higher counts of >5×10^4 log Cfu/ml from Zimbabwe [12] and 5.19log10 Cfu/ml from Ghana reported, were very high compared to the *E.coli* counts observed from all the three sources in the present study. An incidence of 100% was reported from Tripoli [3], which was similar to the incidence of *E.coli* observed in the present study from Hawkers samples and the *E.coli* count of 69× 10^5 Cfu /ml was reported from Tripoli [3], which was very high in the present study from all the three samples.

The *salmonella* incidence was 8%, 12% and 36% and the counts were 4.2, 6.5, and 8.8 Cfu/ml in the samples from organized, Semi-organized and Hawkers samples respectively. *Salmonella* was detected in the buttermilk samples from Egypt [14] and Belgium [27], whereas no *salmonella* was detected from samples of Kolhapur [17]. A count of log 10 3.9 Cfu/ml of *salmonella* in the samples collected from Egypt [14] was reported, which was higher than the counts observed in the present study from all the three sources.

The *staphylococcus aureus* incidence was 48%, 60%, and 100% Cfu/ml and counts were 8.58 ×10^2, 2.86 ×10^3, and 3.52× 10^4 Cfu/ml in the samples from organized, Semi-organized and Hawkers samples respectively. *Staphylococcus* was detected in the buttermilk samples from Ghana [4], Sudan [1] and Tripoli [3], whereas *staphylococcus* was not detected in the samples from Egypt [21]. Very high counts of *staphylococcus* (6.22^a Cfu/ml) in the samples from Sudan [1] was reported. An incidence of 40% was reported from Tripoli [3] which was less than the incidence of *staphylococcus* observed in the present study from organized sector samples and a count of 76 × 10^4cfu/ml was reported from Tripoli [3], was higher than the counts from any source in the present study.

The *Campylobacter* incidence was 8%, 16%, and 28%, the counts were 1.2, 2.8, and 4.8 Cfu/ml in the samples from organized, semi-organized and Hawkers samples. Campylobacter was detected in the buttermilk samples collected from Belgium [27].

IV.CONCLUSIONS

The Sensory Quality of buttermilk was high in organized sector, less in Hawkers and moderate in Semi-organized sector and the microbiological incidence and counts were high in Hawkers, least in Organized sector and in between in Semi-organized sector in the present study.

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