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Extent of Water Adulteration and its Influence on Physical Characteristics of Market Milk

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Abstract: The study was carried out to investigate the extent of water adulteration and its effect on the physical characteristics of market milk at the Institute of Food Sciences and Technology, Sindh Agriculture University, Tandojam. For this purpose, two different areas i.e., Hyderabad city (B) and its surrounding areas (C) were selected for sampling of market milk and from each area twenty samples were collected randomly from different sale points. Control milk samples (A) were also obtained from University dairy farm. The data revealed that all the samples of both areas were adulterated with water (100%). The extraneous water in the market milk of Hyderabad city remained 21.18% while in surrounding areas of Hyderabad it occurred 17.75%. The data regarding physical characteristics between control and market milk samples showed significant differences in pH value, freezing point, specific gravity, titratable acidity and viscosity. It is concluded from the present study that all the market milk samples did not meet the required quality accepted as standard.

Key words: Water adulteration, physical characteristics, market milk

INTRODUCTION

Milk is a valuable food. It readily digested and absorbed by human digestive system and consists of nutrients which are needed for proper growth and maintenance of body. Milk is produced throughout the year. However, milk production is greatly reduced during summer months due to heat stress and scarcity of fodder. Milk is transported from point of production to cities mainly through middlemen, such milk is watered /skimmed/adulterated to increase its volume. As milk is a perishable commodity and is likely to be spoiled during transportation therefore the middlemen add ice in it to increase its shelf life.

The milk suppliers/dealers appear to have found three ways to increase their margin from the sale of milk; (i) dilution (ii) extraction of valuable components, i.e. milk fat removed as cream and (iii) a combination of (I) and (ii).The hazards caused by milk adulteration are monumental and incalculable. Unfortunately, due to unorganized and non-regulated marketing system, the quality of milk is hardly maintained at consumer level. Addition of water and ice is common which affects the physical quality of milk. The composition of milk obtained from different sources studied by Izhar and Masud (1991) indicated the gradual deterioration in the quality of milk and in several instances, it was so low that it failed to meet even the minimum legal requirements.

The economic costs of rectifying the system will be far less than the social cost of ignoring the current levels of adulteration in fresh milk supplies (Hashmi, 2004). As the water is the most common adulterant found in milk and if contaminated it may also poses a great health risk to consumers.

As milk is directly related with the health of consumer and its adulteration may leads to serious health hazards, for this reason present study is planned to observe the extent of water adulteration and its influence on the physical characteristics of market milk.

MATERIALS AND METHODS

Collection of samples: The present study was conducted to observe the extent of water adulteration and its effect on the physical quality of market milk during summer season of 2012. For this purpose, two different areas (i.e., Hyderabad city and surroundings of Hyderabad) were selected for sampling of market milk and accredited with codes B and C, whereas control milk samples obtained from university dairy farm was accredited with code A. Twenty samples each were collected randomly from different sale points of both areas and from dairy farm. Each sample was collected in sterilized glass bottle, labeled and immediately brought in icebox to the laboratory of Institute of Food Sciences and Technology for analysis.

Physical analysis: All the samples were analyzed for water adulteration and physical characteristics like extraneous water, freezing point, pH, titratable acidity, specific gravity and viscosity according to the methods of Association of Official Analytical Chemist (AOAC, 2000).

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Statistical analysis: The data obtained was tabulated and analyzed according to statistical procedure of analysis of variance (ANOVA) and significant differences of the mean were further computed using Least Significant Difference (LSD) at 0.05% level of probability through computerized statistical package i.e., Student Edition of Statistix (SXW), Version 8.1 (Copyright 2005, Analytical Software, USA).

RESULTS AND DISCUSSION

All the market milk samples collected from Hyderabad city and its surrounding areas were adulterated with water thus the water adulteration remained 100% in the market milk samples of both areas. The mean extraneous water in market milk samples was higher in Hyderabad city (21.18±1.54%) as compared to that of the surrounding of Hyderabad city (i.e., 17.75±1.88) as shown in Table 1. Similar findings have been reported by Bhatt *et al.* (2008), who observed that adulteration practice was higher in urban area in comparison to the rural area. These results are also in agreement with the findings of Lateef *et al.* (2009), who observed extraneous water 93.33% in all the samples studied.

The mean extraneous water in market milk samples was higher than control milk samples. This could be due to the reason that present study was carried out in summer season when overall supply of milk decreases up to one half (Zia, 2007). Therefore, to compensate this gap between demand and supply milk dealers adulterate milk by adding water which is probably carried out during the handling of milk starting from milking till it reaches the consumer or end user. In another study, Tariq (2001) observed that milk men add dirty ice to increase the shelf life of milk which is also one of the reasons of elevated level of extraneous water in milk samples. Similarly, Ahmed (2009) observed more than 95% of milk samples adulterated with water in Sudan and Tasci (2011) found 30% milk samples with added water in Turkey. It was also noticed that average freezing point of market milk samples of Hyderabad and its surrounding areas was -0.428±0.0008 and -0.447±0.01%, respectively and was significantly ($P<0.05$) lower than that of control milk samples -0.543±0.0001 (Table2). Freezing point of market milk samples of Hyderabad and its surrounding areas was higher as compared to that of control milk sample. Present findings are in accordance with the results of Meredith *et al.* (2007), who reported that milk containing extraneous amounts of water will have a grossly elevated freezing point.

Table 1: Extraneous water (%) observed in market milk samples

	Areas studied	
Variance	B	C
Mean	21.18	17.75
SE±	1.54	1.88

Table 2: Mean freezing point of control and market milk samples

	Freezing point		
Variance	A	B	C
Minimum	-0.550	-0.500	-0.515
Maximum	-0.528	-0.361	-0.366
Mean	-0.543	-0.428	-0.447

LSD (0.05) = 0.02 SE±0.01

The data regarding pH value in market milk in Fig. 1 revealed that the average pH value in market milk sample of Hyderabad city (B) and its surrounding areas (C) was 6.91±0.03 and 6.80±0.02, respectively was significantly ($P<0.05$) higher than that of control milk samples (A) 6.70±0.01%. The higher pH observed in market milk samples was may be due to the extensive use of preservatives and other adulterants in market milk. In a similar study, Javaid *et al.* (2009) observed remarkable differences among the mean pH values (6.54, 6.53, 6.65 and 6.66) of several milk samples. In different studies conducted by Meredith *et al.* (2007), Gran *et al.* (2003) and Kanwal *et al.* (2004), pH value of milk samples were observed in between 6.44 to 6.99.

The mean titratable acidity of market milk of Hyderabad and its surrounding areas (i.e., 0.15±0.0001 and 0.14±0.00006, respectively) was significantly ($P<0.05$) lowers than that of control milk (0.19±0.0002) (Fig. 2). This may be due to the addition of preservatives that may be used to increase the shelf life of milk or to retards the growth of lactic acid bacteria and for enabling them to produce lactic acid from lactose. These results are not in line with the findings of Lateef *et al.* (2009), who reported titratable acidity 0.07% in market milk. In some other studies carried out by Kanwal *et al.* (2004), Javaid *et al.* (2009) and Shojaei and Ysadollah (2008), titratable acidity of market milk was found 0.13, 0.15 and 0.17%, respectively.

The data pertaining to average specific gravity (Fig. 3) of market milk samples at Hyderabad and its surrounding areas was 1.023±0.00005 and 1.027±0.00005,

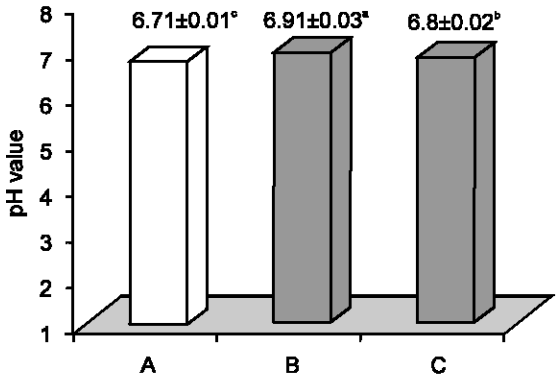

Fig. 1: Mean pH values of control and market milk samples. LSD (0.05) = 0.06 SE±0.03

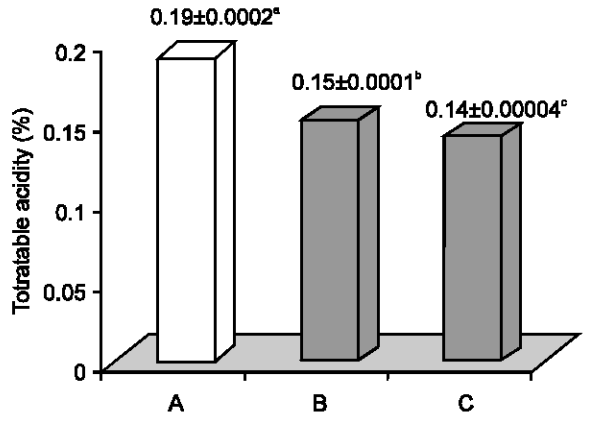

Fig. 2: Mean titratable acidity of control and market milk samples. LSD (0.05) = 0.0005 SE±0.0002

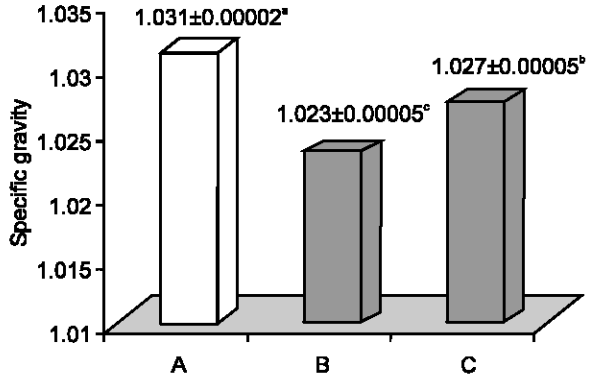

Fig. 3: Mean specific gravity of control and market milk samples. LSD (0.05) = 0.0001 SE±0.00006

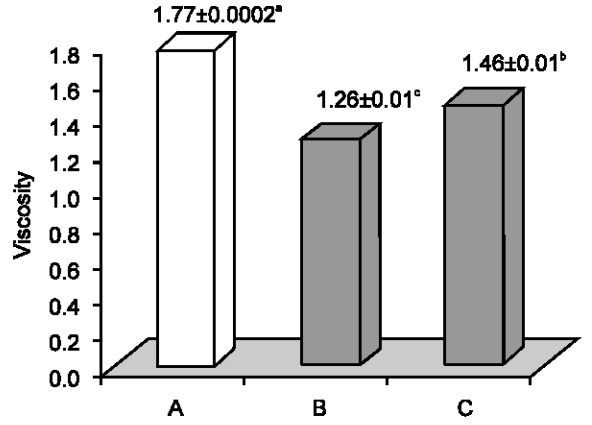

Fig. 4: Mean control and market milk samples. LSD (0.05) = 0.03 SE±0.01

respectively and significantly (P<0.05) lower than that of control milk (1.031±0.00002). The findings of present study are not in agreement with the findings of Khan *et al.* (2005), who observed specific gravity 1.033 in milk samples. However, specific gravity of market milk samples in present study is in agreement with Lateef *et al.* (2009), who reported 1.020, this low specific gravity is may be due to the addition of water or removal of milk fat (cream) from the market milk. In order to increase the profit the milk dealers use cheap practices to mask these adulteration by adding starch. Moreover, Tasci (2011) reported that milk samples analyzed in turkey were not in the normal range in terms of SNF and density.

The results of mean viscosity of market milk samples were given in Fig. 4, illustrated that market milk samples of Hyderabad and its surrounding areas were 1.26±0.01 and 1.46±0.01, respectively and were significantly (P<0.05) lower than that of control milk (1.77±0.0002). The average viscosity of market milk in present study are relatively in accordance with the findings of Javaid *et al.* (2009). The low viscosity is ultimately due to dilution of market milk samples with extraneous water or due to the removal of cream from it.

Conclusions: It is concluded from the present study that the milk samples of Hyderabad city are more adulterated than its surrounding areas. It is also concluded from the study that adulteration of water altered the physical characteristics of market milk and exhibited strong influence on impairing the quality of market milk.

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