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Bhavya Y
P.G. Scholar, Department of
Livestock Production
Management, P.V. Narsimha
Rao Telangana Veterinary
University, Rajendranagar,
Telangana, India

Suresh Rathod
Associate Professor, Department
of Livestock Production
Management, P.V. Narsimha
Rao Telangana Veterinary
University, Rajendranagar,
Telangana, India

Sarjan Rao K
Professor & University Head,
College of Veterinary Science,
Proddatur, SVVU, Tirupati-
A.P., India

Nalini Kumari
Associate Professor, Department
of Animal Nutrition, College of
Veterinary Science, Korutla,
Telangana, India

Composition and quality studies of milk from production to consumption in urban automated dairy sector

Bhavya Y, Suresh Rathod, Sarjan Rao K and Nalini Kumari

Abstract

The present study was conducted in the ten commercial dairy farms maintaining minimum of 100 animals as a herd and adopted the automatization in milking in and around Hyderabad city of Telangana State. The milk samples were collected from automated urban dairy units at three different strata, that is at composite cow milk (S-1), bulk milk tank (S-2) and after processing (S-3). Dairy units were categorized into fully and semi-automated dairy units. The average fat% values in fully automated farms was more than the semi-automated farms. SNF values are almost similar in both automated and semi-automated milk samples. It is positive sign and profitable as the price for milk is given based on the fat percent. Quality of milk samples was tested and found that pH values ranged within normal i.e between 6.6-6.8. It means that milk produced in the fully automated farms have better keeping quality. Regarding microbial quality in general RRT grades of first and second strata milk samples was fair but in fully automated farms three strata samples for RRT graded as good which shows good keeping quality. The somatic cell counts are high in all the three strata samples in all the dairy units which is of concern. In terms of SPC count fully automated units samples are of good grade but in semi-automated first two strata samples are good and third strata sample was graded as fair. All the milk samples shown coliforms in 1:100 and 1:10 dilution and graded as not satisfactory.

Keywords: Automation, Quality of milk

Introduction

India, well known as oyster of the global dairy industry accounting to 132 million tonnes (MT) of milk production (DADF, GOI, 2012-13) is a major contributor to the total livestock output value to gross domestic product (GDP). Considering its economic potential, extensive and intensive exploitation of milk can both contribute to the nutrient requirements of Indian people and increase the income of farmers. The domestic production could be increased in terms of quantity and quality with adoption of Good Dairy Farming Practices. In modern society consumer concern about methods of food production include food safety. Under, Indian dairy farm conditions, manual labor will be future problem and milking by machine in certain high milk producing mastitis areas will become efficient and economic. But studies on the use of machine milking in India are very limited and sporadic. Therefore this study was undertaken in view of the growing population awareness about food safety and quality, knowledge of the microbial and chemical composition of milk is of great significance for further development of its hygienic processing into high quality consumer products.

Materials and Methods

To conduct the studies on quality of milk ten samples from each selected dairies were collected randomly at three strata level 1. Production (immediately after milking) 2. Preservation (milk tanks) and 3. Supply chain (consumer level). The samples are transported to the laboratory in thermocol ice boxes to the College of Veterinary Science, Rajendranagar, Hyderabad and the samples were subjected to the standard quality assessment tests that includes Fat%, SNF%, Somatic Cell Count, pH, Resazurin Reduction Test (RRT), Standard Plate Count (cfu/ml) and Coliforms Count (cfu/ml).

The Fat% and SNF% values of milk are determined by using a digital EKOMILK SCAN analyser, the pH value was determined by using a digital pH meter, prior to use, the pH meter was standardized with standard buffer solution of pH 4 and 7. A direct microscopic counting method was performed to evaluate the SCC of milk (Singh and Dang 2002) using Newman's stain, only those cells, which possess blue stained nucleus, were counted. Resazurin reduction test, Standard Plate Count and Coliform enumeration of the milk samples was conducted as per the procedures given in IS: 1479, Part III (1977), IS: 1479, Part III (1977), and IS: 1479,

Correspondence
Suresh Rathod
Associate Professor, Department
of Livestock Production
Management, P.V. Narsimha
Rao Telangana Veterinary
University, Rajendranagar,
Telangana, India

Part III (1977). The results obtained from standard procedure was subjected to the standard statistical procedure of Snedchor and Chochran (2009) to draw the meaning full inference.

Results and Discussion

The pH values in three sets of samples were within the range of normal i.e in between 6.6-6.8. In fully automated farms the mean pH value for three strata samples was slightly less (6.68, 6.65 and 6.63) than semi-automated farms i.e 6.78, 6.73 and 6.69. This may be due to less handling of milk in fully automated dairy farms whereas the values are slightly more in semi-automated farms. Similar findings was also noticed by Kabui *et al.* (2014). This means that milk produced in the fully automated farms have better keeping quality than the semi-automated and having good quality for consumers. Control of pH through establishment of BMC's improved the keeping quality through the control of microbial load and lactic acid production.

It was noticed that there was increased average fat values in fully automated farms (4.18%, 5.32% and 4.07%) than in the semi-automated farms (3.66%, 4.41% and 3.92%) The increase in fat% was observed due to complete milking with machines. Similarly the results of the study are in comparison with the studies of Hiedi salovuo *et al.* (2005) and Dang and Anand (2007) studies are in contrary. The SNF values are almost similar in both automated (8.375%, 8.9275% and 8.09%) and semi-automated milk samples (8.582%, 8.948% and 8.094%). Chaudhary *et al.* (2001) reported that the overall least square mean for fat percent was 4.33 ± 0.09 and SNF 8.64 ± 0.08 in machine milked cows are in comparable to the results obtained from this study. Hence the complete milking through machine milking leads to increase in fat%.

The first (3.8) (3.3), second (3.1) (2.7) and third (4.5) (3.8) strata samples of all the dairy farms graded as fair quality both in automated and semi-automated dairy unit except third strata sample of fully automated dairy unit, which was grade as good, it means it has good keeping quality. Similarly Kabui *et al.* (2014) analysed milk samples using the resazurin test indicated that readings are ranging from 4-6 on the Lovibond comparator indicating that the milk was of good acceptable quality.

The somatic cell counts are high in all the samples in all the dairy units whereas fully automated (253896.5, 366271 and 303551.5) farms have comparatively low SCC counts than

semi-automated (441593.16, 480543.16 and 406919) farms and this shows that the source of contamination and udder infections high and risk of mastitis. Similarly findings were observed by Chaudhary *et al.* (2001), Barkema *et al.* (1998), Hiedi salovuo *et al.* (2005) and Dufour *et al.* (2011).

SPC count for fully automated dairy farm samples in three strata was 32750, 38000 and 26750 in cfu/ml respectively and are of good quality but in semi-automated first and second strata samples (51000, 58833.3 cfu/ml) are graded as good and 3rd strata sample (37833.3 cfu/ml) fair in quality. The SPC counts of fully automated milk samples showed good grades and low values of SPC. These study are in comparison with the studies of Kabui *et al.* (2014), Lingathurai and Vellathurai (2010), Chaudhary *et al.* (2001), Grimaudet *et al.* (2007), Uma Maheswari and Sabitha (2015), Elmoslemany A. M *et al.* (2009) and similarly Klunge *et al.* (2000) observed increased count after the introduction of the automatic milking system.

The Coliform counts in 1:100 and 1:10 dilution graded as not satisfactory, relatively in three strata of fully automated units (5.5, 7.25 and 5 cfu/ml) have less coliform counts than semi-automated unit (25.3, 33.3 and 16.6 cfu/ml). These results are in comparison with the studies of Khan *et al.* (2008), Sandhya Deepika *et al.* (2015), Lingathurai and Vellathurai (2010), Elmoslemany A. M *et al.* (2009) and Hiedi salovuo *et al.* (2005).

Conclusion

The studies on automisation and the use of machine milking in India are very limited and sporadic. Bulk milk tank somatic cell counts and coliform counts are of concern still in all the dairy units which is to be taken care of in consideration of growing population awareness about food safety and quality, knowledge of the microbial and chemical composition of milk is of great significance for further development of its hygienic processing into high quality consumer products.

Table 1: Physical quality of milk at three strata level in fully automated and semi automated dairy unit

S.No.	Strata	Fully automated			Semi automated		
		pH	Fat	SNF	pH	Fat	SNF
1	Strata-1	6.68	4.18	8.37	6.78	3.66	8.58
2	Strata-2	6.65	5.32	8.92	6.73	4.41	8.94
3	Strata-3	6.63	4.07	8.09	6.69	3.92	8.09

Table 2: Microbial quality of milk at three strata level in fully automated and semi-automated dairy unit

S.No.	Strata	Fully automated				Semi-automated			
		RRT (hr)	SCC	SPC (cfu/ml)	Coliform (cfu/ml)	RRT (hr)	SCC	SPC (cfu/ml)	Coliform (cfu/ml)
1	Strata-1	3.87	253896.5	32750	5.50	3.33	441593.1	51000.0	25.3
2	Strata-2	3.12	366271.0	38000	7.25	2.75	480543.1	58833.3	33.3
3	Strata-3	4.50	303551.5	26750	5.00	3.83	406919.0	37833.3	16.6

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