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Effect of type of floor type and ventilation on physico-chemical composition, somatic cell count and microbiology of buffalo milk

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Abstract

The present study was undertaken to study the effect of floor type and ventilation on the microbial quality and composition of buffalo milk in rural villages of district Jammu. The buffalo management practices were studied by means of designed questionnaires. Milk samples were collected and analyzed for milk physico-chemical composition, somatic cell count and microbiological quality. Ventilation had non-significant effect on milk physico-chemical composition. However, fat, protein, solid not fat and total solids were higher under proper ventilation milking conditions. The type of floor had significant ($p < 0.05$) effect on somatic cell count of milk and microbiological quality of buffalo milk. Advanced management practices may be followed by farmers to improve the quality and composition of buffalo milk under rural conditions.

Keywords: physico-chemical composition, somatic cell, microbial quality, rural conditions

Introduction

Management has been recognized as an important tool to improve the quantity as well as quality of milk and milk products. Poor management practices like unhygienic equipments for milking, equipments for storage of milk, food, soil, faeces and animal health have profound impact on the hygienic quality of the milk (Koprivica *et al.*, 2012) [2]. Cousin (1982) [1] reported that there are so many sources viz. udder, body of the cows, litter, floor, flies, insects and rodents, water supply, milker, milk utensils and atmosphere etc. for bacterial contamination of milk. Thus, the hygienic practices practiced during milking determine what foreign microorganisms will enter the milk, including human pathogens. The hygiene of dairy animals can be used as an indicator of animal welfare, as it provides information about the quality of life of the animals and the quality of the farm facilities (Welfare Quality Consortium, 2009) [10]. Keeping in view the above facts, present study entitled "effect of type of floor type and ventilation on physico-chemical composition, somatic cell count and microbiology of buffalo milk" was undertaken.

Material and Method

Data and sample collection

The present study was based on field survey where primary data on buffalo management practices were collected from villages of district Jammu with the help of a designed questionnaire. The physical, chemical and microbiological examination of milk samples collected from these respective villages was carried out to study the impact of floor type and ventilation on hygienic quality and composition of buffalo milk. The animals were divided into two groups. Group A included animals in which traditional ventilation and floor type are followed and group B included animals in which modern ventilation and flooring practices are followed.

Physio-chemical parameters

1. The milk fat in the respective milk samples was determined using Gerber's method using a butyrometer.
2. The milk protein percentage was determined using formaldehyde titration method (Pyne's method).
3. The Solid-Not Fat (SNF) and Total solids (TS) content of milk samples were determined by Richmond's Formula:

$$\% \text{ SNF} = \text{CLR}/4 + 0.2\text{F} + 0.14$$

$$\% \text{ TS} = \text{CLR}/4 + 1.2\text{F} + 0.14$$

Where CLR is the corrected lactometer reading and 'F' is the fat percentage of milk sample.

Microbiological examination

1. Total somatic cell count of all the milk samples was done as per the modified technique of leukocyte count described by Tomer, *et al.*, 1988^[8].
2. The standard plate count (SPC) was determined using plate count agar obtained from Hi Media Laboratories Pvt. Ltd., Mumbai (Code No. M091).
3. Coliform bacteria was determined using Violet Red Bile Agar from Hi Media Laboratories Pvt. Ltd., Mumbai (code No. M091).

Results

Effect of type of floor on physico-chemical composition, somatic cell Count and microbiological examination of buffalo milk

The least square means (\pm SE) of milk components (Fat, Protein, SNF, and TS), Titrable acidity and Somatic Cell Count considering the effect of floor were 5.86 ± 0.019 , 3.20 ± 0.057 , 9.32 ± 0.092 , 15.19 ± 0.146 , 0.214 ± 0.003 and 5.39 ± 0.03 for the Kachha type of floor and 6.07 ± 0.107 , 3.32 ± 0.061 , 9.36 ± 0.081 , 15.44 ± 0.140 , 0.211 ± 0.004 and 4.865 ± 0.07 for the Pucca type of floor. The least square analysis of variance showed that the effect type of floor on

Physico-chemical composition of milk was found not to be significant. However there was significant ($p < 0.05$) effect of type of floor on the somatic cell count. The somatic cell count was found significantly higher in Kachha type of floor than in the Pucca floors.

The least square means (\pm SE) of total viable count and coliform count of buffalo milk considering the effect of type of floor were 5.81 ± 0.05 (\log_{10} cfu/ml) and 4.99 ± 0.05 (\log_{10} cfu/ml) for Kachha type of floor and 5.45 ± 0.07 (\log_{10} cfu/ml) and 4.69 ± 0.06 (\log_{10} cfu/ml) respectively for Pucca type of floor (table 6a and figure 6a). The least square analysis of variance showed that the effect of type of floor on total viable count and coliform count was found to be significant ($p < 0.05$).

Effect of type of ventilation on physico-chemical composition microbiological examination and somatic cell count of buffalo milk

The least square means (\pm SE) of milk components (Fat, Protein, SNF, and TS), Titrable acidity and Somatic Cell Count considering the effect of type of ventilation were 6.13 ± 0.094 , 3.08 ± 0.051 , 9.32 ± 0.064 , 15.46 ± 0.116 , 0.210 ± 0.003 and 5.06 ± 0.10 for well ventilated households and 5.59 ± 0.11 , 3.05 ± 0.075 , 9.39 ± 0.138 , 14.98 ± 0.19 , 0.219 ± 0.004 and 5.15 ± 0.24 for those households having improper ventilation. The least square analysis of variance showed that the effect of ventilation on milk physico-chemical composition and SCC was found not to be significant.

The least square means (\pm SE) of total viable count and coliform count of buffalo milk considering the effect of type of ventilation were 5.55 ± 0.07 (\log_{10} cfu/ml) and 4.71 ± 0.06 (\log_{10} cfu/ml) for those households having good ventilation and 5.65 ± 0.15 (\log_{10} cfu/ml) and 4.72 ± 0.09 (\log_{10} cfu/ml) for those households having improper ventilation in the sheds. The least square analysis of variance showed that the effect of type of ventilation on total viable count and coliform count was found not to be significant.

Discussion

Housing practices were found to have non-significant effect on physico-chemical composition of milk. This seems reasonable as composition of milk is mainly determined by the nutrition, stage of lactation, parity and season of the year (O. Connor, 1994)^[4]. However, type of floor had effect on the SCC with Kachha floors showing significantly higher SCC counts than the Pucca floors. The dampness of the Kachha floor provides a suitable condition for microbiological proliferation leading to poor hygiene and udder contamination. Once contaminated by the wastes, udder is more likely to get infected, thereby contributing to the higher somatic cell counts in milk. Earlier studies (Mahony, 1998; Toledo *et al.*, 2002)^[5, 7] in organized dairy cattle herds also reported no significant effect of housing on chemical composition of milk. However, it has been shown that cows reared under organic system could have higher levels of fat and protein in milk (Weller *et al.*, 2002)^[11]. Studies resembling conventional housing system (Weber *et al.*, 1993)^[9] however showed that there could be higher levels of protein and fat in milk of animals under conventional system than those reared under organized herds. In general, the findings of the present study concurred with the findings of Kumar (2014)^[3], who reported no significant effect of milking management practices on milk composition. On the contrary higher fat, protein, SNF and lactose percentage and lower SCC counts were associated with hygienic milking conditions.

The microbiological quality of milk was highly associated with the type of floor. Total viable counts and Coliform counts were significantly higher in kachha floors than pucca floors. This seems valid as cleaning of kachha floor is difficult and it easily becomes damp due to the dung, urine, drinking water etc. The dung and other wastes usually get adhered to udder, teats, legs, abdomen etc and become the source of contamination to raw milk. Cleaning of dung and wastes and maintaining dryness of floor are easier in Pucca type of floor, that minimizes the microbial burden and contamination problems usually associated with Kachha floors.

Type of ventilation had no significant effect on the microbiological quality of buffalo milk. However, a lower trend of TVC and CC was found in well ventilated sheds compared to the sheds having improper ventilation. Proper ventilation in the sheds reduces the accumulation of the dirty air/foul air in the shed that otherwise would cause air borne contamination to the milk during milking. This is in agreement with Pandey *et al.* (2014)^[6].

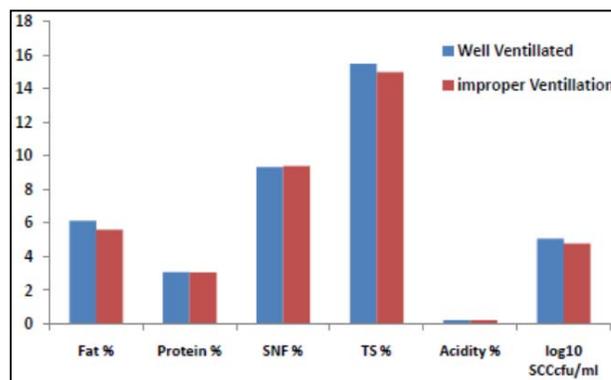


Fig 1: Milk physico-chemical composition and Somatic cell count in well ventilated and improperly ventilated sheds



Fig 2: Bacterial colonies on Plate Count Agar.

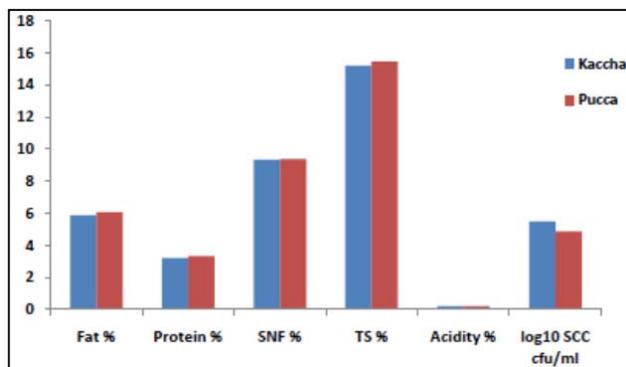


Fig 3: Milk physico-chemical composition and Somatic cell count in Kachha and Pucca type of floor.



Fig 4: Coliform Colonies on Violet Red Bile Agar

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