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Hygienic milk production: Quality improvement practice at dairy farm level

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Abstract
In the present study Dairy environmental samples such as soil, dung, fodder and liquid samples such as portable water, aseptic milk, can milk, chilled milk, pasteurized milk, swab of milk handler, udder of milch animal, rinse of can and pail, and the air of milk parlour were collected aseptically from KVAFSU dairy farm. Samples such as milk handler, udder of the cow, can rinse, pail rinse bacterial analysis was done before milking and after properly washing and treatment of things then result was interpreted to highlight the importance of hygienic milk production.

Keywords: Sources of milk contamination, sterile milk, hygienic milk production

1. Introduction
India is the leading producer and consumer of milk across the globe. Milk is a good medium for the growth of microorganisms due to lactose, milk protein, milk fat, vitamins and minerals. Microorganisms are ubiquitous in nature, based on their role they may be beneficial, pathogenic or spoilage types that multiply exponentially increasing the population as well metabolic activities. Milk synthesized in udder is almost sterile, but taken out through milking, microorganisms enter from various sources like milch animal itself, milker, milking barn, milking utensil, farm water, equipment, storage & transportation. The microbial contaminants act on milk constituents and bring about spoilage, while few microbes may be pathogens involved in causing the diseases. In order to produce good quality fluid milk, UHT milk and milk products, the basic requirement is the hygienic or clean milk. Hygienic milk or clean milk is the 'milk obtained by healthy milch animal under hygienic conditions to increase the shelf life by reducing the microbial contaminants from external sources. In the present work an attempt is being made to express the significance of asepsis at each step of milking to reduce the microbial contamination. [(Abdifatah *et al*., 2022) [1], (Bafanda *et al*., 2018)] [5].

2. Objectives
- To trace the microbial sources of contamination during milking
- To prevent microbial contaminants at major steps of milking

3. Materials and Methods
Dairy environmental samples from KVAFSU dairy farm, like solid samples such as soil, dung, fodder and liquid samples such as portable water, aseptic milk, can milk, chilled milk, pasteurized milk, swab of milk handler, udder of milch animal, rinse of can and pail, and the air of milk parlour were collected aseptically. Solid samples were serially diluted from first dilution i.e.., 11 gm in 99 ml diluents (phosphate buffers) and using those further dilutions carried out. First dilution of liquid sample was by transferring 11 ml to 99 ml diluents and further required dilutions were prepared. Air analysis from the milking parlour - air is collected on the pre-solidified SPCA (Standard plate count agar), VRBA (Violet Red Bile Agar), MEA (Malt Extract Agar) agar petri plates for 10 min. Microbiological parameters carried out were, Total Bacterial Count (SPCA – 37 °C/24-48 h); Coliforms (VRBA – 37 °C/18-24 h) and Yeast & Mold counts (MEA at pH 3.5 –30 °C/3-5 days).The viable counts of solid samples were expressed as cfu/g, while the liquid samples were expressed as cfu/ml - water: cfu/udder – udder of cow; cfu/lit – rinse of pail or can, cfu/10 min – air of milking parlour (Harrigan, 1998) [8].

4. Result and Discussion

The microbiological analysis of the collected samples was tabulated and were discussed with other research study

Table 1: Microbiological analysis of dairy environmental samples

Sl. No	Sample Name	Counts log_{10} cfu/gm or ml or lt or udder or 10min			Sample figure
		TBC	Coliform	Yeast & molds	
Solid Dairy Environmental Samples					
1	Soil	7.5 ± 0.26	4.6 ± 0.17	3.2 ± 0.12	
2	Dung	9.0 ± 0.15	5.73 ± 0.62	3.4 ± 0.33	
3	Fodder	4.23 ± 0.12	5.43 ± 0.61	3.73 ± 0.33	
Liquid Dairy Environmental Samples					
1	Portable Water	3.3 ± 0.15	2.30 ± 0.23	0.60 ± 0.19	
2	Air of Milking Parlour	2.5 ± 0.09	0.6 ± 0.77	1.17 ± 0.08	
3	Milker Hand Swab	Before 2.23 ± 0.16	1 ± 0.05	1 ± 0.05	
		After 1.12 ± 0.06	0	0	
4	Swab of Cow Udder	Before 2.45 ± 0.09	1.2 ± 0.55	1 ± 0.08	
		After 1.0 ± 0.05	0	O	
5	Can Rinse	Before 5.87 ± 0.08	2.2 ± 0.08	1 ± 0.06	
		After 1.87 ± 0.07	1 ± 0.05	0	
6	Pail Rinse	Before 3.2 ± 0.53	1.2 ± 0.12	1 ± 0.05	
		After 1 ± 0.05	0	0	
7	Aseptic Milk	1 ± 0.05	0	0	
8	Can Milk	4.8 ± 0.24	0	0	
9	Chilled Milk	5.7 ± 0.08	2.2 ± 0.34	0	
10	Pasteurized Milk	2.5 ± 0.24	0	0	

4.1 Viable counts of Dairy Environmental Samples

TBC, coliform and yeast & mold counts of solid dairy environmental samples ranged from 9.0±0.15 to 4.23±0.12; 4.6±0.17 to 5.73±0.62 and 3.2±0.12 to 3.73±0.33 log_{10}cfu/gm, respectively. Among the solid samples, dung showed more count of TBC (9.0±0.15 log_{10}cfu/gm), while low counts (4.23±0.12 log_{10}cfu/gm) were in fodder sample. Range of viable (log_{10}cfu/ml) TBC was 5.7±0.08 to 1±0.05; coliforms 0 to 2.30±0.23 and yeast and molds 0 to 0.60±0.19 in liquid dairy environmental samples. Microbiological parameters carried out were, Total Bacterial Count (SPCA – 37 °C/24-48 h); Coliforms (VRBA – 37 °C/18-24 h) and Yeast & Mold counts (MEA at pH 3.5 –30 °C/3-5 days). Among all samples, parameters of Coliform and yeast and molds, were found to be highest in dung and fodder with 5.73±0.62 and 3.73±0.33 log_{10}cfu/gm, respectively. The common factors of milk contamination by microorganisms are milking environment, soil, dung, fodder, air, personnel, milking equipment, milk transportation and farm water were reported by (Bekuma *et al*., 2018) [7].

4.2 Viable counts before and after cleaning and sanitation:

Total bacterial count, coliform, yeast & mold counts of milking parlour air, was found to be 2.5±0.09; 0.6±0.77; 1.17±0.08 log_{10} cfu/10 min, respectively. TBC, coliform and yeast & mold counts of udder before cleaning was 2.45±0.09; 1.2±0.55; 1±0.08 log_{10} cfu/udder that reduced to 1.0±0.05; 0; 0, after proper cleaning and sanitation (50 ppm of chlorine). Similarly, milker's hand before cleaning was 2.23±0.16; 1±0.05; 1±0.05 and reduced by 1.12±0.06;0; 0, after proper cleaning and sanitation (50 ppm of chlorine). Milking can before cleaning was 5.87±0.08; 2.2±0.08; 1±0.06, and reduced to 1.87±0.07; 1±0.05; 0. Milking pail before cleaning was 3.2±0.53; 1.2±0.12; 1±0.05 and reduced to 1±0.05; 0; 0.

The can rinse done before and after showed larger difference signifying the importance properly washing and requirement of maintaining hygienist of cans. Milk handler may harbor the pathogenic bacteria or if he is ill, if milking is done by such person there is high risk of transfer of bacteria into the milk, in the present study there is significant difference before and after analysis of hygienic milk production highlighting the importance of clean milk production (Adugna and Eshetu., 2021) [2]. Barbuddhe S B and Swain B K.., 2008 [6] reported that the cleaning of udder before milking, milking utensils, milk cans and time taken for transportation of milk from dairy cooperative society to dairy have been identified as the critical control points in hygienic production of milk.

5. Conclusion

Reducing microorganisms in milk increases shelf life of milk. Proper setting of good hygienic practices will surely help in reducing microorganism's entry into raw milk. Hygienically drawn milk can be used for UHT milk and milk products preparation with enhanced keeping quality. Hygienic milk practices, improves the quality of raw milk, which directly influence the final quality of milk and milk products.

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