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Microbiological quality of raw milk and effect on quality by implementing good management practices

S.A.S.D De Silva[a], K.A.N.P Kanugala[b], N.S Weerakkody[a]*

[a]*Department of Agricultural and Plantation Engineering, The Open University of Sri Lanka, Nawala.*
[b]*Food Quality Assurance Division, Nestle Lanka PLC, Kurunagala factory, Pannala.*

Abstract

Raw milk is a complete food which contains protein, fat, sugars, vitamins and minerals. Even though, raw milk is sterile at secretion, contamination of milk by microorganisms can take place during milk handling, storage and other pre-processing activities. The objectives of this study were to assess the initial microbial load and to determine correlation between Methylene blue dye reduction test with standard plate count method and find possible methods to improve the quality and reduce the wastage of raw milk. As per the records obtain from the chilling centers, about twenty per cent (per month) of raw milk collected to the centers in each district has to be discarded due to spoilage. Out of 13 chilling centers in Kurunagala district, five chilling centers namely Badalgama, Elabadagama, Kuliyapitiya, Dambadeniya and Minuwangoda chilling centers were randomly selected and the initial microbial loads of milk from chilling tanks were tested using Standard Plate Count and Methylene blue dye reduction test. Further, Self-filled questionnaire was used to gather data related to practices in milk supply chain and swab samples were taken from the containers used for milk collection process. Though the microbial population should be below log 6.00 according to the factory standards in Sri Lanka to accept milk for further processing, standard plate count of chilling centers were log 7.08, 6.76, 6.56, 6.70, and 6.88 (CFU/ml) respectively. Good management practices were introduced to rectify the main cause for high microbial counts. After the improvements low microbial counts of above chilling centers were achieved as log 5.91, 5.85, 5.85, 5.86 and 5.94 CFU/ml respectively. Standard Plate Count showed significant difference ($p < 0.05$) after practicing good management practices. Strong correlation (r^2 0.91) was observed between Methylene blue dye reduction test and Standard Plate Counts (log CFU/ml). Therefore, Methylene blue dye reduction test can be used effectively, economically and efficiently, to detect the quality of raw milk and can use as an alternative method for costly and tedious microbiological analysis methods.

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corresponding author. Tel.: +94112881396; fax: +94112822737.
E-mail address: neweer@ou.ac.lk

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1. Introduction

Milk is synthesized in specialized cells of the mammary gland and is virtually sterile when secreted into the alveoli of the udder[1]. Microbial contamination can generally occur from three main sources such as; within the udder, exterior of the udder and surface of milk handling and storage equipment[2].]

Milk is usually get contaminated by microorganisms. Good milk hygiene practices such as maintaining clean and healthy cows, keeping a clean milking environment free of dust and mud, avoid milking if the farmer is suffering from communicable diseases like diarrhoea or typhoid, not mixing colostrum and fore milk, washing hands with soap and clean water before milking, washing the udder with warm water and drying the udder with a clean dry cloth and use of clean containers for milking, will improve the quality of raw milk. In addition, cows with mastitis should be milked last and their milk should be discarded and dip teats in an antiseptic solution will further help to reduce contamination of raw milk [3].

Identification of initial microbial load is important and different methods are used at field and laboratory level. Methylene blue dye reduction test (MBRT) has been used as rapid alternative method to determine whether milk is acceptable or not. In addition the standard plate count (SPC) is a procedure that allows microbiologists to estimate the quantitative population density of microorganism in liquid milk. Small scale household milk producing farmers are found in Kurunagala district where the average temperature is 32^0C, which enhance microbial growth in raw milk. In addition poor hygienic conditions result higher initial microbial counts in harvested raw milk. As a consequence maintaining the final product quality standards has been difficult. Therefore, there is a need to identify causes for the microbial contamination to reduce the initial microbial load up to acceptable level in raw milk. The objective of this study was to assess the initial microbial load and find possible methods to improve the quality and reduce the wastage of raw milk in Kurunegala District of North Western province in Sri Lanka.

ndMaterials a .2M ethodology

Collection of samples .2.1

Raw milk samples were collected from udders of dairy cows, milking utensils, collecting points and chilling centers located at Kurunegala district. A total of 176 samples comprising of milk from dairy animals were collected at different levels of collection and processed. Accordingly 33 raw milk samples from Badalgama, 35 raw milk samples from Kuliyapitiya 30 samples from Elabodagama, 38 samples from Dambadeniya and 40 samples from Minuwangoda were collected. All the samples were kept in an icebox and transported to the laboratory under chilled conditions within 2 hours and processed for microbiological analysis. Milk samples were analyzed by Standard Plate count test and Methylene blue dye reduction test.smethod

Standard Plate Count .2.2

In order to perform microbial quantity analysis Standard Plate Count (ISO 4833-2:2013) was practiced. Two replicates of each sample were tested.

Methylene .2.3b luedye reduction test (MBRT)

The MBRT test was carried out according to the method described byAtherton et al[4]. Two replications for each sample were carried out in the same manner and results were gathered to build the correlation of the SPC verses MBRT. Further studies were carried out according to the bacterial count results obtained from the milk samples.

2.4 Test for antibiotics and hydrogen peroxide in milk samples