

ABSTRACT

Milk quality is of utmost importance in the dairy sector as low quality milk directly affects the earnings of small holder dairy farmers (SHDF). Milk quality is affected by microbial contaminants that proliferate during storage and transportation especially at ambient temperatures. There is little information on characterization of bacterial milk contaminants in Siaya County, important in understanding their role in milk quality deterioration. Introduction of Solar powered milk cooling system (SPMCS) in Siaya County was intended to preserve quality and reduce milk loss due to bacterial contamination. However, there is paucity of information on the physico-chemical quality of milk cooled using SPMCS. Low temperatures provided by SPMCS slows bacterial multiplication but scanty information is available on the bacterial load of milk cooled using the system. Similarly, the system was intended to preserve milk quality and reduce rejection rate hence increased sales, but there is no information on the relationship between cooling of milk and earning of the SHDF in the study area. The main objective of this study was to characterize bacteria contaminants of uncooled and cooled milk preserved using SPMCS, assess the physico-chemical quality of milk and its effect on the SHDF earnings in Siaya County. The specific objectives were; to compare the physico-chemical quality of cooled and uncooled milk, to determine bacterial colony forming units in cooled and uncooled milk samples, to characterize bacteria contaminants from cooled and uncooled milk samples and to assess the effect of cooled milk on the earnings of SHDF. A longitudinal study design was employed to collect milk samples from milk delivered to Sam Malanga Dairy Cooperative Society located 0°03'36"North, 34°17'24"East. One hundred and forty-four samples of raw milk transported in insulated mazzi cans (cooled) and 144 samples of milk transported in plastic jerry cans (uncooled) were collected and submitted to JOOUST botany laboratory. Bacterial isolation and characterization experiments were arranged in completely randomized design (CRD). Samples were analyzed for physico-chemical properties as well as microbial load. Bacterial contaminants were characterized using morphological and molecular markers and their phylogenetic relationship determined. All the 36 farmers using SPMCS were recruited into the study and a survey study design adopted. Questionnaire was administered to establish the effect of milk cooling on the farmers' earnings. Data on physico-chemical analysis and bacterial load was subjected to analysis of variance (ANOVA) where significant means were separated using Least Significant Difference at [LSD_{5%}]. Morphological characteristics of bacterial isolates were subjected to a hierarchical cluster analysis. Molecular data was blasted and analysed in MEGA 6 software to compare sequences of the isolates with those deposited in National Centre for Biotechnology Information database. Data on earnings of SHDF was analysed using t- test and regression analysis. All the cooled milk were negative for clot-on-boiling (COB) and alcohol test while 12.5 % and 22.2 % of uncooled milk were positive for COB and alcohol test respectively. There was a significant difference ($p < 0.005$) between the pH of cooled (6.63) and uncooled milk (6.4). There was equally a significant difference in the cfu of cooled milk ($5.8 \log_{10}$ cfu/ml) and uncooled milk ($6.4 \log_{10}$ cfu/ml). Both Gram negative and positive cocci and bacilli bacteria were identified. The dendrogram clustered the isolates into two groups at 75% similarity level. The phylogenetic tree grouped the isolates into four clades *Enterobacteriales*, *Pseudomonales*, *Actinomycetales* and *Bacillales* at 99% similarity level. Farmers' earnings significantly ($p < 0.005$) increased from KES 8,138.67 before to KES 12,253.14 per month after installation of SPMCT. The study concludes that the SPMCS has the potential to preserve milk quality and enhance small holder dairy farmers' earnings. The study recommends the adoption of SPMCS by SHDF to preserve the quality of milk and increase earnings.