

Influence of Time, Temperature and Starting Bacteria Load Parameters on the Quality of Raw Bulk Tank Milk

S.R.A. Meleck; G. Keefe, DVM, MSc, MBA

Dept. Health Management, Atlantic Veterinary College, University of Prince Edward Island

Introduction

Higher quality raw milk produces superior milk products that have a preferred position in the marketplace. The production of high quality milk products requires that milk be harvested with the minimum of bacterial contamination, and stored at low temperatures for the shortest time period practical before processing. These three factors (low start bacterial load, low storage temperature and short storage time) inhibit bacterial growth, which is important to maintain quality and to increase shelf life. The objective of this study was to examine the relative importance of these factors, and interactions between the factors, on end bacterial burden.

Materials and Methods

Raw milk was collected from the bulk tanks of five farms from around Charlottetown, Prince Edward Island. Aliquots from each farm were assigned to one of three temperature groups (2°C, 4°C and 6°C) and spiked with 0, 4000 or 8000 colony forming units (cfu) of bacteria, harvested from bulk tank samples (mixed bacteria population). Total end bacteria burden (cfu) was measured in each farm (n=5), temperature (n=3), starting bacteria load (n=3) combination, each day for five days, for a total of 225 samples. The natural-log transformed cfu values were analyzed by a linear mixed model with random effects of the three samples generated per farm, and fixed effects of the added cfu content, day and temperature.

Results

There was no effect of farm of origin of the milk used on the end bacteria count. Starting cfu level,

temperature, the amount of days the milk was stored and a combined temperature*storage day interaction were highly significant predictors of end bacteria load ($p<0.01$). The interaction of temperature and storage day was pronounced after day 3 at temperatures of 4°C and 6°C. Milk stored at 6°C had the most dramatic rise in bacteria count as the number of days in storage increased. In Prince Edward Island, the Dairy Industry Act requires that milk be maintained at a temperature of not more than 4°C. Milk must not exceed 10°C blend temperature when new milk is added to the tank, and must attain a temperature of < 4°C within 30 minutes of milking. Additionally, for Grade A status milk must be picked up within 48 hours of initial milking. Milk for industrial purposes must be picked up within 72 hours of initial tank filling. When milk is handled under these temperature and age conditions, the most important factor is starting bacterial hygiene. High quality raw milk, cooled rapidly to 4°C, can be kept for up to three days with minimal risk, however, if milk is kept for longer periods, lower temperatures (2°C) may be beneficial.

Significance

This study illustrates the importance of beginning on-farm storage with high quality, low bacteria count raw milk. Milk with low bacteria count should maintain high quality if storage is consistent with industry regulations. If longer storage is required, reducing holding temperature to 2°C may mitigate some of the negative impacts of milk age on bacteria count.