

Effect of Feeding Raw Versus Heat-treated Colostrum on Passive Transfer of Immunoglobulin G in Newborn Dairy Calves

M. Donahue, DVM¹; S. Godden, DVM, DVSc¹; R. Bey, PhD¹; S. Wells, DVM, PhD, DACVPM¹; J. Fetrow, DVM, MBA¹; J. Stabel, PhD²

¹College of Veterinary Medicine, University of Minnesota, St. Paul, MN

²USDA, ARS, National Animal Disease Center, Ames, IA

Introduction

The importance of timing, volume and quality of colostrum fed has long been understood, but the improvement of colostrum quality via on farm heat-treatment is a concept developed only within the last few years. Bacterial contamination of colostrum is not only a potential source of pathogen exposure, but perhaps interferes with the absorption of Ig. An earlier pilot study in 49 calves on one farm indicated that feeding heat-treated colostrum enhanced the efficiency of absorption of colostral IgG in the neonatal calf, presumably by reduction in bacteria counts in colostrum. A larger controlled study in six large commercial dairies was undertaken to determine if the pilot study results could be replicated. The objective of this study was to determine if calves fed raw versus heat-treated colostrum differed significantly in serum total solids and serum IgG concentrations.

Materials and Methods

Six commercial dairy farms in Wisconsin and Minnesota, ranging from 1,200 to 1,600 cows, were enrolled into the study between June and August, 2007. First milking colostrum was collected from fresh cows and refrigerated. Daily, or every other day, the refrigerated colostrum was pooled to create a new batch, mixed, and then split into two equal portions. One half of was kept raw, while the other half was heat-treated at 140° F (60° C) for 60 minutes using a commercial on-farm batch pasteurizer (DairyTech, Inc., Windsor, CO). After processing, duplicate 50 mL samples of both raw and heat-treated colostrum were collected into sterile vials, labeled, dated and frozen. Samples for each batch of colostrum, raw and heat-treated, were collected weekly and later underwent analysis to determine microbial total plate count (TPC) and total coliform count (TCC) cultures (cfu/ml), and colostrum IgG concentrations (mg/ml) using turbidometric immunoassay (TIA). The processed colostrum (raw or heat-treated) was then stored in 3.8 L portions in clean, sanitized, and labeled

bottles and refrigerated for subsequent feedings to newborn calves. Newborn calves (n = 1102) enrolled into the study were removed from the dam within one hour of birth and alternately assigned to be fed 3.8 L of either raw or heat-treated colostrum. All colostrum was fed within two hours of birth. Records for calves included calf ID, birthdate, birth time, the type of colostrum fed (raw or heat-treated) and the individual batch of colostrum fed. Calves were then housed individually in barns or hutches. Calf treatment and mortality events occurring between birth and weaning were recorded. Technicians visited each farm weekly to collect blood samples for enrolled calves between the ages of 24 hours and eight days of age. Blood was allowed to clot, serum collected, and serum total protein concentration (TP, g/dl) was analyzed using a hand-held refractometer. The serum sample was subsequently split and frozen in paired aliquots. One of these aliquots was later analyzed for serum IgG concentration (mg/ml) by TIA.

Results

Preliminary results of mean serum TP concentrations were significantly greater for calves fed heat-treated colostrum (5.83 g/dl) vs calves fed raw colostrum (5.70 g/dl; $p < 0.001$). Similarly, the mean serum IgG concentration was significantly greater for calves fed heat-treated colostrum (16.97 mg/ml) vs calves fed raw colostrum (14.48 mg/ml; $p < 0.001$).

Significance

An increased serum IgG concentration is expected to decrease early calfhoo morbidity. Heat-treated colostrum reduces pathogen exposure and potentially bacterial interference of IgG absorption in the gut. Heat-treatment of colostrum is a new management tool which offers to improve successful passive transfer of IgG. Analysis is pending to describe colostrum IgG concentrations (mg/ml), TPC (cfu/ml) and TCC (cfu/ml). This project was funded by USDA-CSREES.