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

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Introduction

It is undisputed that colostrum is necessary for the neonatal calf, not only for its nutritional components but more importantly for the passive transfer of protective colostral immunoglobulins (Ig). Feeding a sufficient volume of high quality colostrum shortly after birth is required to achieve successful passive absorption with serum IgG greater than 10.0 mg/ml at 24 to 48 hours of age. Yet, according to the NAHMS survey of 1993, 41% of calves have failure of passive transfer (FPT). While the importance of timing, volume and quality of colostrum fed have long been understood, 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 (Johnson *et al.*, 2007). 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. Each herd had been confirmed as being Johne's-positive by fecal culture or ELISA testing within the three year period preceding the study.

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 each batch of colostrum was kept raw, while the other half was heat-treated at 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. 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.

Research technicians visited each farm weekly to collect blood samples for previously enrolled calves between the ages of 24 hours and eight days of age. Blood samples and previously collected frozen colostrum samples were transported, on ice, to the College of Veterinary Medicine. Colostrum samples later underwent laboratory culture to determine microbial total plate count (TPC) and total coliform count (TCC) cultures (cfu/ml), and laboratory determination of colostrum IgG concentrations (mg/ml) using turbidometric immunoassay (TIA). Blood was allowed to clot and the serum collected. Serum total solids concentration (TS, g/dl) was analyzed using a hand-held refractometer. The serum sample was then subsequently split and frozen in paired aliquots. One of these aliquots was later analyzed for serum IgG concentration (mg/ml).

Preliminary Results and Conclusions

Mean serum TS 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) ($p < 0.001$). These findings are consistent with the earlier pilot study. Improved serum IgG concentrations in calves fed heat-treated colostrum is thought to be due to reduced bacterial interference with IgG absorption in the gut. Analysis is pending to describe colostrum IgG concentrations (mg/ml), TPC (cfu/ml) and TCC (cfu/ml). Subsequent analysis will summarize the pre-weaning health events for calves enrolled in the study.

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Reference

Johnson, J., S. Godden, T. Molitor, T. Ames, and D. Hagman. 2007. The effect of feeding heat treated colostrum on passive transfer of immune and nutritional parameters in dairy calves. J. Dairy Sci. 90: 5189-5198.