

Relationship Between Bacteria Levels in Colostrum and Efficiency of Absorption of Immunoglobulin G in Newborn Dairy Calves

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Introduction

The dairy industry recognizes the necessity of providing adequate colostrum to newborn calves to obtain passive immunity. This aids in lowering the rate of disease and death amongst young calves. Bacteria in colostrum can interfere with the immunoglobulin G (IgG) absorption in newborn calves, potentially resulting in failure of passive transfer. Industry recommendations currently suggest bacteria levels in colostrum be <100,000 cfu/ml. However, there is some preliminary evidence (Johnson et al, 2007) to suggest that a lower cutpoint for bacteria levels may further enhance absorption of IgG. The study objectives were: 1) To describe the relationship between bacteria counts in colostrum and both apparent efficiency of absorption of IgG (AEA, %) and calf serum IgG concentrations (mg/ml) at 24 hours of age, and 2) Potentially provide evidence for determining an optimal recommended cutpoint for bacteria levels in colostrum that would maximize AEA of IgG.

Materials and Methods

Colostrum treatments were created by pooling harvested maternal colostrum into three to four gallon batches. These batches were then thoroughly mixed and divided into 1.5 to two gallon paired aliquots (A and B). Aliquot A was designated to be fed fresh while aliquot B was first heat treated at 140° F (60° C) for 60 minutes. Prepared aliquots (A and B) were stored in clean 3.8 L bottles in a refrigerator until they were fed. Both fresh and pasteurized aliquots had a 20 ml sample collected immediately prior to refrigeration as well as immediately prior to feeding. Colostrum samples were frozen and submitted to the Udder Health Lab of the University of Minnesota for bacterial cultures and IgG testing. A total of 107 calves were enrolled based on the following criteria: a heifer, more than 70 lb (32 kg) body weight, singleton, calving ease score of one to three, and removed from dam prior to suckling. Between zero to one hours following birth a pre-colostrum treatment venous blood sample was collected and stored in a 10 ml serum tube. A randomly selected colostrum treatment (3.8 L of aliquot

A or B) was then fed using an esophageal tube feeder within two hours of birth. At 24 hours a second venous blood sample was collected and stored in a 10 ml serum tube. Blood samples were refrigerated immediately after collection and were centrifuged approximately 24 hours following collection. The serum was removed and evaluated on-site for the serum total solids level (g/dl), using a refractometer method. The serum samples were frozen and sent to the Veterinary Diagnostic Laboratory for determination of serum IgG levels. Linear regression analysis was used to describe the relationship between total plate counts (log₁₀[TPC], cfu/ml) and total coliform counts (log₁₀[TCC], cfu/ml) in colostrum and both AEA of IgG (%) and serum IgG concentrations (mg/ml) at 24 hours of age.

Results

The mean (range) for AEA IgG and serum IgG at 24 hrs was 31.0% (6.0% to 53.0%) and 23.4 mg/ml (4.3 mg/ml to 34.9 mg/ml), respectively. Mean (range) serum total solids at 24 hours was 6.17 g/dl (4.50 g/dl to 7.80 g/dl). Mean Log₁₀(TPC) and Log₁₀ (TCC) were 4.80 cfu/ml and 4.37 cfu/ml, respectively. TPC and TCC in colostrum were negatively associated with both AEA IgG (%) and serum IgG concentrations (mg/ml) at 24 hours of age. For every one log increase in the TPC there was an estimated 2.4% decrease in AEA IgG (%) (P < 0.0001). The TCC was closely correlated to the TPC in colostrum samples.

Significance

A negative relationship existed between bacteria counts in colostrum and both efficiency of IgG absorption and final IgG concentrations in the serum. These results provide support for implementing on-farm techniques in colostrum management to lower bacteria levels in colostrum that is fed to calves. The negative relationship found was linear, making it unclear if there is a distinct cutpoint that the dairy industry could adopt as an acceptable upper limit for bacteria counts in colostrum.