

Effect of adding gut-active carbohydrates to fresh colostrum on passive transfer of immunoglobulin G in Holstein dairy calves

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Introduction

Lower concentrations of coliform bacteria in maternal colostrum (MC) have been associated with enhanced IgG absorption in calves. Mannan-oligosaccharide, a gut active carbohydrate (GAC) derived from yeast cell walls, can adsorb pathogens expressing type-1-fimbriae, which reduces their ability to colonize the gastrointestinal tract. Results of preliminary research suggest that feeding GAC in colostrum enhanced serum IgG concentration in calves. The purpose of this study was to investigate whether addition of a GAC (Bio-MOS®. Alltech, Inc.) to colostrum would increase IgG absorption in newborn calves.

Materials and Methods

In the summer of 2012, newborn Holstein calves at a commercial transition cow facility in western Wisconsin were enrolled in the study. Each day, unique 2-gallon pools of fresh first-milking maternal colostrum (MC) were created, split into duplicate 1-gallon aliquots, and refrigerated until feeding. Newborn calves were removed from the dam within 30 to 60 minutes after birth and before suckling, were weighed, and paired on the basis of birth order. Within each pair, calves were randomly assigned to be fed either 1 gallon of fresh MC (control) or 1 gallon of fresh MC with 30 g of Bio-MOS® added to it immediately before feeding (treatment), and both gallons of fresh MC originated from the same 2-gallon pool. A sample of colostrum was collected from each gallon before feeding and before addition of Bio-MOS, and frozen for bacterial culture and IgG determination at a later time. A venous blood sample was collected from each calf before feeding colostrum and again 24 hours after colostrum feeding for determination of serum

IgG concentration by means of radial immunodiffusion analysis. Comparisons between the 2 treatment groups were made with mixed linear regression analysis.

Results

Calves in the control group (n=48) had significantly ($P<0.001$) higher apparent efficiency of absorption (AEA%) of IgG (30.4%) than did calves in the treatment group (n=47; 23.9%). Similarly, calves in the control group had significantly ($P=0.005$) higher serum IgG concentrations at 24 hours (30.8 mg/mL) than did calves in the treatment groups (23.0 mg/mL). Colostrum total coliform count and AEA% of IgG were negatively associated (estimate [SE] = -1.03% [0.50%]; $P=0.045$), as were colostrum IgG concentration and AEA% of IgG (-0.14% [0.03%]; $P<0.001$).

Significance

This study indicated that supplementing fresh MC with GAC resulted in impaired efficiency of absorption of IgG and reduced serum IgG concentrations in newborn Holstein calves. These results conflict with those of another study, in which calves fed fresh colostrum supplemented with GAC had higher serum IgG concentrations than did calves that were fed fresh colostrum without GAC. These results also conflict with a parallel study conducted by our laboratory group, in which supplementing the same GAC into a commercial colostrum replacer had no effect on passive transfer of IgG. Though we did not identify such an interaction in this study, we speculate that there may be an interaction between colostrum coliform concentration and GAC supplementation on passive transfer of IgG. The effect of supplementing MC with GAC requires further investigation.