

Relationship between Serum Total Protein and Serum IgG in Holstein Calves Fed Either a Lacteal- or Plasma-derived Colostrum Replacer

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Introduction

Bovine neonates have a naïve immune system and must initially rely on the absorption and passive transfer of maternally derived immunoglobulins (Ig) ingested in colostrum. Acceptable passive transfer (APT) is defined as a serum IgG \geq 10 mg/mL between 24-48 hours of age. A serum total protein (STP) cutpoint of 5.0 or 5.2 g/dl is commonly used to predict APT for calves fed lacteal-derived whole colostrum (Calloway *et al*, 2002). However, many producers now feed powdered commercial colostrum replacers (CR). Some CR products contain lacteal-derived (LD) Ig while others contain Ig derived from spray-dried plasma (PD). Research is needed to determine the best STP cutpoint to predict APT for calves fed either LD or PD CR products. The objectives of this study were to 1) describe levels of passive transfer and 2) determine the relationship between STP and IgG for neonatal calves fed a commercially available LD CR or PD CR product, respectively.

Materials and Methods

In June through August of 2009, heifer calves born at the Transition Management Facility (TMF; Emerald, WI) were enrolled into the study. Calves were removed from the dam within 30-60 minutes of birth and before suckling, weighed, then randomly assigned to be fed either a LD CR containing 150g IgG (n = 36; Land O' Lakes Colostrum Replacement, Land O' Lakes, Inc., St. Paul, MN) or a PD CR containing 130g Ig, (n=38; Colos-trx® 130 Colostrum Replacer, AgriLabs, Inc., St. Joseph, MO) via an esophageal feeding tube, within two hours of birth. After the first colostrum feeding, calves were fed 1.9L of a commercial milk replacer formula twice daily until 24 hrs of age. Venous blood samples were collected from the calves at birth and 24 hrs later. The serum was separated and frozen, serum was submitted to Prairie Diagnostic Services Laboratory (University of Saskatchewan, Saskatoon, Canada), where STP (g/dl) and IgG (mg/mL) concentrations were measured using a digital refractometer, and an RID method, respectively.

Descriptive statistics were used to calculate STP, IgG, apparent efficiency of absorption (AEA, %), and APT rates in calves fed each respective CR. Univariate linear regression (Proc MIXED, SAS version 9.2) was used to describe the relationship between STP (dependent variable) and IgG (explanatory variable). The resulting regression equation was used to estimate the STP value that would be predicted if IgG was 10 mg/mL.

Results

The mean (+/- SD) STP at 24 hrs of age for the LD CR and PD CR treatment groups were 5.4 +/- 3.8 g/dl and 4.7 +/- 1.9 g/dl, respectively. Serum IgG concentrations at 24 hrs were significantly higher in calves fed LD CR (14.7 +/- 2.9 mg/mL) versus PD CR (9.6 +/- 1.8 mg/mL). The AEA (%) was greater for calves fed LD CR (38.2 +/- 6.3%) versus calves fed PD CR (28.4 +/- 5.0%). The proportion of calves with APT was 94.4% and 36.8% in LD and PD CR treatment groups, respectively. The estimated predictive STP cut-point (95% CLs) for APT was 5.0 (4.7, 5.3) g/dl for calves fed the LD CR, and 4.8 (4.4, 5.1) g/dl for calves fed the PD CR. Using these two TP cutpoints, calves were grouped into 2x2 tables (a = APT, b = FPT, c = CR TP > cutpoint, d = CR TP < cutpoint).

Significance

Calves fed 150 g of IgG in a LD CR experienced significantly better rates of APT and higher STP and IgG measures as compared to calves fed 130 g of Ig in a PD CR. Two potential factors contributing to these differences could include a higher total mass (g) of IgG consumed plus greater AEA % of IgG for calves in the LD CR group. A serum TP cutpoint of 5.0 g/dl or 4.8 g/dl was most predictive of APT (serum IgG of 10 mg/mL) in calves fed either an LD or PD CR product, respectively. Producers measuring TP to monitor passive transfer rates in CR-fed calves should select different TP cutpoints, depending on what type of CR product (LD or PD) is fed.