Assessment of lamb passive transfer

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Introduction

The single most important event in the newborn lamb's life is consumption of colostrum to initiate passive transfer of maternal antibodies. There is a paucity of information relative to assessment metrics in lambs as compared to dairy calves. Determining if criteria for successful or failure of passive transfer from calves is applicable to other newborns is of interest to facilitate evaluation of colostrum management practices in small ruminants. The objective of this study was to measure serum immunoglobin (IgG) concentration in neonatal lambs and determine relationship of serum total protein and colostrum IgG concentration to lamb serum IgG concentration.

Materials and methods

This study was reviewed and approved by the Pennsylvania State University IACUC. The samples from this study were collected from sheep from the Pennsylvania State University sheep unit. Ewe breeds were Dorset and Hampshire. Colostrum samples were obtained by farm personnel between 0 and 2 hours after lambing and lambs nursed freely. Lamb numbers and lambing difficulty score were recorded. Colostrum samples were transported to the lab and Brix (MISCO, Solon, OH) reading performed and colostrum IgG concentration determined (RID, Triple-J Farms, Bellingham, WA). Blood was collected from all lambs between 2- and 7-days following birth. Serum was harvested for analysis of IgG concentration (ELISA, Immunology Consultants Laboratory Inc, Portland, OR). Total protein (TP) determination was performed using the digital refractometer (MISCO, Solon, OH). Data were first analyzed using an ANOVA to identify main effects that influenced serum IgG concentration. Regression models were performed to determine any relationship between TP and serum IgG concentration. Contingency tables were used to establish a critical threshold value for TP or colostrum IgG in determining a desired serum IgG concentration.

Results

Breed influenced ($P < 0.0001$) birth weight with Dorset lambs (10.5 ± 0.6 lb) having lower birth weights compared to Hampshire lambs (12.7 ± 0.7 lb). Serum samples (n = 98) were taken from lambs that are Dorset (n = 36) and Hampshire (n = 62) meat-breed sheep. Average days of age at bleeding was 3.5 with a range of 2-7 days. In this data the lamb serum IgG values had mean ± standard deviation (median, range) of 14.8 ± 7.2 mg/mL (13.7, 4.3-42.5). Lamb serum TP values were 5.9 ± 0.6 g/dL (5.9, 4.3-7.8). Association between the refractometer and serum IgG was lower than expected (r2 = 0.22, $P < 0.0001$). Neither age at bleeding nor breed influenced serum IgG concentration. Serum TP ($P < 0.0001$) and colostrum IgG ($P = 0.001$) both influenced serum IgG concentration. A regression model to predict serum IgG concentration was y (mg/mL) = 5.37 × – 16.83 (r2 = 0.22, $P < 0.0001$). Assuming a desired serum IgG concentration of 15 mg/mL, a TP concentration of 6.0 g/dL was the desired cutoff with 94.52% sensitivity, 59.32% specificity, 74.19% positive predictive value, and 89.74% negative predictive value.

Significance

Study findings indicate an association between lamb serum IgG concentration and TP readings from a refractometer. However, this association was not robust as documented in dairy goats. Due to the negative proportional bias in the Bland-Altman plot there was greater error in the lamb serum IgG readings from the ELISA than error in the refractometer. As indicated by the mean of the IgG serum concentrations approximately 50% of lambs were considered to have FPTI; however, according to the refractometer TP mean a majority of lambs had successful passive transfer of immunity. Further research to determine the desired lamb serum IgG concentration based on health and performance is needed.