

Use of brix refractometer in assessing sheep colostrum

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Introduction

Ensuring lambs have consumed enough high-quality colostrum to achieve successful passive immunity transfer is critical to mitigating health risks and mortality rates in neonates. Unlike the situation in dairy cattle where various tools can be used to assess colostrum quality, little opportunity is available to quantitatively evaluate sheep colostrum easily. More recently, the Brix refractometer has been validated for assessing colostrum immunoglobulin (IgG) concentration in cattle and dairy goats. The objective of this study was to determine if the Brix refractometer can provide an accurate assessment of colostrum IgG concentration in meat-breed sheep.

Materials and methods

This study was reviewed and approved by the Pennsylvania State University Institutional Animal Care and Use Committee. 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. Lamb numbers and lambing difficulty score were recorded. Colostrum samples were transported to the lab and Brix (MISCO, Solon, OH) reading performed. Samples were then frozen for later IgG analysis. Colostrum IgG determination was by radial immunodiffusion using commercial sheep kits (RID, Triple-J Farms, Bellingham, WA). Many sheep colostrum samples were highly viscous resulting in abnormal Brix measurements. These samples were serially diluted to determine if this would result in more consistent Brix readings once back calculated. Data were first analyzed using an ANOVA to identify main effects that influenced colostrum IgG concentration. Pearson Correlation and regression models were performed to determine any relationship between Brix and colostrum IgG concentration. Contingency tables were used to establish a critical threshold value for Brix in determining a desired colostrum IgG concentration.

Results

All Brix and RID values were normally distributed. Colostrum samples ($n = 44$ total) were collected from 20 Dorset and 24 Hampshire ewes. Overall mean \pm standard deviation (median, range) ewe colostrum IgG concentration was 94.7 ± 74.5 mg/mL (80.4, 0.55-297.6). Breed influenced colostrum IgG content with higher ($P = 0.005$) concentrations for Dorset (160.6 ± 17.4 mg/mL) compared to Hampshire (96.6 ± 14.7 mg/mL) ewes. Lamb numbers or lambing difficulty did not influence colostrum IgG concentration. Association between Brix value using raw colostrum relative to measured colostrum IgG concentration was low ($r^2=0.158$, $P = 0.0039$), which prompted methods of either heating or diluting viscous samples for better measurements. Warmed samples had no impact. Using diluted samples to measure the Brix then back calculating original concentration provided a stronger association ($r^2 = 0.68$, $P < 0.001$). The colostrum IgG concentration deemed appropriate for successful passive transfer of immunity in lambs was found to be 80 mg/mL (data not shown). The Brix refractometer reading to ensure this IgG concentration was 35 with 90.5% sensitivity, 58.6% specificity, 73.6% positive predictive value and 82.9% negative predictive value.

Significance

Unlike previous published studies evaluating the use of Brix refractometer to evaluate colostrum IgG concentration in dairy cows and dairy goats, no indication of highly viscous colostrum impeding the refractometer reading has been reported. This might suggest those species with lower colostrum volume, such as beef cattle or meat-breed sheep, the use of the Brix refractometer may require dilution of colostrum samples for accurate assessment. The improvement in significance as well as in the predictivity of the Brix refractometer illustrates the need for dilution of viscous colostrum samples. Measured colostrum IgG concentration was much higher than those reported for dairy cows or dairy goats. The use of 35 Brix measure as a desired threshold was based on lamb serum IgG (data not shown). This Brix is higher than the recommended threshold for dairy cattle and dairy goats.

