

AASRP Research Summaries

Assessment of goat colostrum quality and passive transfer

E.V. St. Clair, BS; R. W. Russell, BS, LVT; R. J. Van Saun, DVM, MS, PhD, DACT, DACVN
Pennsylvania State University, University Park, PA 16802

Introduction

Colostrum provides agammaglobulinemic newborns with immunity through immunoglobulin (IgG) passive transfer shortly after birth. Research on goat colostrum quality and passive transfer assessment is limited. Study objectives were to evaluate colostrum quality in goats defining a relationship between Brix reading and IgG concentration, document serum IgG concentration based on total IgG consumed, and determine a relationship between total protein and serum IgG concentrations.

Materials and Methods

All procedures were approved by the Pennsylvania State University Institutional Animal Care and Use Committee. Samples were obtained from a 900-doe commercial dairy. First colostrum samples were collected and Brix digital refractometer (MISCO, Solon, OH) used on the fresh individual and pooled samples. All data relative to kidding and amount, timing, and method of colostrum feeding were compiled. Colostrum was frozen and shipped to Penn State for post-thaw Brix determination and measurement of total IgG concentration using radial immunodiffusion (RID, Triple-J Farms, Bellingham, WA). Kid blood samples were collected between 1- and 4-days following birth. Serum total protein (TP) determination (g/dL) was determined by digital refractometer. Serum IgG concentration was determined by goat IgG enzyme linked immunosorbent assay (ELISA, ZeptoMetrix, Buffalo, NY). Data were analyzed by ANOVA and regression modeling to determine significant effects influencing the relationship between measures of interest.

Results

Paired Brix and RID determinations were performed on 58 individual and 56 pooled doe post-thaw colostrum samples. The 58 individual Brix determinations were also performed on fresh colostrum. Mean \pm SD (median, range) colostrum IgG for all samples was 71.0 ± 36.8 mg/mL (74.2, 4.2-180.5). Overall post-thaw and fresh colostrum Brix determinations were 20.7 ± 4.5 (20.3, 8.7-34.3) and 21.2 ± 4.7 (21.7, 9.1-34.0), respectively. Brix measurements determined in fresh and thawed colostrum were highly correlated ($P < 0.0001$) for all ($r^2 = 0.97$), individual ($r^2 = 0.98$)

or pooled ($r^2 = 0.76$) samples. Similarly, post-thaw Brix and RID measures were highly correlated ($P < 0.0001$) in overall ($r^2 = 0.85$), individual ($r^2 = 0.89$) and pooled ($r^2 = 0.77$) samples. Brix determinations on individual samples tended to be influenced by dry period length ($P = 0.084$), but not age or kid number. Linear regression model relating Brix to RID in goat colostrum was $\text{RID (mg/mL)} = 6.97(\text{Brix}) - 73.65$ ($r^2 = 0.73$, $P < 0.0001$). Mean \pm SD (median, range) serum TP ($n = 30$) and total IgG concentration ($n = 57$) were 6.0 ± 0.8 g/dL (6.0, 4.5-7.2) and 15.8 ± 7.3 mg/ml (15.3, 3.1-36.1), respectively. Calculated IgG grams delivered at first feeding and total prior to bleeding was 17.6 ± 6.3 g (range: 6.0-39) and 35.0 ± 11.2 g (range: 11.9-64.3), respectively. Time to first feeding averaged 106 ± 136 mins (median: 60 min). Serum TP measured between 1- and 4-days of life was highly associated ($r^2 = 0.73$; $P < 0.0001$) with serum IgG concentration. Incorporation of age at bleeding ($P = 0.08$) only slightly improved the relationship between TP and serum IgG concentration ($r^2 = 0.76$, $P < 0.0001$). Total IgG consumed showed the greatest influence ($P = 0.0020$) with no effect of method of feeding or time to feeding. Amount of IgG fed at 1st feeding ($P = 0.0069$), volume at first feeding ($P = 0.10$), time to second feeding ($P = 0.061$), and kid age ($P = 0.047$) accounted for more variation ($r^2 = 0.45$, $P = 0.0093$) in serum IgG concentration than total IgG consumed ($r^2 = 0.36$, $P = 0.013$). Mean total consumed IgG amount was 35.0 ± 11.2 g (36.1; 11.9-64.3). Assuming blood volume at 10% of birth weight, total blood IgG mass was determined from measured serum IgG concentration. Calculated efficiency of IgG absorption was $16.8 \pm 8.8\%$ (16.4; 3.6-52.9).

Significance

Like data for dairy cattle, the digital Brix refractometer is a valid method to predict colostrum quality based on IgG concentration in goats. Serum TP is an effective method to evaluate the amount of IgG in serum. In summary, goats in this study on average consumed 35 g IgG achieving a 15 mg/mL serum IgG concentration with an associated 6.0 g/dL TP concentration.