

Can a Cria's Immunity Be Predicted By the Dam's IgG Before Birth?

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That is one question that Kim Gleason and Lynn Edens asked over a year ago when they began a multi-faceted, multi-site research study. One of the goals of their research project was to determine if an IgG sample taken from females within 60 days of anticipated birth could predict failure of passive transfer. Cria are born without a functional immune system and rely on immunity passed from mom in the form of IgG at birth through colostrum. In a normal healthy dam at birth, a large bolus of immunity is passed into her colostrum that is ingested by the cria as soon as it stands and begins to suckle. Because of mechanics within the rumen of a neonate, the highest rate of IgG absorption from colostrum into the cria's bloodstream occurs within a few hours of birth. By 24 hours after birth, that absorption declines to nearly zero percent. That is why it is so important that a newborn cria is able to stand and nurse from its mom within a few hours of birth-to get the most immunity when they can absorb it at the maximal efficiency. Failure to obtain these necessary immunoglobulins at birth results in a condition referred to as Failure of Passive Transfer (FPT), and is the leading cause of neonatal mortality in alpacas. It is

estimated that approximately 1 in 4 (25%) of all cria born in the U.S. have some degree of FPT.

There are many circumstances that contribute to FPT, both from the cria's perspective and from the dam's perspective. For instance, cria that are born prematurely, cold, or weak or after a difficult birth (dystocia) are at risk of not being able to stand and suckle their mom's rich colostrum within a few hours. Also, cria that are born with overly lax or contracted tendons, or weakness in the stifle/hip may have difficulty standing to nurse, or even demonstrate a complete inability to stand at all. All of these visually obvious situations would be considered critical and would require prompt managerial intervention in the form of supplemental colostrum, or even costly hospitalization with such risky procedures as plasma transfer. Left unattended to, these cria could easily succumb to life threatening septicemia and weakness. Besides physical impairments, there are also physiologic problems within the cria that may prevent proper absorption of IgG from the colostrum, even though it is able to immediately stand and nurse.

From the dam's perspective, there are numerous factors as well that may contribute to FPT, including dystocia, no or low colostrum, initial rejection of the cria by the dam (not unusual for maiden females in particular,) or failure to transfer IgG into her own colostrum. It is this area that the authors set out to study and to determine if it is possible to test the dam and predict FPT in the impending birth, and thus be proactive with therapeutic and managerial intervention to possibly prevent costly medical care and/or cria mortality. In addition, the authors sought to determine if

the dams' IgG levels would in any way predict weight gains and growth curves of their cria.

For this prospective observational study, blood samples were taken from dams within 60 days of impending birth, and from their cria within 36 hours of birth. Cria weights were recorded at birth, and at 2 weeks and 2 months. All blood samples were prepared at Little Creek Farm, where serum was extracted and analyzed on a commercial spectrophotometry analyzer for IgG level. Sixty total dam/cria birth pairs from both study locations were included in the study over a period of one year. Births occurred in all four seasons. Based on initial prepartum IgG levels recorded for dams, they were divided into 3 distinct groups: 1000-1499 mg/dl, 1500-2000 mg/dl, and IgG >2000 mg/dl. All data were analyzed by Analysis of Variance statistical methods.

A couple of interesting results were apparent. First, this study did not find a correlation between dam's prebirth IgG and subsequent cria birthweights or growth curves. In other words, the dam's IgG level did not appear to be a predictor for slow or fast weight gain by her cria. However, when considering the dam's prepartum IgG level relative to her own cria's IgG level at birth, there were significant, and perhaps counterintuitive, findings. Specifically, when the dam's IgG level was in the range of the lower and mid-level group, cria were born with "normal" IgG levels by industry standards. However, when the dam's prebirth IgG was > 2000 mg/dl, there were significantly more cria with FPT. Because this an important finding and possible prebirth indicator for FPT in alpacas, that the authors wrote a scientific paper that was recently accepted for publication in the

prestigious veterinary scientific journal, *Theriogenology*. Results of this study were also presented to the veterinary scientific community at the national conference of Theriogenologists in Asheville, North Carolina this past July.

For a possible explanation as to why a higher IgG level in dams might result in FPT in cria, it was necessary to review previous veterinary research studies conducted in other livestock species. Several studies were published in cows that linked heat stress to higher blood IgG levels and correspondingly lower concentrations of IgG in colostrum. This research suggested that when a cow is heat stressed, IgG is diverted away from the udder for some reason, and this results in higher circulating levels of IgG in the bloodstream. Additional studies in cows also reported that heat-stressed calves had a lower ability to absorb IgG into their systems, so that heat stressed calves developed FPT at a rate of 25%.

The results of the present study of alpacas are consistent with those previously reported in cattle. A deeper analysis of the dams with prebirth IgG >2000 mg/dl revealed significantly more births in spring months. Since herd practices in the northeastern US states typically concentrate breeding efforts in spring months, AND alpacas are typically not shorn until mid to late spring, alpacas could be routinely birthing while carrying nearly 365 days of fiber growth. With this in mind, it is not inconceivable that many prepartal dams, at least in our region of the northeast, have some degree of heat stress prior to birth – in fact, the authors have anecdotally noted elevated temperatures in fully fleeced, healthy alpacas even when

weather conditions are normal for spring. This provides potential further validation for the study finding that more births with FPT occurred in the spring months from dams that demonstrated an elevated prebirth IgG level.

The preliminary results of this multifaceted study suggest that it may indeed be possible to use a dam's blood IgG level before birth as a predictor for potential problems in the cria. Even if the cria presents normally and stands and nurses within a couple of hours, FPT is still possible if the quality of the mother's colostrum is compromised. This is a finding that is not as readily observable as contracted tendons or inability to stand, which makes this so concerning. In this type of situation, FPT may go unnoticed until a day or two after birth when the cria isn't gaining weight properly or is not active, by which time it is past the window of optimal IgG absorption. Further data and analysis will hopefully lead to a predictive tool that will give breeders the opportunity to cost-effectively adjust management practices to reduce the risk of FPT and expensive remedial interventions. For instance, if we can demonstrate a link between dam colostrum levels and prepartum body temperatures, this could result in a type of screening tool to help breeders identify at-risk cria even before they are born, and perhaps take measures to cool dams in the weeks prior to birth.

The potential difficulty of identifying which cria are at risk of FPT raises a related question, which is whether breeders should implement a more hands-on approach and supplement every cria with bottle-fed colostrum at birth to prevent FPT, or milk the dam and bottle-feed the first colostrum

to the cria to ensure sufficient intake. Interestingly, the preliminary data from our research hints that the act of cria suckling on its dam is the best route for the cria to receive IgG with optimal absorption (or, possibly, the way that the dam provides the best or most colostrum for the cria,) and, correspondingly, that milking the dam and hand-feeding the colostrum does not produce the same degree of benefit. More broadly, this study highlights the potential importance of identifying dams that may have inferior colostrum due to environmental influences or inherent factors, and to only target their cria for supplementation at birth. The authors are currently further investigating the role of heat stress on passive transfer in alpacas and hope to share their findings with both the scientific and breeder communities in the near future.

