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BRIEF COMMUNICATION: Immediate removal of dairy goat kids from the doe as a strategy to manage colostrum intake

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Introduction

An impeded transfer of antibodies between the maternal and fetal circulatory system results in goat kids lacking immunity at birth (Hurley & Theil 2011). The dam's colostrum, which supplies energy, nutrients and growth hormones, also passively provides immunity via immunoglobulin G (IgG) (Hurley & Theil 2011). Without colostrum, morbidity and mortality increases (O'Brien & Sherman 1993). Unfortunately, colostrum is also a source of disease, such as caprine arthritis-encephalitis (CAE) (Reina et al. 2009). Therefore, removal of the offspring prior to maternal colostrum transfer is often practiced (Reina et al. 2009) because it allows for feeding alternative, disease-free colostrum. For goats, colostrum alternatives include: bovine, heat-treated caprine, and artificial bovine-based replacer. While incorrect heat-treatment can reduce IgG content (Tyler et al. 2000) and some artificial replacers fail to improve immunity acquisition (Constant et al. 1994), few adverse effects (e.g. reduced kid survival) of these alternatives have been noted (MacKenzie et al. 1987; Moretti et al. 2012).

Worldwide, farmers are attempting kid removal and alternative colostrum feeding, but it is not known to what extent this practice occurs, nor how successful farmers are at preventing colostrum ingestion from the doe. Since bovine and caprine IgG can be measured in serum, presence or absence of either can help determine the colostrum type ingested. Therefore, the objectives of this study were to: 1) determine the prevalence of immediate kid removal, and 2) compare the farmer-reported percentage of kids successfully removed to the percentage of kids with caprine serum IgG (an indicator of doe colostrum ingested).

Materials and methods

This study was approved by AgResearch Ltd. Ruakura Animal Ethics and Human Research and Ethical Conduct Committees. Beginning in May 2015, 16 dairy goat farmers (Waikato region, NZ) agreed to participate in a three year study and enrolled 1269 Saanen Alpine cross kids at birth (between 70 and 83 kids/farm). For a subset of the enrolled kids (n = 416, between 24 and 33 kids/farm), each farmer agreed to provide information on birth date and time, colostrum type provided, and their opinion on the success of kid removal. Farmers answered a questionnaire

regarding their colostrum management and their staffing during the kidding period. Blood samples were collected between 24 and 48 h after birth for the subset kids. Serum IgG concentrations (mg/ml) were measured using caprine and bovine IgG ELISA (Bethyl laboratories Inc, USA; Cat. No. E50-104 and E10-118, respectively). Cross-reactivity was tested by placing 100 ng/ml of bovine IgG on the caprine assay; approximately 28% of the bovine IgG was measurable on this assay. Therefore, a cautionary threshold of 30%+ of caprine IgG (in relation to bovine IgG) was utilized to determine if a kid had ingested some of its mother's colostrum. Kids were categorised as having been successfully removed if they did not ingest any of their dam's milk. Farmer-reported and IgG-determined successful removal percentages were calculated for each farm (PROC UNIVARIATE, SAS 9.2). The results are presented as percentage means \pm SD.

Results and discussion

Of the 16 farms, eight were not attempting to remove kids immediately after birth; the farmers indicated that they were satisfied with their disease management (e.g., herd classified CAE-negative, only keeping kids from CAE-negative does). Farmers also stated that they felt that only keeping kids from the older does was beneficial. In sheep, it has been shown that lambs born to ewes 4 years or older are 50% less likely to become positive for maedi-visna (MV) (Berriauta et al. 2003); however, this practice has not been validated in goats for reducing CAE. The remaining eight farms attempting immediate kid removal after birth cited prevention of disease as a motivating factor. Removal is a beneficial tactic if a doe may be CAE-positive, as illustrated in sheep where 20% of lambs suckling MV-positive dams became infected (Alvarez et al. 2005); however, removal does not entirely guarantee kids remaining CAE-negative. Adams et al. (1983) found that even when kids were removed via caesarean section, a small percentage still became CAE-positive.

In the farms aiming to remove all kids from dams prior to colostrum ingestion, there was a divergence between this goal and what farmers actually reported. Farmer-reported success of removal of kids from the does was $61 \pm 35\%$, ranging from almost no success to complete success reported (Table 1).

Table 1 Farmer-reported and IgG-determined success of removal of kids from their dams prior to the consumption of colostrum. Results are from the eight farms that indicated they actively attempted to prevent colostrum ingestion by separating kids from dams immediately after birth.

Farm	n	Successful removal of kids		
		Farmer-reported ¹ (%)	IgG-determined (of farmer-reported kids) ² (%)	IgG-determined (of all kids) ³ (%)
1	26	8	4	19
2	24	33	8	25
3	26	35	4	4
4	25	56	48	56
5 ⁴	33	61	-	-
6	24	96	88	88
7	25	100	96	96
8 ⁴	25	100	-	-

¹Percentage of kids reported by the farmer as having been successfully removed from the mother prior to the consumption of dam colostrum

²Percentage of kids found to have been successfully removed as determined by lack of serum caprine IgG (for kids that farmers reported successful removal only)

³Percentage of kids found to have been successfully removed as determined by lack of serum caprine IgG (for all kids - successful and unsuccessful removal reported by farmer)

⁴Not possible to establish IgG-determined success for farms feeding heat-treated goat colostrum (as both result in the kid having caprine serum IgG)

No farms completely prevented dam colostrum ingestion in their kids, however two farms (Farms 6, 7) achieved IgG-determined success rates of greater than 85%, and this was consistent with farmer-reported success (Table 1). Three farmers (Farms 1, 2, 4) under-reported their success; each of these farms had at least a few kids with serum IgG indicative of no doe colostrum ingestion, yet the farmers did not report them as being successfully removed (Table 1). This indicates that farmers were either being cautious with reporting, or that kids did stay with their dams for a period of time, yet failed to suckle. IgG-determined success could not be calculated on two farms (Farms 5, 8) because the removed kids were subsequently fed heat-treated caprine colostrum (Table 1). The farmer questionnaire and observations by research personnel during the kidding period highlighted one key difference between the two most successful farms and the others: staff presence. Both farms had staff continuously on-site in the daytime, and neither kept kids from does that kidded at night.

Two areas of improvement for future work have been identified. Firstly, kid removal success was determined by the lack of caprine IgG in the serum, however, bovine IgG did cross-react with the caprine assay. A 30% threshold was utilized to compensate for this cross-reactivity, but a formal validation is needed. Secondly, this method

was useful for the six farms feeding bovine colostrum; it could not be utilized on the two farms feeding heat-treated caprine colostrum, since this type of colostrum cannot be distinguished from dam colostrum.

Eight of the 16 enrolled NZ farms opted to utilize methods other than immediate kid removal from the dam to help control CAE. The remaining farms actively attempted to keep kids from consuming their dam's colostrum by removing them at birth; nonetheless, perceived prevention of colostrum ingestion and actual ingestion of colostrum by the kid from the dam did not always correspond. This disconnect may be perpetuating CAE presence on farms where farmers believe they are successfully controlling the disease. Monitoring will continue for two years to establish CAE status of the enrolled kids.

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