BRIEF COMMUNICATION: Investigating the pattern of lameness in dairy goats across the first two years of life

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Abstract

Lameness is a painful condition with significant welfare and economic implications. There are few data about the high-risk periods of lameness in dairy goats, therefore, the aim of this study was to evaluate how lameness occurrence changes across the first two years of life. Eighty female goats of approximately five months of age were enrolled. Gait-scoring assessments were completed at 9, 13, 17, 21 and 25 months of age. Gait scores were assigned using a 5-point gait scoring system. As there were a low number of 3, 4 or 5 gait scores recorded, a binary outcome variable was created to compare non-lame (score 1) to an impaired gait (score ≥ 2). A logistic regression (PROC GLIMMIX) was used to test if there was a difference in the proportion of goats with an impaired gait among assessments. When compared with the nine-month assessment, the odds of a goat having an impaired gait were greater by a factor of 2.15 (95% CI: 1.02 – 4.54, P<0.05) at the 13-month assessment and 3.79 (95% CI: 1.90 – 7.57, P<0.001) at the 25-month assessment; as these assessments were both following kidding events, this suggests that parturition may increase the risk of lameness in dairy goats.

Keywords: gait score; uneven gait; impaired gait; parturition; welfare

Introduction

Lameness is a painful condition (Whay et al. 1997) that results in an altered gait due to the animal attempting to avoid weight-bearing on the affected limb (Leach et al. 2009). In its milder forms, a lame animal may exhibit an uneven gait, whereby there is a decreased symmetry of limb movement (e.g., shortening of stride) (Winckler & Willen 2001; Flower & Weary 2006). In a case of severe lameness, an affected animal may be unwilling or unable to bear any weight on the affected limb (Flower & Weary 2006; Dyer et al. 2007).

Lameness in dairy cows has been researched extensively; it is one of the most significant welfare and economic issues due to its high prevalence (39%: Haskell et al. 2006; 55%: von Keyserlingk et al. 2012), its associated impacts on production (Willshire & Bell 2009) and the serious negative impact it has on individual animals (von Keyserlingk et al. 2009). While the effect of lameness on goats has received less attention, available literature suggests that it does impact production (Christodoulopoulos 2009) and lameness prevalence on farms can be high (19.2%: Anzuino et al. 2010; 67%: Groenevelt et al. 2015).

Lameness is a complex and often multifactorial problem (Chesteron et al. 1989; Solano et al. 2015), with numerous associated management and animal-related risk factors. One of the high-risk periods of lameness in dairy cows occurs after calving (Offer et al. 2000; Tarlton et al. 2002). Metabolic and hormonal changes associated with calving weaken the connective tissue of the hoof suspensory apparatus, leading to an increased risk of lameness due to sole ulcers and white line disease (Tarlton et al. 2002). The first calving may be a critical period as high numbers of dairy heifers become lame early in their first lactation (Webster 2002). Additionally, animals that have previously been lame are more likely to go lame in the future (Hirst et al. 2002; Randall et al. 2015). Similar, robust work is lacking in goats, particularly in a New Zealand context; however, the findings in cows suggest that management around first parturition may be important for lameness prevention. Indeed, Groenevelt et al. (2015) suggested that the difference in the incidence of lameness in lactating goats and young goats was due to a parturition effect. Unfortunately, the young goat stock in this study were assessed for lameness in pens rather than on concrete; this is a significant confounder, as goats do not often show visible lameness until they start walking on solid hard flooring substrate (Groenevelt 2017). Thus, the aim of this study was to investigate how lameness occurrence changes in the first two years of life in a herd of New Zealand dairy goats.

Materials and methods

This study was part of a larger study which was approved by AgResearch Ltd., Ruakura Animal Ethics Committee (#13686). Eighty female goats of approximately five months of age from one commercial farm in the Waikato region of New Zealand were enrolled in the study. The herd was maintained indoors and bedded on wood shavings. Housing and husbandry management was maintained as per the farm's routine protocol. Goats were first mated at approximately 7-8 months of age and first kidded at approximately 12-13 months of age, at which point they entered the milking herd. Goats were dried off at approximately 21 months of age and had their second kidding at 24-25 months.

Gait-scoring assessments were completed at 5, 9, 13,

17, 21 and 25 months of age. At each assessment, goats were recorded (HC-V270, Panasonic Camcorder, Osaka, Japan) walking along a concrete raceway from the milking parlour back towards their pens. The video camera was set up on a tripod to allow a length of approximately 4.5 m of the walkway to be viewed. This allowed at least four full strides to be recorded. From the 13-month assessment onwards, gait scoring was completed following morning milking to reduce any effect of milk fill and udder distention on gait. The videos were watched separately by two trained observers and gait scores assigned using the 5-point gait score described by Deeming et al. (2018) (Table 1). Each scoring session occurred four months apart which minimised the risk of observers being familiar with the goats and the previously assigned gait scores. Additionally, inter-observer and intra-observer reliability was determined following the completion of each assessment to ensure $K_w \geq$ 0.80 (almost perfect agreement; Dohoo et al., 2003). Study goats that were assigned a gait score of 2 or above at any of the assessments were investigated and promptly treated by a veterinarian if necessary.

There was a low number of 3, 4 or 5 gait scores recorded, thus a binary outcome variable comparing non-lame (score 1) to an impaired gait (score 2-5) was created. A logistic regression (PROC GLIMMIX) using a binary distribution and a logit link function was used to test if there was a difference in the proportion of goats with an impaired gait among the gait assessments. Goat within assessment was included as a random effect. The assessment at five-months of age was excluded from analysis as accurate gait scores could not be assigned due to goats moving faster than a walk. Therefore, the nine-month assessment was used as the reference category. The results are presented as odds ratios and 95% confidence intervals. In addition to the logistic regression, the number and percentages of goats with a non-lame gait (score = 1), an uneven gait (score = 2) and lame gait (score > 3) at each assessment are presented.

Results and discussion

Few goats were clinically lame (gait score ≥ 3) at each of the assessments: the majority were either not lame (gait score = 1, assessment range: 52 – 77%) or showed an uneven gait (gait score = 2, assessment range: 12 - 43%) (Table 2). The prevalence of clinical lameness was less than 9% of goats at all assessments over two years. Nevertheless, it is suggested that a clinical lameness prevalence of 5% or more in sheep should prompt an investigation of the cause (Winter 2004).

The highest proportions of goats classified as having an impaired gait were observed at the 13-month (37.3%) and 25-month assessment (47.5%). The odds of a goat having an impaired gait were greater by a factor of 2.15 (95% CI: 1.02 – 4.54, P<0.05) at the 13-month assessment and 3.79 (95% CI: 1.90 – 7.57, P<0.001) at the 25-month assessment compared to the nine-month assessment. These assessments were following kidding, suggesting a potential parturition effect.

There are a number of factors during the period when dairy cows transition from dry to the milking herd that can lead to lameness (Bell 2015; Tarlton et al. 2002; Bergsten et al. 2015). Physiological and hormonal changes involved with the weakening of the suspensory apparatus in the hoof, metabolic stressors through feeding of transition diets, changes to social dynamics and changes in housing and husbandry have been identified as lameness risk factors during the transition period in dairy cows (Tarlton et al. 2002; Bergsten et al. 2015). The higher prevalence of an impaired gait following kidding observed in the current study suggests that the time around parturition could be relevant in dairy goats as well. Our study was limited to lameness observations, and we were not able to collect data regarding changes in housing, diet, and social structure. Nonetheless, given that these management variables are typically altered following parturition, we suggest goats could be helped to adjust to the upcoming changes. For

Table 1 Description of the 5-point gait scoring system previously developed for use in dairy goats (Deeming et al. 2018).

Gait scoring system		Assessment criteria					
Category	5-point	Limp	Moving forward	Weight bearing	Head nod	Identify affected leg(s)	Other descriptors
Normal gait	1	No	Yes	Yes	No	-	Even stride on all four legs, tracking up, walks with a fluid motion.
Uneven gait	2	No	Yes	Yes	No	No	Shorter stride, not tracking up, joints slightly stiff, inward or outward swinging of a hoof at each stride.
Mildly lame	3	Yes	Yes	Yes	No	Possibly	One or more legs may be affected. Observer may not be able to determine affected leg(s). Mild limp.
Moderately lame	4	Yes	Reluctant	Reluctant	Possibly	Yes	One or more legs may be affected. Moderate limp or slight goose stepping.
Severely lame	5	Yes	Unwilling/ unable	Unable	Yes	Yes	One or more legs may be affected. Severe limp or walking on knees, or pronounced high goose stepping.

Table 2 Number and percent (presented in brackets) of goats that were scored as being not lame, having an uneven gait or a lame gait using a 5-point gait scoring system at six assessments.

		Gait score			n[b]
Assessment	Age (months)	1, not lame	2, uneven gait[a]	≥ 3, lame gait[a]	
1[c]	5	-	-	-	-
2	9	60 (76.9)	17 (22.8)	1 (1.3)	78
3	13	42 (62.7)	19 (28.4)	6 (8.9)	67
4	17	57 (86.4)	8 (12.1)	1 (1.5)	66
5	21	47 (74.6)	16 (25.4)	0 (0.0)	63
6	25	32 (52.5)	26 (42.6)	3 (4.9)	61

[a]For analysis, goats with an uneven gait and lame gait were grouped to create a binary variable comparing non-lame to impaired gait; [b]Numbers decline due to goats being removed from the herd for health and production reasons. No animals were removed due to lameness; [c]Assessment 1 was excluded from analysis as accurate gait scores could not be assigned due to goats moving faster than a walk.

instance, goats spend up to 15 h/d lying down prior to kidding, however, this pattern decreases following kidding (Zobel et al. 2015) due to the sudden change in management (e.g., twice-daily milking). Therefore, farmers could move the goats through the milking parlour during the dry period to increase activity levels and to ensure the goats' hooves are exposed to concrete during this time. Unlike in cattle, where concrete is an established risk factor for lameness (Somers et al. 2003; Dippel et al. 2009), access to hard surfaces is suggested to be beneficial for goats (Zobel et al. 2019). Exposure to the milking parlour and the concrete walkways may be particularly important for primiparous goats kept entirely indoors, as they will have had minimal prior contact with concrete. In addition to increasing activity, keeping groups of goats as stable as possible during the dry period and transition period may reduce the stress on the goats (Patt et al. 2012), thus reducing the risk of antagonistic interactions. In cows, reducing aggression has been linked to reduced lameness risk (Mahendran & Bell 2015).

We caution that it was not within the scope of the present study to investigate the exact cause of the observed gait impairment. Further work is required to determine the environmental and animal-related risk factors associated with the transition period. Nevertheless, management interventions around kidding may be considered to minimise lameness risk at this potentially critical time point.

Acknowledgements

Funding for the research and the student stipend was provided by the NZ Ministry of Business, Innovation and Employment (MBIE, Wellington, New Zealand), and the Dairy Goat Cooperative (NZ) Ltd. (DGC, Hamilton, New Zealand). Special thanks are given to the participating DGC farmer.

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