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Performance and Behavior by Spring-Born Katahdin Lambs Weaned Using Traditional or Fenceline-Weaning Methods in the Morning or Evening

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Summary

Many stressors, including social, environmental, physical, and nutritional, are involved with traditional weaning, which may negatively impact animal performance and behavior. Alternative weaning strategies may be a possible solution to minimize these negative effects. Therefore, the objective of this study was to determine the effects of weaning method and time of day on lamb performance and behavior. Over two consecutive years, 190 spring-born Katahdin ram and ewe lambs (n = 93, 26 kg ± 0.47 kg initial BW, 96 d of age, average in year 1; n = 97, 18 kg ± 0.99 kg initial BW, 89 d of age, average in year 2) were separated from their dams, stratified within litter size at weaning and by BW, sex, and age of their dam and allocated randomly in a 2 × 2 factorial design to one of four treatments representing: 1) Fenceline AM; 2) Fenceline PM; 3) Traditional AM; and 4) Traditional PM for a 14-d weaning period. Lamb weights were collected at the beginning (d 0) and 14-d post-weaning. Behavioral measurements were taken for 10 min per pen at 12 h, 24 h, 48 h, and 72 h post-weaning. Weaning and final weight, ADG, and total gain did not differ ($P \geq 0.88$) across treatments. Percentage of lambs vocalizing were greater ($P = 0.01$) from fenceline weaned lambs compared with traditionally weaned lambs. Percentages of animals walking rapidly, running, standing, and lying down did not differ ($P \geq 0.13$) across treatments. A time effect was detected ($P < 0.01$) for percentage of lambs vocalizing. A treatment × time interaction ($P = 0.04$) was observed for percentage of lambs lying down. Therefore, utilizing alternative weaning strategies may not improve performance by spring-born Katahdin lambs and may have negative effects on lamb behavior.

Key Words: Behavior, Katahdin, Performance, Weaning

Introduction

Weaning is a common livestock management practice; however, negative effects on animal performance in sheep (Knights et al., 2012) and cattle (Lefcourt and Elsasser, 1995; Meyers et al., 1999; Price et al., 2003; Boyles et al., 2007) and negative effects on behavior in sheep (Orgeur et al., 1998; Orihuela et al., 2004; Schichowski et al., 2008) and cattle (Stookey et al., 1997; Price et al., 2003; Boland et al., 2008; Ness et al., 2012) have been reported during the weaning process. Typically, livestock are weaned by abruptly separating offspring away from their dams without visual or audible contact (Enríquez et al., 2011). It has been reported that when lambs are abruptly separated from their dams, they vocalize more (Orgeur et al., 1998; Schichowski et al., 2008) and have higher agitation scores (Schichowski et al., 2008) compared with lambs that are gradually weaned. In recent years, fenceline weaning has increased in popularity. Fenceline weaning is a management practice where offspring are separated from their dams by some form of barrier that allows the animals to have nose-to-nose contact with their dams. When compared with traditional weaning in cattle, fenceline weaning may positively affect animal gain (Price et al., 2003; Boyles et al., 2007; Ness et al., 2012) and behavior (Stookey et al., 1997; Price et al., 2003; Boland et al., 2008; Ness et al., 2012). Another alternative weaning strategy is shifting the time weaning is initiated, such as weaning in the evening compared with weaning in the morning. Evening weaning may increase pig performance and feed intake (Ogunbameru et al., 1992) and improve cattle performance and behavior (Ness et al., 2012) over the weaning period. Using fall-born calves, Ness et al. (2012) evaluated the effects of alternative weaning strategies and time of day. It was observed that calf ADG and total gain was improved and percentage of calves vocalizing was lower with fenceline and evening weaning strategies compared with traditional weaning in the morning after a 14 d weaning period. However, little information is available on the effects of these weaning-management practices and time of day sheep are weaned, particularly in Katahdin hair sheep. Therefore, the objective of this study was to determine the effects of weaning method and time of day weaning is initiated on spring-born Katahdin lamb performance and behavior.

Materials and Methods

Animal Management

This study was conducted at the Lincoln University Carver Farm located in Jefferson City, Mo. All animals were treated according to the recommendations of The Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching (Consortium, 1988). Over two consecutive years, Katahdin ewes (n = 132) and their spring-born lamb progeny (n = 190; n = 93, 26 kg ± 0.47 kg initial BW, 96 d of age, average in year 1; n = 97, 18 kg ± 0.99 kg initial BW, 89 d of age, average in year 2) were used in a 2 × 2 factorial design to determine the effects of weaning strategy and time-of-day weaning was initiated. Each year, lambs were born during a 45-d lambing period, reared on pasture in a similar environment, and had access to a grain-based, supplemental-creep feed (Table 1). Each year, prior to weaning, ram and ewe lambs were stratified within litter size at weaning and by BW, sex, and age of their dam and were allocated randomly to one of eight groups. At initiation of the weaning period each year, lambs were separated from their dams, vaccinated for *Clostridium Perfringens types* C and *D* and *Tetanus Toxoid* (Bar-vac© CD/T; Boehringer Ingelheim, Inc., St. Joseph, Mo.), dewormed (Cydectin©; Boehringer Ingelheim, Inc., St. Joseph, Mo.), and groups were assigned randomly in replicate to one of four weaning treatments representing: 1) Fenceline AM (n = 46); 2) Fenceline PM (n = 46); 3) Traditional AM (n = 50); and 4) Traditional PM (n = 48) for a 14-d weaning period. Inherent differences between fenceline and traditional treatments related to nutrition, space, etc. were intentional to emulate typical production settings. Morning weaning occurred at 0730 h and PM weaning was at 1730 h. Fenceline weaned lambs were placed, adjacent to their dams, in 0.1-ha paddocks consisting predominantly of endophyte-infected tall fescue [*Lolium arundinaceum* (Schreb.) Darbysh; 61 percent NDF and 32 percent ADF]. Traditionally weaned lambs were housed in a 37.2 m^2 drylot away from their dams and had access to endophyte-infected tall fescue hay (69 percent NDF and 38 percent ADF). All lambs had *ad libitum* access to water and sheep trace mineral (ADM Alliance Nutrition, Inc., Quincy, Ill.) and in order to minimize nutritional variations between treatments, were offered the same grain-based supplement (Table 1) that was available prior to weaning, at equivalent to 2 percent of BW at 0930 for the duration of the 14-d weaning period.

Lambs were weighed at the end of the weaning period and were revaccinated. Behavioral measurements were observed for each group of lambs over a 10-min period at 12 h, 24 h, 48 h, and 72 h post-weaning according to Ness et al. (2012). Behavior measurements taken in the AM were taken prior to feeding. Each group was observed by one of two of the same trained observers each year to determine if each individual lamb vocalized, walked rapidly, ran at a quick speed throughout its pen, was standing, or lying down. Each lamb could exhibit any of the aforementioned behavior measurements over each of the 10-min observation periods; however, lambs were recorded only once per behavior variable at each collection period. Pen average for each behavioral measurement was calculated by dividing the number of lambs that

Table 1. Percentage of feedstuff in the supplemental diet (DM).

Feedstuff	Percentage
Cracked corn	42.0
Dry distillers grain with solubles	53.8
Soybean meal	3.0
Ammonium chloride	0.2
Calcium carbonate	1.0

.exhibited the behavior by the total number of lambs in the pen and multiplying by 100; this was done to determine the percentage of lambs that exhibited each behavioral measurement at each observation time.

Statistical Analyses

The experimental design of the study was a 2 × 2 factorial design, and performance measurements were analyzed using the PROC MIXED procedure of SAS (SAS Inst., Inc., Cary, N.C.) with pen of animals considered as the experimental unit, pen (treatment) as the error term, and year the random effect. Sire (pen) was added in the random statement to remove sire variation. Three pre-planned, orthogonal-contrast statements were used: 1) the mean of fenceline weaning compared with the mean of traditional weaning; 2) the mean of AM weaning compared with the mean of PM weaning; 3) and their interactions. Treatment means were reported as least squares means.

Behavioral measurements were analyzed using the PROC MIXED procedures for repeated measures of analysis of variance with group of animals considered the experimental unit and observation time considered the repeated measurement. Year was considered the random effect and pen(treatment) as the error term. The same orthogonal contrast statements for performance measurements were used to evaluate behavior. If a treatment × time interaction was observed then means were separated using an F-protected *t*-test, and all treatment means were reported as least squares means. If no treatment × time interactions were observed, then only main effects were tested.

Results and Discussion

Lamb mortality was not observed over the 14-d weaning period for any treatment. Weaning weight, final weight, ADG, and total gain for the duration of the 14-d weaning period did not differ ($P \geq 0.88$) across treatments (Table 2). Similar results were observed in crossbred-tropical hair lambs (72 d of age) that were weaned using restricted suckling mechanisms (Orihuela et al., 2004). In cattle, Ness et al. (2012) reported comparable findings for weaning weight and 14-d weight; however, PM and fenceline weaned calves had greater ADG and total gain over the weaning period compared with AM and traditional weaning. Similarly, comparing fenceline with traditional weaning in cattle, others (Price et al., 2003; Boyles et al., 2007) have reported an increase in animal performance. Also, PM weaning has been reported (Ogunbameru et al., 1992) to positively impact pig performance with PM weaned pigs having increased ADG compared with AM weaned pigs; however, similar results in sheep were not detected in the current study. In a study with weaned Targhee and crossbred-wool lambs, McClure et al. (1994) evaluated the effects of dietary treatment on post-weaning performance. Lambs assigned to the drylot treatment had access to a 13.9 percent CP (as-fed) all-concentrate diet and lambs on pasture treatments had access to either ryegrass (*Lolium perenne*), orchardgrass (*Dactylis glomerata L*), or alfalfa (*Medicago sativa*) pastures ranging from 22 percent to 29 percent CP as-fed. Authors reported that lambs offered the all concentrate diet had higher end BW, ADG, and total gain compared with lambs grazing pasture treatments. In our study, performance in newly weaned lambs was similar between pasture (with grain-based supplement) and drylot (with hay and grain-based supplement) weaning strategies.

Fenceline-weaned lambs vocalized more ($P < 0.01$) compared with traditional weaned lambs; however, percentage of lambs vocalizing did not differ ($P = 0.56$) from AM compared with PM (Table 3). Oriheula et al. (2004) reported fenceline-weaned lambs vocalized more compared with alternative restricted suckling weaning strategies; similar behavior was observed in our study. In their study, fenceline weaned lambs continue to vocalize until d 3, whereas, other treatments stopped vocalizing by d 2. In contrast, Ness et al. (2012) reported that the percentage of calves vocalizing was greater from traditionally weaned calves compared with fenceline-weaned calves and calves weaned in the AM vocalized more compared with PM-weaned calves. Weaning treatment had no effect ($P \geq 0.13$) on the percentage of lambs walking rapidly, running, standing, or lying down during the 10-min observational period, which disagrees with previous work completed on cattle (Price et al., 2003). In that

Table 2. Performance by spring-born Katahdin lambs weaned in the morning or evening using either fenceline or traditional weaning strategies.

	Treatment[a]					
Item	FAM	FPM	TAM	TPM	SEM[b]	Contrast[c]
Weaning BW, kg	22.0	22.0	22.0	22.2	3.69	NS
Final BW, kg	24.9	24.9	25.0	24.7	4.89	NS
ADG, kg	0.19	0.21	0.21	0.19	0.088	NS
Total wt. gain, kg	2.7	2.8	2.9	2.6	1.23	NS

[a] FAM = Fenceline AM; FPM = Fenceline PM; TAM = Traditional AM; TPM = Traditional PM.
[b] SEM = Pooled standard error of the mean.
[c] Contrast: NS = No significant difference ($P > 0.05$). The three pre-planned orthogonal contrast statements were: 1) the mean of fenceline weaning compared with the mean of traditional weaning; 2) the mean of AM weaning compared with the mean of PM weaning; 3) and their interactions.

Table 3. Behavioral measurements by spring-born Katahdin lambs weaned in the morning or evening using either fenceline or traditional weaning strategies.

	Treatment[a]					
Item	FAM	FPM	TAM	TPM	SEM[b]	Contrast[c]
Vocalization, %	33	28	19	13	5.6	W
Walking rapidly, %	2	6	1	1	2.3	NS
Running, %	7	0	0	0	5.4	NS
Lying down, %	38	21	44	35	8.5	NS
Standing, %	80	92	87	83	5.1	NS

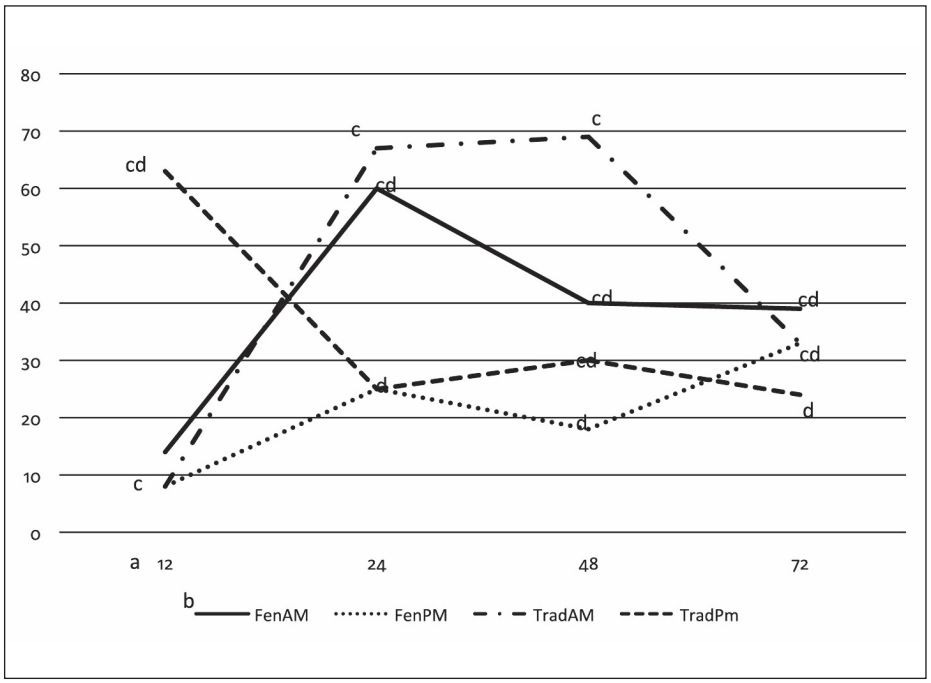
[a] FAM = Fenceline AM; FPM = Fenceline PM; TAM = Traditional AM; TPM = Traditional PM.
[b] SEM = Pooled standard error of the mean.
[c] Contrast: W = Mean of fenceline weaned lambs compared with the mean of traditional weaned lambs ($P < 0.01$); NS = No significant difference ($P > 0.05$). The three pre-planned orthogonal contrast statements were: 1) the mean of fenceline weaning compared with the mean of traditional weaning; 2) the mean of AM weaning compared with the mean of PM weaning; 3) and their interactions.

study, fenceline weaned calves walked 73 percent less and laid down 19 percent more compared with traditionally weaned calves on pasture or in a drylot (Price et al., 2003). However, Boland et al. (2008) and Ness et al. (2012) reported no differences in standing and lying down between fenceline and traditionally weaned calves. A time effect was detected ($P < 0.01$) with lambs vocalizing more at 12 h (41 percent) and 24 h (30 percent) h compared with 48 h (14 percent) and 72 h (7 percent) h (data not shown). Galeana et al. (2007), while not measuring lamb vocalization, did observe that the number of ewes in proximity to a barrier fence in fenceline-weaned animals decreased significantly after 72 h in comparison with 24 h. Our findings agree with work in cattle by Stookey et al. (1997), who reported that calves vocalized more on d 1 and d 2 of the study compared with d 4 to d 6 and d 8 to d 10. A treatment × time interaction ($P = 0.04$) was detected for percentage of lambs lying down, with traditional AM lambs lying down more at 24 h and 48 h post-weaning compared with lambs from fenceline AM at 12 h, fenceline PM at 12 h, 24 h, and 48 h, traditional AM at 12 h, and traditional PM at 24 h and 72 h (Figure 1). Therefore, lamb behavior during the weaning period may not be improved by alternative weaning strategies and time of day, contrary to what has been reported in other livestock species. This is possibly due to the gregarious nature of sheep.

Conclusion and Implications

Based on these findings, lamb performance may not be improved when utilizing alternative weaning strategies, such as fenceline or evening weaning; however, alternative weaning strategies may haffect lamb behavior. Considering the advantageous findings in earlier research with cattle that were fenceline weaned in the evening, it appears that sheep respond differently to weaning practices.

Figure 1. Percentage of spring-born Katahdin lambs lying down after weaned in the morning or evening using either fenceline or traditional weaning strategies at 12 h, 24 h, 48 h, and 72 h post-weaning.



[a] FAM = Fenceline AM; FPM = Fenceline PM; TAM = Traditional AM; TPM = Traditional PM.
[b] Behavioral measurements taken at 12 h, 24 h, 48 h, and 72 h post weaning.
[c-d] Means without common superscript differ ($P \leq 0.05$).

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