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SHORT NOTE [NOTA CORTA]

EFFECT OF FEED DEPRIVATION TIME ON BACTERIAL CONTAMINATION OF SKIN AND CARCASS IN MEAT GOATS

[EFECTO DEL TIEMPO DE RESTRICCIÓN DE ALIMENTO SOBRE LA CONTAMINACIÓN DE PIELES Y CARCASA EN CABRAS DE CARNE]

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SUMMARY

Previous research has shown that diet and feed deprivation time prior to slaughter can influence the fecal shedding of bacteria in goats. This experiment was conducted to determine the effects of feed deprivation time (FDT) on skin and carcass bacterial counts. Thirty-two Boer × Spanish goats (BW = 18.8 ± 0.82 kg) were randomly assigned to one of 4 FDT (0, 9, 18, or 27 h) before slaughter. Immediately after slaughter and evisceration, the pH values of rumen liquor and cecal digesta were determined. Rumen and rectal content samples were collected and transported to the laboratory for culture and determination of microbial load. Initial pH of *Longissimus* muscle (LM) was determined at 15 min postmortem on each carcass. Swab samples were collected from skin (leg; 25 cm^2 area) and carcass (flank, brisket and leg; 75 cm^2 area) of each animal to assess the bacterial load. The 27-h FDT group had higher ($P < 0.05$) rumen pH (6.95) than 0 h (6.23) or 9 h (6.46) FDT groups. Cecal pH was not affected ($P > 0.05$) by FDT. The microbial counts of rumen and fecal contents were not influenced by FDT. The *E. coli*, total coliform (TCC), and total plate counts of rumen content were 2.93, 3.14, and 6.08 log_{10}CFU/g, respectively, and those of fecal contents were 3.56, 7.25 and 6.81 log_{10}CFU/g, respectively. The FDT had no effect on the initial (pH = 6.87) of LM. The *E. coli*, TCC, and aerobic plate counts on skin were 1.13, 1.49, and 3.78 log_{10}CFU/cm^2, respectively, and those on carcasses were 1.51, 1.65, and 3.11 log_{10}CFU/cm^2, respectively. Both skin and carcass microbial counts were not affected ($P > 0.05$) by FDT. The results indicate that feed deprivation time alone up to 27 h may not significantly influence gut, skin, or carcass microbial loads.

Key words: *Goats; Feed deprivation; E. coli; Carcass contamination*

INTRODUCTION

Controlling pathogens in the live animal is a critical step in the production of safe and wholesome meat products. The hide and gastrointestinal (GI) tract of animals entering abattoirs are potential sources of carcass contamination with pathogenic bacteria. Feed withdrawal in animals prior to slaughter is a common practice to facilitate skinning and evisceration. Feed deprivation may also reduce skin contamination from fecal material during slaughter and dressing. However, Reid et al. (2002) reported that feed withdrawal increased fecal shedding of pathogenic *E. coli* in cattle. Furthermore, fasting pasture fed cattle for 42 h prior to slaughter substantially increased the number of *E.coli* within the GI tract compared to cattle fed before transport (Jacobson et al., 2002). Gutta et al. (2009) also reported that feed deprivation for 24 h increased bacterial counts in the rumen of sheep and goats compared with 12 h deprivation. However, the duration of feed deprivation (12 or 24 h) had no differential effect on bacterial counts in sheep and goats. Because of inconsistent results observed in these studies, it is necessary to determine the optimal feed deprivation time (FDT) prior to slaughter in small ruminants. Therefore, the objective of this study was to determine the effects of duration of feed deprivation (0, 9, 18, or 27 h) prior to slaughter on bacterial loads in GI tract as well as on skin and carcass surfaces in meat goats.

MATERIALS AND METHODS

Experimental animals were obtained from the Georgia Small Ruminant Research and Extension Center at Fort Valley State University (FVSU). Thirty-two Boer × Spanish goats (BW = 18.8 ± 0.82 kg) were randomly allocated to one of four pens. All experimental animals were fed hay with *ad libitum* access to water for 4 d. After 4 d of feeding, pens were randomly assigned to one of four FDT (0, 9, 18, or 27 h). Animals from each assigned pen were transported to holding pens at the FVSU slaughter facility and held without feed such

that the animals were feed deprived for the designated lengths of times. After feed deprivation for either 0, 9, 18, or 27 h, the animals were stunned using a captive bolt pistol and then slaughtered using standard procedures.

After evisceration, the pH values of rumen liquor and colon digesta were immediately determined using a pH meter (Model No. 445, Fisher Scientific, Pittsburgh, PA, U.S.A.). Samples from rumen and rectum were also aseptically collected for microbial analysis. Initial pH of *Longissimus* muscle (LM) was recorded at 15 min postmortem on each carcass using a potable pH meter with a penetrating probe (Pakton® Model OKPH1000N, Fisher Scientific). Sterile sponges, hydrated with 10 mL of buffered peptone water (BioPro® Enviro-Sponge Bags, International BioProducts, Redmond, WA, U.S.A.) with disposable sterile paper template (5 x 5 cm^2) were used for collection of skin and carcass swab samples. The sampling of skin and carcass from each animal was performed according to the procedure of Kannan et al. (2007). Skin swab samples were obtained by wiping area of the hind leg (25 cm^2), and carcass swab samples were determined by wiping each carcass at three anatomical locations (flank, brisket and leg) using the same template and sponge for all three locations (total area of 75 cm^2). All the collected samples for microbial analysis were prepared with 0.1% sterile buffered peptone water according to Kannan et al. (2007), and were inoculated on Petrifilm plates (3M™ Microbiology Products, St. Paul, MN, U.S.A.) to determine *E. coli*, total coliform (3M™ Petrifilm™ *E. coli*/coliform Counts Plates), and aerobic plate counts (3M™ Petrifilm™ Aerobic Count Plates) as recommended by the manufacturer.

All data were analyzed as a Completely Randomized Design (CRD) using PROC MIXED procedures of SAS (release 9.1, SAS Institute Inc., Cary, NC, U.S.A.), with animals considered to be the random effect and feed deprivation times considered to be the fixed effects. When significant by ANOVA ($P \leq 0.05$), least squares means were generated and separated using pairwise *t*-tests (PDIFF option).

RESULTS AND DISCUSSION

The duration of feed deprivation had a significant effect on rumen pH values; however, the cecal pH was not affected by feed deprivation time (Table 1). Goats subjected to 27-h feed deprivation had a higher ($P < 0.05$) rumen pH value compared with those subjected to 0 or 9 h feed deprivation. The 18 h FDT group also had higher rumen pH than the 0 h FDT group. The initial *Longissimus* muscle (LM) pH was not affected by FDT (Table 1).

Rumen *E. coli* counts were not affected by FDT and the counts ranged from 2.65 to 3.25 $\log_{10}$ CFU/g (Table 2). Neither total coliform (3.04 to 3.38 $\log_{10}$ CFU/g) nor aerobic plate counts (5.64 to 6.51 $\log_{10}$ CFU/g) in the rumen were influenced by FDT. In fecal contents (Table 2), the duration of feed deprivation did not significantly influence *E. coli* (2.84 to 4.28 $\log_{10}$ CFU/g), total coliform (7.07 to 7.43 $\log_{10}$ CFU/g), or total plate counts (5.59 to 7.48 $\log_{10}$ CFU/g). Previous studies showed that increased *E. coli* growth in the rumen of feed deprived animals might be due to increased pH as fasting lowers production of volatile fatty acids. However, this trend was not found in the present study.

Although coliform organisms prefer a near-neutral pH for their optimum growth, the organisms can still grow in the pH ranges of 4.4-9.0. Ruminal pH values of all feed deprived animals were suitable for *E. coli* and other microbial growth.

Prior to slaughter, skin *E. coli* (1.00 to 1.25 $\log_{10}$ CFU/cm^2), total coliform (1.45 to 1.60 $\log_{10}$ CFU/cm^2) and aerobic plate counts (3.31 to 4.05 $\log_{10}$ CFU/cm^2) were not different among the FDT groups (Table 2). No significant differences were found in carcass *E. coli*, total coliform and aerobic plate counts among the FDT groups. However, *E. coli* on carcass surfaces decrease ($P = 0.10$) continuously with the duration of feed deprivation. Carcasses from the 27 h FDT group tended to have lower ($P = 0.10$) aerobic plate counts than did those from 0 h FDT group. Major sources of carcass contamination are unclean animal skin and visceral contents of animals entering the slaughter facility. Carcass *E. coli* and other microbial counts were not related to skin or gastrointestinal tract counts in the present study. However, *E. coli* and aerobic counts on carcasses had a tendency to decrease ($P = 0.10$) with increasing feed deprivation times.

CONCLUSION

Carcass contamination is related to the prevalence of *E. coli* and other pathogenic bacteria in feces. Duration of feed deprivation influences rumen pH. Higher rumen pH generally favors higher *E. coli* counts in the rumen; however, such a relationship between pH and bacterial counts was absent in this study. Increasing feed deprivation time tends to reduce *E. coli* and aerobic counts on carcasses of meat goats.

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Table 1. Effects of the duration of feed deprivation on pH of gastrointestinal tract contents and *Longissimus* muscle (LM)

	Feed deprivation, h				
Item	0	9	18	27	SEM
Rumen	6.23[c]	6.46[bc]	6.74[ab]	6.95[a]	0.082
Colon	6.74	6.74	6.78	6.82	0.052
LM	6.48	6.60	6.58	6.53	0.053

[a,b,c]Within a row, least squares means with different superscripts differ ($P < 0.05$)

Table 2. Effects of the duration of feed deprivation on microbial loads in gastrointestinal tract contents and on skin and carcass surfaces in meat goats.

	Feed deprivation, h				
Item	0	9	18	27	SEM
Rumen (log_{10} CFU/g)					
E. coli	2.98	3.25	2.65	2.86	0.411
Total coliform	3.05	3.38	3.06	3.04	0.440
Aerobic	6.51	6.29	5.88	5.64	0.420
Cecal (log_{10} CFU/g)					
E. coli	2.84	3.99	3.11	4.28	0.982
Total coliform	7.40	7.07	7.43	7.10	0.329
Aerobic	5.59	7.48	7.31	6.86	0.636
Skin (log_{10} CFU/cm^2)					
E. coli	1.25	1.00	1.25	1.00	0.124
Total coliform	1.45	1.47	1.45	1.45	0.291
Aerobic	3.31	3.91	3.85	4.05	0.234
Carcass (log_{10} CFU/cm^2)					
E. coli	1.94	1.83	1.16	1.14	0.275
Total coliform	1.90	1.86	1.16	1.66	0.343
Aerobic	3.32	3.11	3.65	2.35	0.361

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