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Influence of Feeding Peanut Skins on Performance of Gulf Coast Ewe Lambs

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Abstract

The effects of varying levels of dietary peanut skins (PS) inclusion on dry matter intake (DMI), growth, and carcass characteristics of lambs was assessed in 135-d feeding trial. We hypothesized that supplementing lambs' diet with increasing levels of PS would increase DMI, enhance body growth, and impact carcass characteristics. Thus, the overall objective of the study was to gain a thorough understanding of the feeding value of PS to lambs. Twelve Gulf Coast ewe lambs (27.75 ± 0.93 kg initial body weight (BW) and 7 to 8 months of age) were blocked by BW and were randomly assigned within block to 1 of the 3 dietary treatments. Lambs were grouped in 2 pens per treatment (2 lambs/pen; n = 4/dietary treatment) with pen serving as the experimental unit. Lambs were fed dietary treatments containing 0 (control), 20, or 40% PS (DM basis) as a replacement for corn and SBM. Control diet contained dry-rolled corn, SBM, and fescue/Bermuda grass hay at forage to concentrate ratio of 63:37. All diets were formulated to meet or exceed the NRC requirements of the finishing lambs. At the end of the feeding trial, lambs were slaughtered, and carcass data were collected after a 48-h chill. Dry matter intake and final BW were not different among treatments (P >0.05). Also, no differences were observed in hot carcass weight (HCW; P = 0.57), cold carcass weight (CCW; P = 0.24), body wall fat (P = 0.06), 12th rib fat (P = 0.10), and kidney and pelvic fat (K&P fat; P = 0.65) among treatments. However, rib eye area (REA) was greater (P < 0.01) in lambs fed 0% and 20% PS than in lambs fed 40% PS. These results suggest that PS can replace a portion of corn and SBM commonly fed to lambs without any adverse effects on carcass characteristics or lambs performance. Thus, PS needs to be seriously considered as a potential low-cost feedstuff for ruminants.

Key Words: Carcass, meat sheep, peanut skins, feed.

Abbreviations: ADF, acid detergent fiber; ADG, average daily gain; BW, body weight; CCW, cold carcass weight; CP, crude protein; DDGS, dried distillers grains with solubles; DM, dry matter; DMI, dry matter intake; HCW, hot carcass weight; K&P fat, kidney and pelvic fat; ME, metabolizable energy; NFC, non-fibrous carbohydrate; NDF, neutral detergent fiber; PS, peanut skins; P, phosphorus; REA, rib eye area; S, sulfur; SBM, soybean meal; UMC, urea-molasses cake; TDN, Total digestible nutrients.

Introduction

Many alternative and by-product feeds, such as dried distillers grains with solubles (DDGS) and cotton seeds, are now available, often at a fairly low cost, to provide supplemental nutrition for ruminants. Peanut skins (PS) are a low-value by-product of peanut processing operations. Because of its high protein and fat content and low fiber content, PS would be an excellent feed source replacing soybean meal (SBM) in ruminant diets (Utley et al., 1993). However, phenolic compounds found in PS, such as tannins can have detrimental effects on animal performance (Price and Butler, 1980; Hill et al., 1986a; Hill et al., 1986b; Utley et al., 1993). Tannins are known to bind with enzymes and form nutritionally unavailable polymers with

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dietary proteins (Jung and Fahey, 1983). Various methods can be used to eliminate the detrimental effects of tannins such as feeding extra crude protein (CP), supplementing diet with urea-molasses cake (UMC), and feeding ammonia-treated PS (Jung and Fahey, 1983).

Increasing dietary protein allows higher levels of PS to be fed to finishing steers without encountering effects on digestibility and performance (McBrayer et al., 1983; Hill et al., 1986a,b). The levels of PS included would be dependent upon the amount of excess protein present in the diet as well as the cost of the PS as a feed ingredient (McBrayer et al., 1983). Under proper conditions, feeding of PS to cattle grazing winter annual pastures appears practical at up to 9% of the dry matter intake (DMI; McBrayer et al., 1983). A limited number of research studies have examined the effects of feeding high levels of PS in the diets of ruminant animals on carcass quality and animal performance (Hill et al., 1986b; Hill et al., 1987; West et al., 1993). Therefore, we hypothesized that up to 40% PS inclusion (DM basis) would result in beneficial influence on the performance of finishing ewe lambs. The overall objective of the study was to determine the influence of feeding high levels of PS on DMI, final body weight (BW), average daily gain (ADG) and carcass characteristics of lambs.

Materials and Methods

Experimental Design

All animal care and handling procedures followed the farms written guidelines set forth by Federation of Animal Science Society (1999) and all procedures involving animals were approved by the Animal Care and Use Committee of Alabama A&M University (AAMU). A total of Twelve Gulf Coast ewe lambs (27.75 ± 0.93 kg initial BW and 7 to 8 months of age) were used in a completely randomized block design. The study was conducted at the AAMU Winfred Thomas Agricultural Research Station and lasted for 135-days.

Experimental Animals

Before the start of treatment diets, lambs were grouped according to their BW and randomly assigned within blocks to the three treatments. Treatments had two replicates with two lambs in each (n = 4/dietary treatment). Before initiation of the study, lambs were vaccinated for clostridial disease (Convexin 8, Schering-Plough, Kenilworth, NJ). During the trial, lambs were housed in pens (2 lambs/pen). Pens were 1.50 × 2.5 m and were bedded with wood shavings to allow minimal stress on lambs. Pens were equipped with plastic feeders and water buckets. Treatment diets were offered once daily at 0800 AM for ad libitum intake with free access to fresh water. Feed refusals were collected every morning, weighed, dried, and analyzed for DM, and used to calculate DMI.

Peanut Skins Analysis

The chemical composition of PS was determined at Nutrition Laboratory, Inc. (Millersburg, Ohio) before PS was used in the trial (Table 1).

Experimental Diets

Peanut skins was added at 0, 20 or 40% of the dietary DM to replace corn and SBM. Ingredient and chemical composition of different concentrates containing varying levels of PS were determined at Auburn University before the start of the trial (Table 2). The total diets containing PS were formulated to meet or exceed the NRC (2007) requirements for finishing lamb. Lambs were allowed 7-day adjustment period in the stalls and 7-day transition period to the PS diets followed by 135 d feeding period.

Data Collection Procedures

Lambs' initial and final BW were the average of 2 BW taken on two consecutive days. After 135 d finishing period, lambs were transported to the Auburn University Lambert-Powell meat's laboratory (Auburn, AL) for slaughter and subsequent carcass data collection. Carcass data collected by trained personnel after a 48-h chill (temperature <2°C, humidity near 100%), included final BW, hot carcass weight (HCW), cold carcass weight (CCW), 12th rib fat, body wall fat, kidney and pelvic fat (K&P fat), and rib eye area (REA).

Table 1. Nutrient composition of Peanut Skins.

Item	Units	DM basis
CP[1]	%	22.68
Available protein	%	19.00
Adjusted CP	%	21.27
ADF[2]	%	39.62
NDF[3]	%	32.66
ADF protein	%	3.68
NDF protein	%	6.08
NFC[4]	%	28.41
Lignin	%	12.13
Starch (est.)	%	26.99
Crude fat	%	19.05
TDN[5]	%	87.66
NEl	Mcal/lb.	0.919
NEm	Mcal/lb.	0.984
NEg	Mcal/lb.	0.676
Ash	%	2.70
Lignin insoluble ash	%	0.22
Calcium	%	0.25
Phosphorus	%	0.15
Magnesium	%	0.11
Potassium	%	0.64
Sulfur	%	0.12
Sodium	%	0.25
Copper	ppm	46
Manganese	ppm	32
Zinc	ppm	47
Iron	ppm	262

[1]Crude Protein. [2]Acid detergent fiber. [3]Neutral detergent fiber. [4]Non-fibrous carbohydrate. [5]Total digestible nutrients.

Table 2. Ingredient and chemical composition of different concentrates containing varying levels of Peanut skins (PS) and fescue/bermudagrass hay (F/BGH; g/kg, DM basis).

Item[1]	Diet (DM basis)		
	0% PS (control)	20% PS	40% PS
Concentrate	63.0	64.4	63.8
F/BGH	37.0	35.6	36.2
Total	100	100	100
Concentrates ingredients			
	0% PS (control)	20% PS	40% PS
Cracked corn	49.5	36.2	21.1
Soybean meal (48% CP)	12.2	6.9	1.4
Peanut skins	---	20	40
Sheep Premix[2]	1.3	1.3	1.3
Total	63.0	64.4	63.8
Chemical composition of the experimental diets			
Item	0% PS (control)	20% PS	40% PS
DM	88.0	89.5	90.2
CP, % of DM	15.7	17.0	18.5
Ether extract, % of DM	3.0	5.2	6.5
NDF, % of DM	33.0	35.0	36.0
ADF, % of DM	20.1	21.9	22.0
Tannins, % of DM	1.6	4.4	5.7
Ash, % of DM	4.0	4.8	4.0

[1] All values are on DM basis (unless otherwise indicated). [2](%) Ca 9.0, P 8.0, Salt 41.0, K 0.10, Mg 1.0; (ppm) Cu 1,750, Se 25.0, Zn 7,500, and (IU/kg) Vitamin A 308,644, Vitamin D 24,251 and Vitamin E 1,653.

Table 3. Dry matter intake (DMI), initial body weight (BW), average daily gain (ADG), and final BW for lambs fed different levels of PS[1].

Items	Diet			SEM	P-value[2]	
	0% PS (control)	20% PS	40% PS		Linear	Quadratic
DMI, kg/day	1.71	1.72	1.73	0.02	0.46	0.82
BW						
Initial BW, kg	28.68	27.75	26.83	3.88	0.76	1.00
ADG, kg	0.12	0.12	0.10	0.03	0.55	0.77
Final BW, kg	39.55	38.43	35.33	1.50	0.63	0.15

[1]Four lambs were assigned to each treatment (n = 4/dietary treatment). [2]Based on orthogonal contrasts for equally spaced treatments.

Statistical Analysis

The experiment was arranged as a complete randomized block, with pen as the experimental unit, and data were analyzed according to linear and quadratic orthogonal contrasts. Assumptions of normality were tested in the experiment using the UNIVARIATE procedure (SAS, 2006). The GLM procedure of SAS was used to statistically analyze performance and carcass characteristics. The effects of treatment and block were included in the model statement for each experiment. Least squares means were generated and separated using the PDIFF option of SAS for significant main effects. The protected F-test was used to determine overall significance where P-values of 0.05 were considered significant.

Results

Lambs Overall Performance and Carcass Characteristics

No differences (P > 0.05) in DMI, ADG or final BW were observed among treatment diets (Table 3). Similarly, no effects (P > 0.06) on HCW, CCW, 12th rib fat, body wall fat, and K&P fat were observed when 20 or 40% PS was included in lamb's diets (Table 4). However, REA was lower (P <0.01) for lambs fed the 40% diet compared to lambs fed the 0 or 20% diets (Table 4).

Discussion

Feed Intake

The lack of differences in DMI among treatments may be caused by the similar NDF concentrations in diets as the NDF concentration in diets is the main dietary constraint for reduced

Table 4. Hot and cold carcasses weight for lambs fed different levels of PS[1].

Items	PS% (Diet)			SEM	P-value[2]	
	0% PS control)	20% PS	40% PS		Linear	Quadratic
Carcass characteristics						
HCW[3], kg	17.73	17.40	16.95	0.87	0.57	0.96
CCW[4], kg	15.7	14.80	13.90	0.90	0.24	0.99
12th Rib fat, cm	0.35	0.28	0.15	0.06	0.10	0.75
Body wall fat, cm	1.30	1.18	0.43	0.21	0.06	0.31
K&P fat[5], kg	0.38	0.33	0.35	0.04	0.65	0.45
REA[6], cm^2	1.88^a	2.4^a	1.0^b	0.08	0.01	0.003

[1]Four lambs were assigned to each treatment (n = 4/dietary treatment). [2]Based on orthogonal contrasts for equally spaced treatments. [3]Hot carcass weight. [4]Cold carcass weight. [5]kidney and pelvic fat. [6]Rib eye area. [a,b]Means without common superscript letters differ ($P < 0.05$).

DMI in ruminants (Van Soest, 1994). Results of DMI are consistent with West et al. (1993) when cows where fed diets contained 0 or 16% PS. However, West et al. (1993) noticed that DMI decreased when cows were fed diets that contain 24% PS. McBrayer et al. (1983) reported a decrease in DMI when 20% PS was included in diets of growing-finishing cattle.

Weight Gain

In agreement with our study, Utley and Hellwig (1985) reported no differences in ADG in calves fed either 0 or 10% PS. Similarly, Hill et al. (1986a) observed that BW and ADG did not differ for steers fed control diet and high-protein PS diet with soybean. However, McBrayer et al. (1983) noticed that feeding 10% PS diet increased ADG for heifers compared to 20% PS diet. Furthermore, McBrayer et al. (1983) reported that ADG of heifers fed control diet and attained slaughter weight by 72 d on feed was higher than those failed to attain slaughter weight by 100 d when fed 10 and 20% PS diets.

Carcass Characteristics

There were no differences in carcass characteristics between treatments except for REA, which was significantly higher for lambs fed the 40% PS. Results in the present study agree with previous research (Hill et al., 1986b; Hill et al., 1987) except for REA. Hot carcass weight in lambs fed the 40% PS (16.95 kg) was numerically less than that of the 0% and 20% PS (17.73 and 17 kg, respectively; Table 4). Meanwhile, the REA was significantly lower when 40% PS was included in lambs finishing diets (Table 4). In agreement with the results of the current study, except for the REA, Hill et al. (1987) noticed that carcass characteristics were similar for steers fed diets with 15% PS. Also, Hill et al. (1986b) noticed that carcass characteristics of steers on diets included different levels of PS were remarkably uniform and no significant differences were observed. The same authors also noticed that carcass weight and internal fat were higher in steers fed diet included urea-molasses cake (UMC)-supplemented PS compared with control. Hill et al. (1986b) concluded that the detrimental effects of tannins when PS was included in steers' diets may be avoided by increasing dietary CP level with high SBM or SBM plus UMC-supplemented diets. Furthermore, Hill et al. (1986b) observed that carcass characteristics of heifers fed different levels of dietary PS were similar, except for dressing percentage, which was significantly higher for control heifers.

Conclusion

The current study demonstrated that feeding increasing level of PS to lambs significantly impacted the REA. However, no differences were observed in DMI, final BW, HCW, CCW, body wall fat, 12th rib fat, and K&P fat among treatments. Peanut skins contain appreciable quantities of both protein and fat that makes it an excellent feed source. The potential for PS to reduce performance, due to the impact of PS tannin on protein metabolism is of concern in marginally adequate CP diets. However, small ruminants have been shown to be especially adept at handling moderately high levels of tannins in their diet. Thus, PS needs to be considered as a potential low-cost feedstuff for ruminants. Future studies needed to further evaluate the advantage of feeding PS.

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