Evaluation of Tallow Treated Protein for Ruminants

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Story in Brief

The feasibility of decreasing ruminal protein breakdown by treating cottonseed meal (CSM) with tallow was studied in growth trials with lambs and cows. In Trial 1, 30 crossbred ewe lambs (79 lb) were individually fed a 72 percent rolled corn ration with four supplemental protein treatments: CSM in meal form (OM); CSM pelleted (OP); CSM in meal form with 15 percent heated tallow with CSM (15M); and CSM pelleted with 15 percent tallow. An equivalent amount of tallow was added to the grain portions of the OM and OP treatments. No differences ($P>.05$) in daily gain (ADG) or feed/gain were found after 56 days.

In Trial II, 61 lactating Hereford cows (983 lb) grazing dormant winter tallgrass range were randomly assigned to three supplemental protein treatments for the period of December 14 to April 18. Treatments were: cottonseed meal (control); CSM mixed with 15 percent tallow and pelleted into ⅝-inch diameter pellets (15P); and CSM plus cottonseed hulls fed to an equivalent energy level (15H). Energy was equalized across treatments using cottonseed hulls and cane molasses so that all cows (group fed) received 1.2 lb crude protein (CP) and 4.3 lb TDN/head/day. No differences were noted for cow or calf weight change or rumen ammonia levels of cows at 1- and 4-hr post feeding.

These data indicate that tallow addition to cottonseed meal does not improve protein utilization by ewe lambs fed a concentrate diet or lactating Hereford cows grazing dormant winter tallgrass range.

Introduction

Supplementation of ruminant diets with free oil alters the composition, mobility and metabolic activity of rumen microflora. This results in changes in cellulose and protein breakdown and in production of methane, volatile fatty acids and ammonia.

Addition of 30 percent oil to protein supplements fed with a 53 percent corn diet has been shown (Glen *et al.*, 1977) to reduce rumen ammonia in lambs and also to increase nitrogen retained compared to protein fed without oil. Peterson *et al.*, 1975, in a similar study found that mixing oil with protein reduced rumen ammonia and plasma urea. However, Bohman *et al.*, 1959, found no significant effect on rate of gain of steers fed 0.5 lb of animal fat added to native grass hay, cottonseed meal or alfalfa. This was a 5 percent fat addition to primarily a native range grass hay diet.

Heat treatment protects dietary proteins for ruminants, but it is important that appropriate temperature and heating times are employed for particular feeds. Sherrod and Tillman (1964) found that CSM autoclaved for 60 min produced superior gains and feed efficiencies as compared to non-autoclaved meals or meals treated longer.

The objectives of this research were: 1) to evaluate the feasibility of using tallow to protect protein from ruminal degradation, and 2) to determine if the heat produced during pelleting would enhance any protection gained from tallow.

Materials and Methods

Thirty crossbred ewe lambs (79 lb) were randomly assigned to four treatments. Lambs were maintained in individual pens and fed *ad libitum* for 56 days. All treatments contained an identical amount of tallow (Table 1). Cottonseed meal (CSM) was fed in two forms: meal and pellet. Within each form an equivalent amount of tallow was added to CSM (15 percent tallow in supplement) or to the grain mixture (0 percent tallow in supplement). Preliminary studies with cows found 15 percent tallow addition to be approximately the highest level of tallow that cows would readily consume in a supplement. Pellet formation (0.78 inch diameter) and stability became a problem above additions of 15 percent tallow to CSM. Average daily gain and fed intake were measured every 28 days after a 12-hr withdrawal from feed and water.

Sixty-one lactating Hereford cows (983 lb) were used in a 125-day wintering trial (December 14-April 18) in Central Oklahoma. Cattle were maintained on native tallgrass range with climax vegetation of little bluestem, big bluestem, Indian grass and switch grass. Cows were randomly assigned to three treatments (Table 2) and were group fed 6 days each week. Cows were rotated between three pastures every 2 weeks to reduce pasture effects. Initial, intermediate (28-day) and final weights were obtained after a 12-hr withdrawal from feed and water. Post-partum interval was calculated by subtracting 283 days from the subsequent calving date. Rumen ammonia-nitrogen samples were obtained from cows via the esophagus at 1- and 4-hr post-feeding of the supplements. Sixty-ml samples were obtained, and microbial activity was stopped with 1 ml of 20 percent HCl. Ammonia nitrogen was analyzed with a colormetric procedure as modified by Chaney and Marbach (1962).

Results and Discussion

Addition of 15 percent tallow to CSM resulted in no ($P>.05$) improvement in gain or feed efficiency in lambs regardless of whether the tallow was added to the protein

Table 1. Percentage composition of diets for lamb growth trial.

Supplement form	Meal		Pelleted	
Tallow % in suppl	0	15	0	15
Ingredients[a]				
Rolled corn	71.63	71.52	71.63	71.52
Cottonseed hulls	14.60	14.58	14.60	14.58
Cottonseed meal	9.36	9.29	9.36	9.29
Tallow	1.86	1.86	1.86	1.86
Wheat midds	1.04	1.24	1.04	1.24
Limestone	.97	.97	.97	.97
Trace mineral salt[b]	.54	.54	.54	.54
Vitamin A[c]	+	+	+	+

[a]Dry matter basis, 10.5% crude protein in each diet.
[b]Ingredients, %: Mn, .25; Fe, .20; S, .10; Cu, .033; I, .007; Zn, .005; N_aCl, 99.
[c]Vitamin A palmitate, 30,000 IU/g or 2420 IU/lb of diet.

Table 2. Ration composition (dry matter basis) of lactating cow supplements.

Ingredients[a]	Control	15P[b]	15H[c]
		lb/hd/day	
Cottonseed meal	2.73	2.73	2.73
Tallow		.48	.48
Cottonseed hulls	3.81	2.24	2.29
Molasses	1.65	.97	.99
KC1	.02	.02	.02

[a]Group fed cows received 1.2 lb CP and 4.3 lb TDN/head/day.
[b]Denotes the addition of 15% tallow to CSM and pelleting prior to feeding.
[c]Denotes the addition of an equivalent amount of tallow as in 15P to cottonseed hulls, molasses and KC1 prior to feeding.

source and pelleted or left in meal form (Table 3). These findings are in disagreement with those of Glen *et al.*, 1977, who found increased nitrogen retention in lambs fed a 30-percent corn oil-linseed meal mixture *vs* untreated linseed meal with a 52-percent corn diet.

Tallow addition to CSM rather than to the grain mixture did not (P>.05) improve lamb growth (Table 3). Addition of tallow to CSM or cottonseed hulls had no apparent effect on cow weight loss or calf gain when compared to the control treatment which contained no tallow (Table 4). Bohman *et al.*, 1959, found the rate of growth of weanling steer calves grazing winter range to be the same for the animals receiving either alfalfa or CSM with or without 0.5 lb of animal fat.

Supplemental protein was fed at 63 percent of NRC (1976) to ensure that cows would not gain weight during the trial and, therefore, cows would be able to demonstrate a protein response if fat addition or the heat from pelleting should alter protein efficiency. Standing dormant winter range grass (3 percent crude protein) has been shown to contribute little to the protein needs of lactating beef cows (Forero, 1979; Rush, 1974).

Post-partum interval was not (P>.05) affected by the addition of tallow to CSM or cottonseed hulls when fed post-calving (Table 4). The relatively short post-partum

Table 3. Intake and performance of growing lambs.

Supplement form	Meal		Pelleted		
Tallow % in suppl	0	15	0	15	SE
Intake (lb/head/day)[a]					
Dry matter	2.38	2.46	2.60	2.79	.33
Crude protein (% NRC)[b]	.24(62)	.26(68)	.26(68)	.29(74)	
Wt gain (lb/day)	.42	.44	.44	.48	.13
Feed/gain	5.68	5.60	5.90	5.77	1.03
No. of lambs/trt	8	8	7	7	

[a]Lambs were fed *ad libitum*.
[b]NRC, 1975.

Table 4. Weight change, reproductive performance and rumen NH_3–N (mg/dl) of lactating cows fed tallow - CSM during winter supplementation.

Item	Control	15P	15H	SE
No. of cow-calf pairs	20	22	19	
Initial wt (lb)				
Cow	983	981	983	
Calf	121	123	123	
Wt change, lb (125 days)				
Cow	−62.7	−66.7	−69.3	23.5
Calf	104.9	105.8	113.7	22.0
Post-partum interval (days)	55.9	60.3	62.9	6.9
Conception rate, %	65	55	58	
NH_3–N (mg/dl)[a]				
1-hr post-feeding	4.16	3.55	3.56	.42
4-hr post-feeding	2.81	2.82	2.86	.42

[a]Sixteen cows/treatment.

interval with low conception rates was probably due to a short breeding season and extremely cold temperatures. Cows cycling early in the 60-day breeding season were bred, while those not bred then were delayed until after the breeding season because of cold temperature and 47 days of snow cover encountered during the trial.

Adding tallow to CSM and/or cottonseed hulls did not reduce ($P>.05$) rumen ammonia nitrogen in cows at 1- and 4-hr post-feeding when compared to CSM without tallow (Table 4).

Addition of 15 percent tallow to CSM and/or pelleting this mixture appeared to be ineffective in protecting CSM from rumen degradation, increasing lamb growth or decreasing weight loss in cows maintained on winter native range.

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