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Addition of Fat to Diets of Lactating Sows: I. Effects on Lactation Performance and Pig Composition

Scott Tilton
University of Nebraska - Lincoln

Austin Lewis
University of Nebraska - Lincoln, alewis2@unl.edu

Phillip S. Miller
University of Nebraska - Lincoln, pmiller1@unl.edu

Paul Ermer
University of Nebraska - Lincoln

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Summary and Implications

An experiment was conducted with 30 lactating sows to determine the effects of high fat lactation diets on the body composition of suckling pigs and sow backfat composition. Sows were provided a lactation diet containing either zero or 10% tallow on an ad libitum basis for a 21-day lactation. No differences in feed intake during lactation were observed, although sows fed tallow consumed more metabolizable energy per day than control sows. Composition of backfat samples taken at weaning from sows suggested an increase in the amount of fatty acid synthesis in adipose tissue of control sows. Sows fed tallow weaned heavier litters, however, body composition of these pigs indicated this increased weight was almost exclusively fat. Additional research is required to determine the effects of this change in body composition in pigs at weaning on their subsequent performance and body composition.

Introduction

The addition of fat to the diet of the lactating sow has been examined by numerous researchers as a potential method to increase energy intake. Typically, these experiments find sows fed high concentrations of fat (ten percent or more) decrease feed intake slightly. However, because of the increased energy density of these diets, energy intake is increased by approximately 1.5 Mcal of metabolizable energy/day. This increase in energy intake by the sow is reflected in small improvements in the growth performance of her offspring. In addition, we reported an increase in the energy content of the milk from sows fed diets with added fat in the 1995 Nebraska Swine Report. The effects of this change in milk composition on the composition of the suckling pig, however, are unknown.

Because of these reasons, an experiment was designed with the primary objective of determining the effects of feeding a lactation diet high in fat on the body composition of pigs at weaning. A secondary objective was to determine whether differences in the fatty acid composition of the sow's backfat occur due to dietary fat intake during lactation.

Procedures

Thirty first-parity crossbred sows were fed 4 pounds/day of a standard corn-soybean meal diet throughout gestation. Sows were housed in gestation crates until day 110 of gestation, at which time they were moved to farrowing crates. Three farrowing rooms were used for this study and each room contained 10 sows. Each farrowing room was blocked by the predicted farrowing date of the sow. Five sows per room were randomly assigned to receive a corn-soybean meal diet and five were assigned to a similar diet containing 10% tallow (Table 1). Diets were formulated to contain 1% lysine. Concentrations of other nutrients were included at 110% of NRC requirements. Sows had ad libitum access to diets, starting immediately after farrowing. Farrowing room temperature was maintained at approximately 70˚F, except for four days during the final week of the study, when daily high temperatures reached between 80 and 90°F. Continuous lighting was provided.

Table 1. Composition of diets (as-fed basis)

Ingredient, %	Control	Tallow
Corn	67.9	56.80
Soybean meal, 46.5% CP	28.00	29.00
Tallow	0.00	10.00
Dicalcium phosphate	2.10	2.30
Vitamin premix	1.00	1.00
Salt	.50	.50
Limestone	.40	.30
Trace mineral premix	.10	.10
Formulated composition:		
Metabolizable energy, Mcal/lb	1.42	1.63
Protein, %	19.00	18.50
Lysine, %	1.00	1.00
Calcium, %	.90	.90
Phosphorus, %	.75	.75
Analyzed composition:		
Gross energy, Mcal/lb	1.72	1.98
Protein, %	17.90	17.23
Dry matter, %	88.1	89.6
Ether extract, %	2.09	10.94
Calcium, %	.96	.95
Phosphorus,%	.78	.79

Table 2. Fatty acid composition of the diets[a]

Fatty acid, %	Control	Tallow
Myristic (C14:0)	N.D.[b]	1.36
Palmitic (C16:0)	13.86	23.65
Palmitoleic (C16:1)	N.D.	2.01
Stearic (C18:0)	20.59	13.15
Oleic (C18:1)	1.12	37.84
Linoleic (C18:2)	61.72	20.89
Linolenic (C18:3)	2.71	1.11

[a]Data are presented as a percentage of the total of these fatty acids present in the sample, but do not reflect differences in the amount of fat in the diet.
[b]N.D. = not detectable.

Table 3. Effect of 0 or 10% tallow in the sow lactation diet on the fatty acid composition of sow backfat at weaning[a]

Fatty acid, %	Control	Tallow	P <
Myristic (C14:0)	1.12	1.02	.05
Palmitic (C16:0)	23.39	23.33	N.S.[b]
Palmitoleic (C16:1)	2.18	2.13	N.S.
Stearic (C18:0)	13.12	13.03	N.S.
Oleic (C18:1)	47.38	47.63	N.S.
Linoleic (C18:2)	12.43	12.49	N.S.
Linolenic (C18:3)	.37	.36	N.S.

[a]Data are presented as a percentage of the total of these fatty acids present in the sample. The number of sows per treatment was 15.
[b]N.S. = not significant, P > .10.

Table 4. Effect of 0 or 10% tallow in the sow lactation diet on sow and pig performance

Criteria	Control	Tallow	P <
No. of sows	15	15	
Feed intake, lb/d			
d 0 to 7	8.60	8.38	N.S.[a]
d 7 to 14	12.67	12.76	N.S.
d 14 to 21	11.99	11.64	N.S.
Average	11.09	10.93	N.S.
Metabolizable energy intake, Mcal/d			
d 0 to 7	12.77	14.19	N.S.
d 7 to 14	18.77	21.57	.05
d 14 to 21	17.75	19.70	.10
Average	16.43	18.49	.05
Sow weight change, lb			
d 0 to 7	1.56	3.76	N.S.
d 7 to 14	1.56	7.48	N.S.
d 14 to 21	-15.71	-14.30	N.S.
Overall	-12.58	-3.06	N.S.
Litter weight, lb			
d 0	32.91	31.86	N.S.
d 7	57.09	57.20	N.S.
d 14	93.48	97.17	N.S.
d 21	128.02	136.27	.05

[a]N.S. = not significant, P > .10.

Table 5. Effect of 0 or 10% tallow in the sow lactation diet on body weight and composition of 21-d old pigs

Criteria	Control	Tallow	P <
No. of pigs	30	30	
Live weight, lb	12.76	13.35	.10
Carcass weight[a], lb	11.88	12.52	.05
Fat, %	10.41	13.68	.05
Protein, %	15.35	14.70	.05
Ash, %	2.70	2.69	N.S.[b]
Dry matter, %	30.47	32.93	.05
Water, %	69.53	67.07	.05

[a]Carcass weight is the weight of the frozen animal after gastrointestinal contents were removed. All percentage data are expressed as a percentage of carcass weight.
[b]N.S. = not significant, P > .10.

Table 6. Effect of 0 or 10% tallow in the sow lactation diet on the weight of carcass components of 21-d old pigs[a]

Criteria	Control	Tallow	P <
No. of pigs	30	30	
Fat, lb	1.241	1.711	.05
Protein, lb	1.825	1.842	N.S.[b]
Ash, lb	.320	.337	N.S.
Dry matter, lb	3.628	4.122	.05
Moisture, lb	8.261	8.397	N.S.

[a]All data are calculated from carcass weight and percentage data.
[b]N.S. = not significant, P > .10.

Sow and litter weights and feed intake were recorded weekly, from day zero (within 24 hours post-farrowing) to day 21. Litter size was standardized to 10 pigs per litter within 48 hours after farrowing using pigs from a separate group of sows managed similar to experimental sows during gestation. At weaning, a backfat sample was taken from the last rib region of each sow for fatty acid analysis. A barrow and gilt from each litter was selected for determination of body composition. These pigs (n = 60) were euthanized and gastrointestinal contents were removed. Diets and carcasses were analyzed for dry matter, protein, fat and ash content. Data were analyzed as a randomized complete block experiment with gilts blocked by farrowing room.

Results and Discussion

Analyzed nutrient content of the diets were similar to predicted values (Table 1), but protein concentration tended to be lower than formulated concentration. However, values for all nutrients exceeded the NRC requirements. Fatty acid composition of the diets is provided in Table 2.

Fatty acid composition of sow backfat samples was similar between treatments (Table 3), with the exception of a higher proportion of myristic acid in control sows. Because myristic acid was not present in the control diet, this would indicate net synthesis in adipose tissue of these sows. This hypothesis is further supported by the slight, but nonsignificant, increases in the proportions of palmitic and palmitoleic in backfat samples from these sows; these fatty acids are present in concentrations greater than would be predicted by diet composition. For sows fed tallow, myristic acid was present in adipose tissue in lower concentrations than in the diet.

Feed intake did not differ between dietary treatments (P > .10; Table 4). However, sows fed the high-fat diet consumed more metabolizable energy than did control sows on weeks two and three of lactation, as well as for the entire lactation. This result is supported by numerous studies have reported slight decreases in feed intake, but increases in energy intake during lactation by adding fat to the diet. No significant differences were observed in sow weight change, although overall control sows lost 9.5 pounds more than sows fed tallow.

No differences in litter weight were observed on days zero, 7 or 14. However, litters from sows fed tallow were heavier (P < .05) at day 21 than litters from control sows. A majority of previous studies where high-fat lactation diets have been fed have also reported heavier litter weights at weaning.

Pigs chosen for body composition analysis from sows fed 10% tallow were heavier than controls, both on a live weight (P < .10) and a carcass (P < .05) basis (Table 5). Composition of pigs from sows fed tallow differed from that of control pigs. Pigs from sows fed tallow were higher (P < .05) in dry matter percentage and lower (P < .05) in percentage water than control pigs (Table 5). This increase in the dry matter percentage was due to an increase (P < .05) in the percentage fat of these pigs. Percentage protein was lower in pigs from sows fed tallow, although the total pounds of protein did not differ between treatments (Table 6). Pounds of fat and dry matter in carcasses of pigs from sows fed tallow were increased (P < .05) in comparison to pigs from the control-fed sows.

Lactating sows fed diets high in tallow tended to have slightly reduced feed intakes and increased metabolizable energy intakes during lactation. This increase in energy intake resulted in an increase in the milk fat percentage in previous experiments and it has now been shown to affect carcass composition of the suckling pig. Pigs nursing sows fed tallow were heavier at 21 days than control pigs; however, most of the difference in weight was attributed to the increased fat in the carcass. Additional research is required to assess the effects of these compositional changes on subsequent performance of pigs from sows fed tallow during lactation.

[1]Scott L. Tilton and Paul M. Ermer are graduate students, Austin J. Lewis is a Professor and Phillip S. Miller is an Associate Professor, Department of Animal Science.