Growth and Feedlot Performance of Steer Calves Born From Beef Cows Supplemented with Linseed Meal During Late Gestation

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Abstract
This study examined the effects of supplementing beef cows with phytoestrogen rich linseed meal (LSM) during late gestation on steer calf growth performance and carcass characteristics. Multiparous cows (n = 72) were allotted randomly to one of 12 pens, with six pens supplemented with pelleted LSM and six pens fed a control sunflower meal (SFM) pellet. Diets were formulated to be isocaloric and isonitrogenous. Treatment supplements were included in a totally-mixed ration each day for the last 60 d of gestation. Steer calves (n = 41) were followed from birth to finishing. Birth weight, actual weaning weight, and ADG and carcass characteristics were recorded. Steer birth and weaning weight were not different between treatments ($P > 0.05$; 96.9 vs. 95.6 ± 2.50 lb.; 561.7 vs. 574.8 ± 9.13 lb., for LSM vs. SFM, respectively). Final live weight was significantly different due to cow gestational supplementation ($P = 0.04$; 1206.2 vs. 1286.3 ± 21.31 lbs., for LSM vs. SFM, respectively) Steer ADG overall was not different due to treatment ($P > 0.05$; 2.82 vs. 2.98 ± 0.18 lbs., for LSM vs. SFM, respectively). Carcass characteristic parameters were not different due to treatment. Supplementation of LSM during late gestation does not appear to negatively impact growth rate in calves.

Key words: phytoestrogen, linseed meal, cattle

Introduction
North Dakota is the national leader in flax production (USDA, NASS 2008). Linseed meal (LSM) is a byproduct of flax where the oil has been removed and is commonly used in livestock diets. Recent research has hypothesized that the maternal diet during gestation can have an effect on the lifetime productivity of the offspring. Flaxseed and LSM contain high levels of the plant phytoestrogens. Fetal exposure to phytoestrogen during gestation from that maternal diet may affect the offspring's development and lifetime productivity.
We hypothesized that 10 percent LSM supplementation of the maternal diet during late gestation would influence calf weight, lifetime gain performance and carcass characteristics.

Materials and Methods
Animals and Diets
This study was approved by the North Dakota State University Institutional Animal Care and Use Committee. At approximately 215 d of gestation, the Carrington Research Extension Center's multiparous, Red Angus x Simmental cows (n = 72) were randomly assigned to one of two treatments: 1) 10 percent LSM pelleted supplement or 2) a control supplement, sunflower meal (SFM). Pelleted supplements were offered (5 lbs. per hd/d) in a totally-mixed ration (Table 1) until parturition. Cows were assigned to treatments using cow weight as a blocking criterion. Additionally calf birth weight and previous calf birth weight were equalized between treatments as much as possible. Animals were allotted to 1 of 12 pens, with six pens supplemented with LSM and six pens fed the SFM pellet.

Cow-calf pair: Calf born from LSM-supplemented cow during the last 60 d of gestation.

Table 1. Gestational cow diet last 60 days until parturition[a].

Item		
Ingredient	LSM	SFM
	----------% DM----------	
LSM Pellet	9.7	-
SFM Pellet	-	9.7
Light Barley	27.6	27.6
Straw	32.8	32.8
Corn Silage	29.9	29.9

[a] Cow ration formulated by recommened requirements (NRC, 2000).

Diets were formulated to provide required nutrients for an approximately 1,475-pound, late-gestation, mature beef cow as suggested by the National Research Council (NRC, 2000).

Upon parturition, cows were comingled and cow-calf pairs managed similarly. Calves were weaned at an average age of 170 d.

Steer calves (n = 41) were followed from birth through finishing period to harvest. Birth weight, actual weaning weight, ADG, and carcass characteristics were recorded for steer calves. Steers were managed similarly and fed as suggested by the National Research Council (NRC, 2000) throughout the course of the study.

Table 2. Steer receiving and finishing period diets.[a]

Item Ingredient	Receiving	Finishing
	----------% DM ----------	
Rumensin	1.4	1.2
$CaCo_3$	0.56	0.5
Corn	29	34.7
Peas	8.9	11.8
Midds	18	-
MWDGS	16.9	12
Corn Silage	16.3	16.8
Clean Out Barley	-	14.6
Hay	8.9	-
Straw	-	8.3

[a] Steer rations formulated by recommened requirements (NRC, 2000).

Statistical analysis

Data were analyzed by least squares (Proc Mixed, V.9.1; SAS Inst. Inc., Cary, NC). Pen was the experimental unit for weaning weight, period weights, ADG and carcass characteristics. The statistical model included the fixed effects of gestational diet of the cow and cow weight block.

Results and Discussion

Growth performance

Steer birth weight and weaning weight (Table 3) were not affected by treatment ($P > 0.05$; 96.9 vs. 95.6 ± 2.5 lbs.; 561.7 vs. 574.8 ± 9.13 lbs., for LSM vs. SFM, respectively). Similarly, Stalker et al. (2006) found supplementation of 42 percent CP versus. no CP supplement prepartum in beef cows did not affect birth weight, but calves born from supplemented cows had greater weaning weights. Conversely, Larson et al. (2009) reported protein supplement offered to cows during late gestation resulted in increased birth weight compared to non-protein supplemented calves. Tou et al. (1998) reported lighter birth weights in rat offspring born from rat dams supplemented with 10 percent flaxseed.

Steer ADG was not different due to treatment (Table 3). Overall ADG ($P = 0.05$) was 2.82 pounds for steers born from supplemented LSM cows and 2.98 ± 0.18 for the SFM treatment.

Table 3. Steer perfomance born from cows supplemented with LSM or control diet during last 60 d of gestation.

Item	LSM	SFM	St. Error	*P*-value[a]
Birth Date, Julian	91.00	88.58	2.70	0.57
Birth Wt., lb.	96.91	95.58	2.51	0.73
Weaning Wt . Lb.	561.73	574.80	9.13	0.37
Wt. Period 1	617.13	630.36	9.05	0.36
Wt. Period 2	728.63	751.13	11.72	0.24
Wt. Period 3	847.32	877.02	14.09	0.20
Wt. Period 4	957.42	990.47	16.85	0.23
Wt. Period 5	1046.23	1087.68	20.08	0.21
Wt. Period 6	1121.53	1169.60	19.32	0.14
Wt. Period 7	1149.47	1234.05	28.52	0.09
Final Live Wt.	1206.17	1286.25	21.31	0.04
Initial ADG	1.98	1.98	0.098	0.9696
Mid ADG	2.62	2.70	0.109	0.6418
Final ADG	2.38	3.48	0.458	0.1543
Overall ADG	2.82	2.98	0.184	0.5438

[a] P-values < 0.05 are considered signicantly different.

Finished CREC steers born from cows supplemented during gestational period.

Carcass quality performance

Steers' hot carcass weight (HCW), backfat, ribeye area (REA) and final yield grade were not affected significantly by cow supplemented treatment during gestation (Table 4). However, dressing percentage was significantly affected (*P* = 0.02; 63.3% and 59.7% ± 0.008, for LSM vs. SFM, respectively). Marbling number approached significance (*P* = 0.09) indicating a trend that marbling score was affected by gestational treatment. Steers born from cows supplemented with SFM had greater marbling than those supplemented with LSM (459.5 vs. 507.39 ± 16.24, LSM vs. SFM, respectively).

Table 4 . Performance of steers born from cows supplemented with LSM or control diet during last 60 d of gestation.

Item	LSM	SFM	St Error	*P*-value[a]
Hot Carcass Wt. lb.	760.85	767.85	7.00	0.53
Marbling Score	459.50	507.39	16.24	0.09
Backfat, in.	0.39	0.41	0.05	0.77
REA, sq. in.	13.03	12.66	0.15	0.13
KPH, %	2.46	2.45	0.05	0.59
Final YG	2.31	2.57	0.16	0.34

[a] P-values < 0.05 are considered signicantly different.

Summary

Linseed meal can be fed to beef cattle during late gestation without any negative effects on calf birth date or birth weight, calf growth performance or carcass quality parameters. Even though final live weight was significantly different, this was contributed to the allotment of steers born from cows treated during gestation. Further beef cattle research on fetal programming during the fetal development stages and early postnatal growth should continue to determine the effects of the cow diet on calf lifetime performance.

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