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Effects of Maternal Late Gestation Nutrition on May-Born Steer Progeny

Alicia C. Lansford

Jacki A. Musgrave
University of Nebraska–Lincoln, jacki.musgrave@unl.edu

T. L. Meyer Meyer

Rick N. Funston
University of Nebraska–Lincoln, rick.funston@unl.edu

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Summary with Implications

May-calving dams were assigned to graze either sub-irrigated meadow or upland range with or without supplementation (1 lb/d 33% CP). Treatment began at approximately 160 d of gestation. Supplementation continued for 85 ± 2 d, while grazing system treatment continued for 116 ± 2 d. Steer progeny were backgrounded after weaning and then assigned to either a short or long yearling feedlot system. Dam supplementation tended to decrease marbling score within both feedlot systems. Short yearling steers had an increased percentage of carcasses grade USDA low Choice or greater if their dams grazed meadow in late gestation. Long yearling steers had increased carcass weight if their dams grazed meadow. Increased profitability of steer progeny carcasses may be realized if May-calving dams are allowed to graze meadow in late gestation.

Introduction

Current research suggests imbalances in maternal nutrition during gestation can affect progeny growth and performance long-term. Previous research (*2009 Nebraska Beef Cattle Report*, pp. 5–8) with March-born steer progeny born to late gestation protein-supplemented dams have increased weaning BW, hot carcass weight (HCW), and percentage of steers grading USDA Choice or greater. Late gestation for a March-herd occurs overwinter, when grasses are dormant and dietary CP is below dam requirements. Conversely, late gestation May-calving dams may experience excess dietary CP when grazing, due to early grass growth (*2019 Nebraska Beef Cattle Report*, pp. 9–11). These differences in forage ontogeny between the 2 calving systems may result in differences in available nutrients to the fetus and cause long-term implications for progeny. The objective of this study was to evaluate the effect of maternal grazing system with and without supplementation on May-born steer progeny assigned to 2 feedlot systems.

Procedure

Dam Management

A 6 yr study was conducted at the Gudmundsen Sandhills Laboratory (GSL), Whitman, to examine the effects of dam grazing system with and without supplementation on steer progeny. Dam management has been reported in detail (*2019 Nebraska Beef Cattle Report*, pp. 9–11). Dams were arranged in a 2 × 2 factorial on approximately d 160 of gestation. Dams grazed either upland range (R) or sub-irrigated meadow (M), and then received either no supplement (NS) or 1 lb/d (S) of a 33% CP (DM) dried distillers grains-based supplement. Grazing treatment continued for approximately 116 ± 2 d (mean ± SD) while supplementation treatment continued for approximately 85 ± 2 d (mean ± SD). Dams were managed as a single herd the remainder of the year.

Steer Progeny Management

Steers were vaccinated and castrated at 2 mo of age. At weaning in January, steers were assigned to 1 of 2 backgrounding treatments (*2019 Nebraska Beef Cattle Report*, pp. 32–35). In May, one-half of the steers from each backgrounding treatment were transported to the feedlot at the West Central Research and Extension Center (WCREC), North Platte, (short-yearling, n = 195) and implanted with Synovex Choice (Ft. Dodge Animal Health, Overland Park, KS). The steers remaining at GSL (long-yearling, n = 197) were implanted with Revalor G (Merck Animal Health, Summit, NJ) and grazed upland range for 90 d. Approximately Sept. 14, long-yearling steers were transported to the feedlot and implanted with Ralgro (Merck Animal Health). Upon feedlot entry, both groups of steers were limit fed 5 d at 2.0% of BW and weighed 3 consecutive d. Feedlot entry BW was the average of these 3 time points. Steers were transitioned over 21 d to a common diet containing 48% dry rolled corn, 40% wet corn gluten feed, 7% prairie hay, and 5% supplement (DM basis). The supplement included vitamins, minerals, monensin (1.3 g/lb; Rumensin, Elanco Animal Health, Indianapolis, IN), and tylosin (1.0 g/lb; Tylan 40, Elanco Animal Health). Steers were placed in a GrowSafe feeding system approximately 2 wk after feedlot entry. No intake data were recorded over the initial 2-wk adaptation period to the system. Recorded intakes from the GrowSafe system were used to calculate DMI and F:G. Approximately 110 d after feedlot entry for short-yearling steers and 70 d for long-yearlings steers, BW was measured and steers re-implanted with Synovex Plus (Ft. Dodge Animal Health). Steers were slaughtered 97 d after reimplant for short-yearlings steers and 95 d for long-yearlings steers. Hot carcass weight was recorded at slaughter and carcass data were collected following a 24-h carcass chill. Final BW was calculated by adjusting HCW to a common dressing percentage of 63%.

Statistical Analysis

All data were analyzed using the PROC GLIMMIX procedure of SAS (SAS Inst. Inc., Cary, NC, version 9.4). The model statement included the fixed effects of dam grazing treatment, supplementation treatment, and the resulting interaction. The experimental unit was considered as dam treatment × feedlot system × year, where dam treatment was either dam grazing system or supplement. Dam age and yr were included as a covariate in all analyses and were removed when $P > 0.05$. Significant

Table 1. Effect of late gestation nutrition[1] on May-born short-yearling steer[2] feedlot BW, ADG, DMI, performance, and carcass characteristics

	M		R			*P*–value[3]		
	NS	S	NS	S	SEM	Graze	Supp	G × S
n	35	27	25	34				
Feedlot entry BW, lb	593	569	580	573	6	0.76	0.17	0.45
Final live BW, lb[4]	1,424	1,413	1,376	1,411	11	0.26	0.61	0.31
ADG, lb	3.90	3.97	3.73	3.90	0.09	0.13	0.17	0.53
DMI, lb	26.7[a]	26.0[ab]	24.9[b]	26.2[ab]	0.4	0.08	0.41	0.05
DMI, % BW	2.6	2.7	2.6	2.6	0.04	0.28	0.26	0.63
F:G, lb:lb	6.7	6.7	6.7	6.7	0.4	0.71	0.45	0.39
Carcass								
HCW, lb	897	891	866	888	15	0.26	0.61	0.31
Marbling score[5]	483	445	443	430	15	0.04	0.06	0.37
12th rib fat, in	0.63	0.65	0.60	0.58	0.04	0.11	0.96	0.47
LMA[6], in²	14.8[x]	14.5[xy]	14.3[y]	14.9[x]	0.3	0.71	0.54	0.08
Yield grade	3.2	3.4	3.3	3.1	0.1	0.40	0.83	0.14
Choice⁻ or greater, %	93	75	69	68	9	0.03	0.13	0.15
Choice⁰ or greater, %	28	20	25	14	10	0.54	0.27	0.79

[a,b]Means within a row lacking a common superscript differ ($P \leq 0.05$).

[x,y]Means within a row lacking a common superscript tend to differ ($P \leq 0.10$).

[1]May-calving dams were arranged in a 2 × 2 factorial at weaning in January and were assigned to 1 of 2 grazing treatments: sub-irrigated meadow (M) or upland range (R) for 116 d and then to 1 of 2 supplementation treatments: 1 lb/d of 33% CP (DM) supplement (S) or no supplement (NS) for 85 d.

[2]Following backgrounding, short-yearling steers entered the feedlot immediately in May.

[3]Graze = grazing treatment, Supp = supplementation treatment, and G × S = grazing and supplement assignment interaction.

[4]Final BW calculated from HCW adjusted to a common dressing percent of 63%.

[5]300 = slight^{00}, 350 = slight^{50}, 400 = small^{00}, 450 = small^{50}, 500 = modest^{00}.

[6]LMA = *Longissimus* muscle area.

interactions were detected between feedlot system and dam grazing and supplement treatment, so data are presented by feedlot system. Data were considered significant at $P \leq 0.05$ and a tendency if $P \leq 0.10$ and $P > 0.05$.

Results

Short-Yearling Steer Progeny Feedlot Performance and Carcass Characteristics

Feedlot BW, ADG, performance, and carcass characteristics of short-yearling steers are presented in Table 1. Feedlot entry and final BW were similar ($P \geq 0.17$) between dam treatments. Correspondingly, ADG was not affected ($P \geq 0.13$) by treatment. There was a pasture × supplement interaction ($P = 0.05$) for DMI, with MNS consuming the greatest amount of feed, RS and MS intermediate, and RNS the least. Despite this, DMI expressed as a percentage of BW and F:G were similar ($P \geq 0.20$) among treatments.

In agreement with final BW, HCW at slaughter were similar ($P \geq 0.26$). Marbling scores were increased ($P = 0.04$) in steers whose dams grazed meadow (464 vs. 436 ± 10, M vs. R), while dam supplementation tended ($P = 0.06$) to decrease marbling scores (463 vs. 438 ± 10, NS vs. S). This contrasts with Stalker et al. (*2006 Nebraska Beef Cattle Report*, pp. 7–9), who observed March-born steers born to supplemented dams had increased marbling scores. Protein supplementation of a March-calving dam may have increased dietary CP and TDN to adequate levels, while protein supplementation of a May-calving dam may have resulted in an even greater excess dietary CP and TDN. Additionally, more ($P = 0.03$) steers graded Choice⁻ or greater if their dams grazed meadow in late gestation (85 vs. 69 ± 8%, M vs. R). Dam treatment did not affect ($P \geq 0.11$) percentage of steers grading Choice⁰ or greater or steer progeny 12th rib fat thickness. There was a tendency ($P = 0.08$) for a grazing × supplement interaction for *longissimus* muscle area (LMA), with RS and MNS steers having the greatest area, MS intermediate, and RNS least. Despite this tendency, yield grades were similar ($P \geq 0.14$).

Long-Yearling Steer Progeny Feedlot Performance and Carcass Characteristics

Feedlot phase BW, ADG, performance, and carcass characteristics for long-yearling steers are presented in Table 2. Similar to short-yearling steers, feedlot entry BW was not affected ($P \geq 0.16$) by dam treatment; however, final BW tended ($P = 0.10$) to be greater for steers born to dams grazing meadow in late gestation (1,517 vs. 1,475 lb ± 17, M vs. R). Despite this, no differences ($P \geq 0.26$) were detected in ADG. Feedlot DMI was increased ($P = 0.01$) if dams grazed meadow (29.4 vs. 28.0 ± 0.4 lb/d, M vs. R), but dam supplementation did not affect ($P = 0.95$) DMI. When DMI was expressed as a percentage of BW, there was a tendency ($P = 0.09$) for a pasture × supplement interaction where steers born to MS dams had the greatest DMI as % BW, MNS and RNS were intermediate, and RS

Table 2. Effect of late gestation nutrition[1] on May-born long-yearling steer[2] feedlot BW, ADG, DMI, performance, and carcass characteristics

	M		R			*P*–value[3]		
	NS	S	NS	S	SEM	Graze	Supp	G × S
n	35	37	26	33				
Feedlot entry BW, lb	802	796	774	807	7	0.56	0.30	0.16
Final live BW, lb[4]	1,536	1,495	1,461	1,490	13	0.10	0.82	0.18
ADG, lb	4.25	4.01	4.03	3.97		0.31	0.26	0.53
DMI, lb	29.5	29.3	27.8	27.8	0.7	0.01	0.95	0.93
DMI, % BW	2.5^{xy}	2.6^{x}	2.5^{xy}	2.4^{y}	0.04	0.05	0.78	0.09
F:G, lb:lb	6.7	7.1	7.1	7.1	0.2	0.91	0.57	0.17
Carcass								
HCW, lb	968	944	922	939	18	0.10	0.82	0.18
Marbling score[5]	502	496	509	463	17	0.39	0.09	0.18
12^{th} rib fat, in	0.64	0.61	0.64	0.64	0.04	0.76	0.77	0.64
LMA[6], in^2	15.1	14.6	14.8	14.8	0.3	0.64	0.18	0.60
Yield grade	3.4	3.4	3.3	3.5	0.2	0.88	0.56	0.63
$Choice^{-}$ or greater, %	91	82	81	78	5	0.12	0.16	0.44
$Choice^{0}$ or greater, %	40	48	48	26	11	0.48	0.44	0.14

^{x,y}Means within a row lacking a common superscript tend to differ ($P \leq 0.10$).

[1]May-calving dams were arranged in a 2 × 2 factorial at weaning in January and were assigned to 1 of 2 grazing treatments: sub-irrigated meadow (M) or upland range (R) for 116 d and then to 1 of 2 supplementation treatments: 1 lb/d of 33% CP (DM) supplement (S) or no supplement (NS) for 85 d.

[2] Following backgrounding, long yearling steers grazed upland range for 90 d before entering the feedlot in mid-September.

[3] Graze = grazing treatment, S = supplementation treatment, and G × S = grazing and supplement assignment interaction.

[4]Final BW calculated from HCW adjusted to a common dressing percent of 63%.

[5]300 = $slight^{00}$, 350 = $slight^{50}$, 400 = $small^{00}$, 450 = $small^{50}$, 500 = $modest^{00}$.

[6] LMA = *Longissimus* muscle area.

the least. Conversely, F:G was similar ($P \geq 0.17$) between treatments despite differences in DMI.

In agreement with final BW, HCW tended ($P = 0.10$) to be greater for steers born to dams grazing meadow (954 vs. 930 ± 11 kg, M vs. R). Similar to short-yearling steers, marbling score had a tendency ($P = 0.09$) to be decreased by dam supplementation (506 vs. 480 ± 11, S vs. NS), but no difference ($P = 0.39$) was detected due to dam grazing treatment. There were no differences ($P \geq 0.12$) in the percentage of steers grading $Choice^{-}$ or $Choice^{0}$ or greater. Neither 12^{th} rib fat thickness nor LMA were different ($P \geq 0.18$) between treatments. Yield grade was also similar ($P \geq 0.56$) between dam treatments.

Conclusions

Dry matter intake was increased for steer progeny in both feedlot systems if their dams grazed meadow in late gestation. Additionally, marbling score of steer progeny within both feedlot systems tended to be decreased if dams were supplemented. Steer progeny in a long-yearling feedlot system tended to have increased HCW if their dams grazed meadow in late gestation, while maternal meadow grazing resulted in an increased percentage of short-yearling steers grading USDA low Choice or greater. Differences in maternal nutrition resulted in differences in feedlot and carcass performance of steer progeny. Grazing May-calving dams on sub-irrigated meadow in late gestation may result in increased carcass value of steer progeny.

Alicia C. Lansford, graduate student

Jacki Musgrave, research technician

T.L. Meyer, research technician

Rick N. Funston, professor, West Central Research and Extension Center, North Platte, NE