Effect of rumen-protected methionine on beef cow-calf pairs performance during pre-and post-calving

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Methionine is one of the first limiting amino acids in cattle [1]. A limiting amino acid is the one that is found in shortest supply in relation to the nutritional requirements needed by the animal. By being one of the first limiting amino acids, methionine is supplemented because of its relatively short supply in the diet of the animal [1]. In all ruminant species, nutrients provided by the diet are utilized by the microorganisms present in the rumen. The product of the fermentation of those nutrients by the microorganisms reaches the small intestine, where it can be absorbed and used by the ruminant. By using a rumen-protected methionine (RPM), the cow has more available methionine reaching the small intestine, which will enhance the animal's performance for milk production and fetal development. Supplementing RPM in dairy cows has yielded an increase in animal performance [2], milk-fat percentage [3] and immune-metabolic status during the peri-partal period [4]. By implementing the same technique in beef cattle, we hypothesize that RPM supplemented beef calves borne from cows supplemented with RPM during the last 90 days of gestation will have increased muscle growth and daily body weight gain. If this hypothesis is supported, cattle farmers may be able to increase their calves' ability to gain weight without using artificial growth factors, such as hormones, while still increasing profits. Furthermore, improving animal performance will lead to more animals to be used for beef production and thus benefit society.

The specific purpose of the research project is to evaluate the effect of RPM during late gestation in the performance of cows in winter and fall calving seasons and determine how this maternal supplementation of RPM affects the offspring's growth before weaning (through the cow's milk) and after weaning by RPM supplementation to the offspring for 100 days. For this study, 22 cows were used for both the winter and fall calving season. From these two groups, 11 cows received RPM for 90 days before calving and the other 11 cows were used as a control.

During the testing and observation of the calves and cows at birth, the RPM calves weighed heavier by a difference of ~11 lbs. more than the control calves ($P = 0.02$) (Table 1). Furthermore, the calves given the RPM supplementation had an increased average daily gain (ADG) over the control group between birth until weaning ($P = 0.03$) (Table 1). Although calf body weight and average daily gain did not have a significant treatment × time interaction, they did demonstrate a time effect (Figure 1). The RPM group only had a significant increase in the ADG over the control between birth and weaning and between 25 and 50 days after weaning. However, the RPM group was steady compared to the extreme fluctuations of the control group. The heifers, first time mothers, used in the project were in two groups with an exact average body weight, 997 lbs, to be used as a baseline (Table 1 Cow BWO). This baseline allowed us to see if the mothers were able to maintain a healthy weight after giving birth and lactating. At the end of the calving season, there were 47 lb. difference between the RPM heifers and the control group, favoring the RPM (Table 1).

The RPM calves had a significant increase in ADG and body weight while still being with their dams or immediately after weaning than when being directly supplemented with RPM in their diet (Table 1). These results suggest that the calves responded more effectively through milk rather than direct RPM supplementation, supporting our hypothesis that RPM cows have greater milk production compared to control cows. Since the RPM supplementation while in the womb increased the weight of the calf at birth, producing calving difficulties (Table 1), we suggest that RPM should not be administered to beef heifers. In conclusion, RPM supplementation improves calves' performance before weaning, probably due to a greater milk yield in RPM supplemented cows.

Table 1. Cow-calf pairs performance data.

Cow#	Treatment	Pelvic_Area	Days_on_RPM	Calf_sex	Calf#	CowBW0	CowBW1	BW0	BW1	ADG (0-1)	BW25	ADG(1-25)	BW50	ADG (25-50)	BW80	ADG (50-80)	Notes
1531	CON	320	106	M	8076	1025	952	65	191	1.48	239	1.85	276	1.61	336	2.31	
6078	CON	320	125	M	8032	985	856	68	218	1.45	274	2.15	303	1.26	326	0.88	
6098	CON		171	M	8111	1085											Cow died after giving birth
6113	CON		158	M	8105	1100											Sick calf-Died
6122	CON	288	123	M	8026	875	904	60	176.5	0.94	226	1.90	255	1.26	303	1.85	
6131	CON	302	131	M	8052	1050	930	70	154.5	0.86	202	1.83	223	0.91	266	1.65	
6142	CON	280	155	F	8101	995	984										Female
6159	CON	276	131	M	8053	940	859	70	181	1.18	220	1.50	247	1.17	293	1.77	
6164	CON	300	126	M	8036	1000	886	75	181	1.06	229	1.85	246	0.74	301	2.12	
6166	CON	278	151	M	8098	900	910	90	152.5	1.42	196	1.67	209	0.57	258	1.88	
15108	CON	323	136	M	8074	1010	948	65	157.5	1.02	202	1.71	238	1.57	281	1.65	
1525	RPM		114	M	8007	1055											No C-section - Stillborn
1596	RPM	320	117	M	8011	985	984	80	227	1.34	273	1.77	282	0.39	357	2.88	
6034	RPM	310	153	M	8100	1185	1220	75	195.5	2.20	216	0.79	262	2.00	269	0.27	
6075	RPM	310	119	M	8016	1060	984	90	249	1.62	316	2.58	331	0.65	386	2.12	
6082	RPM	283	127	M	8041	980	890	85	204	1.34	262	2.23	306	1.91	359	2.04	
6089	RPM	280	169	M	8109	910	886	80	138.5	2.08	171	1.25	200	1.26	234	1.31	
6105	RPM	320	156	M	8104	980	946	80	159	1.74	180	0.81	220	1.74	267	1.81	
6106	RPM	300	120	M	8017	950	862	85	250	1.66	299	1.88	350	2.22	397	1.81	
6110	RPM		141	M	8086	920											C-section - Stillborn
6126	RPM	285	131	M	8051	960	920	65	168.5	1.03	206	1.44	264	2.52	319	2.12	
6153	RPM	255	127	M	8042	980	956	89	189.5	1.18	241	1.98	274	1.43	290	0.62	C-section - Alive
AVG	**CON**	**298**	**138**			**997**	**914**	**70**	**177**	**1.18**	**224**	**1.81**	**250**	**1.14**	**296**	**1.76**	
	RPM	**296**	**134**			**997**	**961**	**81**	**198**	**1.58**	**240**	**1.64**	**277**	**1.57**	**320**	**1.66**	
P value		**0.79**	**0.66**			**1.00**	**0.24**	**0.02**	**0.19**	**0.03**	**0.41**	**0.46**	**0.19**	**0.14**	**0.30**	**0.75**	

Abbreviations: Cow# =Cow ID number; Treatments: control (CON) and rumen-protected methionine (RPM); Calf# =calf ID number; Calf sex: male (M), female (F); CowBW0=cow body weight in pounds at first day of study; CowBW1=cow body weight in pounds at right after calving season finished; BW0=calf body weight in pounds at birth; BW1=calf body weight in pounds at weaning; ADG(0-1)=average daily gain between birth and weaning; BW-25=calf body weight at 25 days after weaning; ADG(1-25) average daily gain between weaning and 25 days; BW(50)=calf body weight at 50 days after weaning; ADG(25-50)=average daily gain between 25 and 50 days; BW80=calf body weight at 80 days after weaning; ADG(50-80)=average daily gain between 50 and 80 days. Notes: reason for removing cow from study. Statistical significant differences where declared at $P < 0.05$.

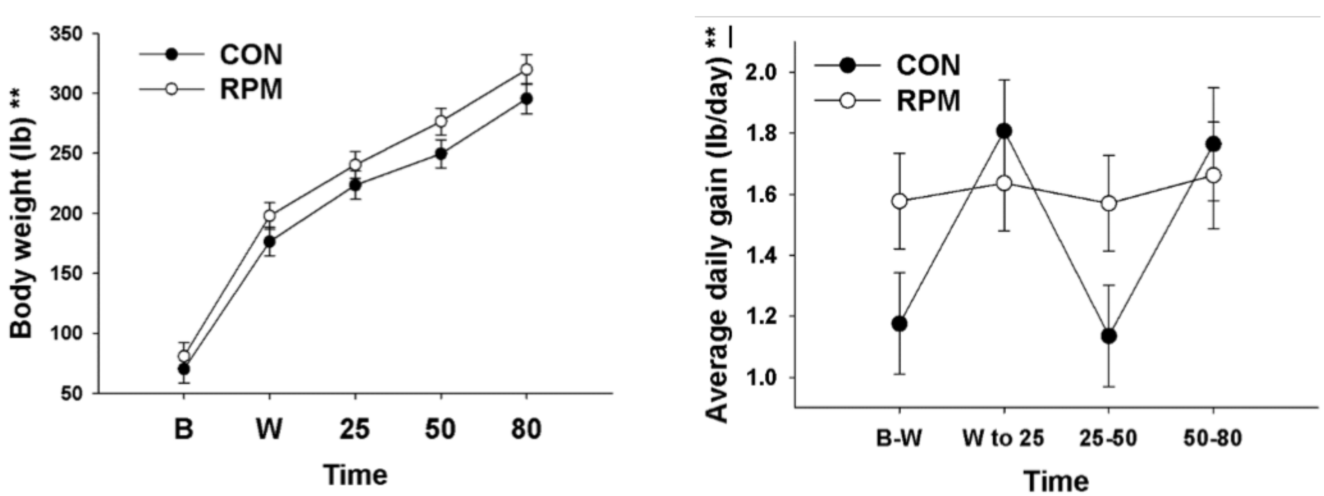

Figure 1. Body weight and average daily gain of beef offspring that received (RPM) and control calves (CON). B = Birthday, W= weaning, 25 = 25 days after weaning, 50 = 50 days after weaning, 80 = 80 days after weaning. B–W = Birthday to weaning, W to 25 = from weaning to 25 days after weaning, 25-50 = from 25 to 50 days after weaning, 50-80 = from 50 to 80 days after weaning. Statistical significant differences were declared at $P < 0.05$ and tendencies at $P > 0.05$ and < 0.1.

Statement of Research Advisor:

Betsy's work documents some of the first data published regarding the use of rumen-protected methionine during late gestation and in postnatal life in beef cattle. Her work is part of an ongoing study. During her summer internship, Betsy learned a muscle biopsy technique on Longissimus dorsi muscle of beef calves, how to extract blood samples from the jugulars vein and how to weight animals without the use of a squeeze chute. Through Betsy's research, she gained experience handling beef cattle that will be advantageous in her future career as a veterinarian.

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