

Beef Research Summary 2019
Gudmundsen Sandhills Laboratory
Whitman, Nebraska



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Beef

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The effect of dam age on heifer progeny performance and longevity

Authors: Joslyn K. Beard, Jacki A. Musgrave, Kathy J. Hanford, Rick N. Funston, and J. Travis Mulliniks

Funding:

Objective: Evaluate the impact of dam age on heifer progeny performance and herd longevity

Results: Heifer calves born to young cows had lighter ($P \leq 0.01$) body weight (BW) at birth and adjusted 205-d BW than heifers from moderate and old cows. Heifer pre-breeding BW and pregnancy determination BW were not influenced ($P \geq 0.17$) by dam age. However, heifers from moderate and old cows had a greater ($P < 0.01$) percentage reach puberty prior to the start of breeding compared with heifers born to young cows. However, there were no differences ($P = 0.28$) in percentage of heifers who calved within the first 21 d of calving in the subsequent calving season and dam age did not influence ($P = 0.15$) heifer pregnancy rates. Average number of calf crops from heifer progeny was different among all dam age groups ($P < 0.01$), with young dams having more calves (3.1 ± 0.7) than moderate (2.8 ± 0.7) and old (2.2 ± 0.8).

Table 1. Effect of dam age on heifer progeny growth performance

Items	Dam Age ¹			SE ²	P-Value
	Young	Moderate	Old		
Heifer BW, kg					
Birth	32 ^a	34 ^b	33 ^b	0.4	< 0.01
205 d	198 ^a	206 ^b	205 ^b	3	0.01
Prebreeding	277	283	281	4	0.21
Pregnancy diagnosis	371	371	366	4	0.17

^{a,b}Means with different superscripts differ $P \leq 0.05$.

¹Dam age = dam age at time of calving, Young (2 to 3 yr of age), Moderate (4 to 6 yr of age), Old (≥ 7 yr of age)

²SE is the SE of the difference between LSMeans.

Table 2. Effect of dam age on heifer progeny reproductive performance

Items	Dam Age ¹			SE ²	P-Value
	Young	Moderate	Old		
Puberty, %	51.55 ^a	69.64 ^b	74.06 ^b	9.7	< 0.01
Pregnancy, %	80.44	84.08	85.89	2.5	0.15
Calved in first 21 d, %	73.34	77.88	78.94	3.0	0.28
Calf Crop ³ , n	3.1	2.8	2.2	0.7	< 0.01

^{a,b}Means with different superscripts differ $P \leq 0.05$.

¹Dam age = dam age at time of calving, Young (2 to 3 yr of age), Moderate (4 to 6 yr of age), Old (≥ 7 yr of age).

²SE is the SE of the LSMeans.

³Number of calf crops produced with dam age groups.

The Effect of Cow Udder Score on Cow/Calf Performance in the Nebraska Sandhills (TAS)

Authors: **Joslyn K. Beard**, Jacki A. Musgrave, Rick N. Funston, and J. Travis Mulliniks **Funding:**

Objective: Evaluate the effect of beef cow udder score on cow performance and pre- and post-weaning progeny performance.

Results: Cow BW at prebreeding and weaning was greater ($P < 0.01$) in BU cows compared with GU counterparts. Calf BW at birth ($P = 0.95$), weaning ($P = 0.40$), and adjusted 205-d BW ($P = 0.28$) were not different between udder groups. Cow udder score did not influence feedlot entry ($P = 0.41$) and final BW ($P = 0.30$), DMI ($P = 0.53$), ADG ($P = 0.60$), and G:F ($P = 0.85$) of steer progeny. However, steers from GU dams had greater HCW ($P = 0.04$) and backfat ($P = 0.02$) compared with BU counterparts.

Table 1. Effect of cow udder score on cow performance

Item	Treatments ¹		SEM	P - value
	BU	GU		
Pre-breeding				
BW (kg)	450	428	4.9	<0.0001
BCS	5.3	5.2	0.04	0.01
Weaning				
BW (kg)	458	441	5	< 0.0001
BCS	5.1	5.4	1.2	0.75
Pregnancy rates, %	83.2	86.9	0.04	0.35

¹Treatments are BU (udder score of 1 or 2) and GU (udder score of 3 or 4)

Table 2. Effect of cow udder score on calf growth to weaning

Item	Treatments ¹		SEM	P - value
	BU	GU		
Birth BW (kg)	32	32	0.5	0.95
Weaning BW(kg)	204	202	3	0.40
Adj. 205 d BW(kg)	154	156	3	0.28

¹Treatments are BU (udder score of 1 or 2) and GU (udder score of 3 or 4).

Table 3. Effect of cow udder score on steer progeny feedlot performance

Item	Treatments ¹		SEM	P - value
	BU	GU		
Entry BW (kg)	269	276	8	0.41
Final BW(kg)	617	628	10	0.30
DMI (kg)	12.5	12.3	0.25	0.53
ADG (kg)	1.67	1.70	0.03	0.60
G:F (kg/kg)	0.14	0.14	0.003	0.85

¹Treatments are BU (udder score of 1 or 2) and GU (udder score of 3 or 4).

Table 4. Effect of cow udder score on steer progeny carcass traits

Item	Treatments ¹		SEM	<i>P</i> -value
	BU	GU		
HCW (kg)	375	389	7	0.04
Yield grade	2.3	2.7	0.20	0.10
LM area (cm ²)	89.7	90.9	1.87	0.63
Marbling score	454.5	461.2	23.2	0.85
Backfat (cm)	1.27	1.45	0.08	0.02

¹Treatments are BU (udder score of 1 or 2) and GU (udder score of 3 or 4).

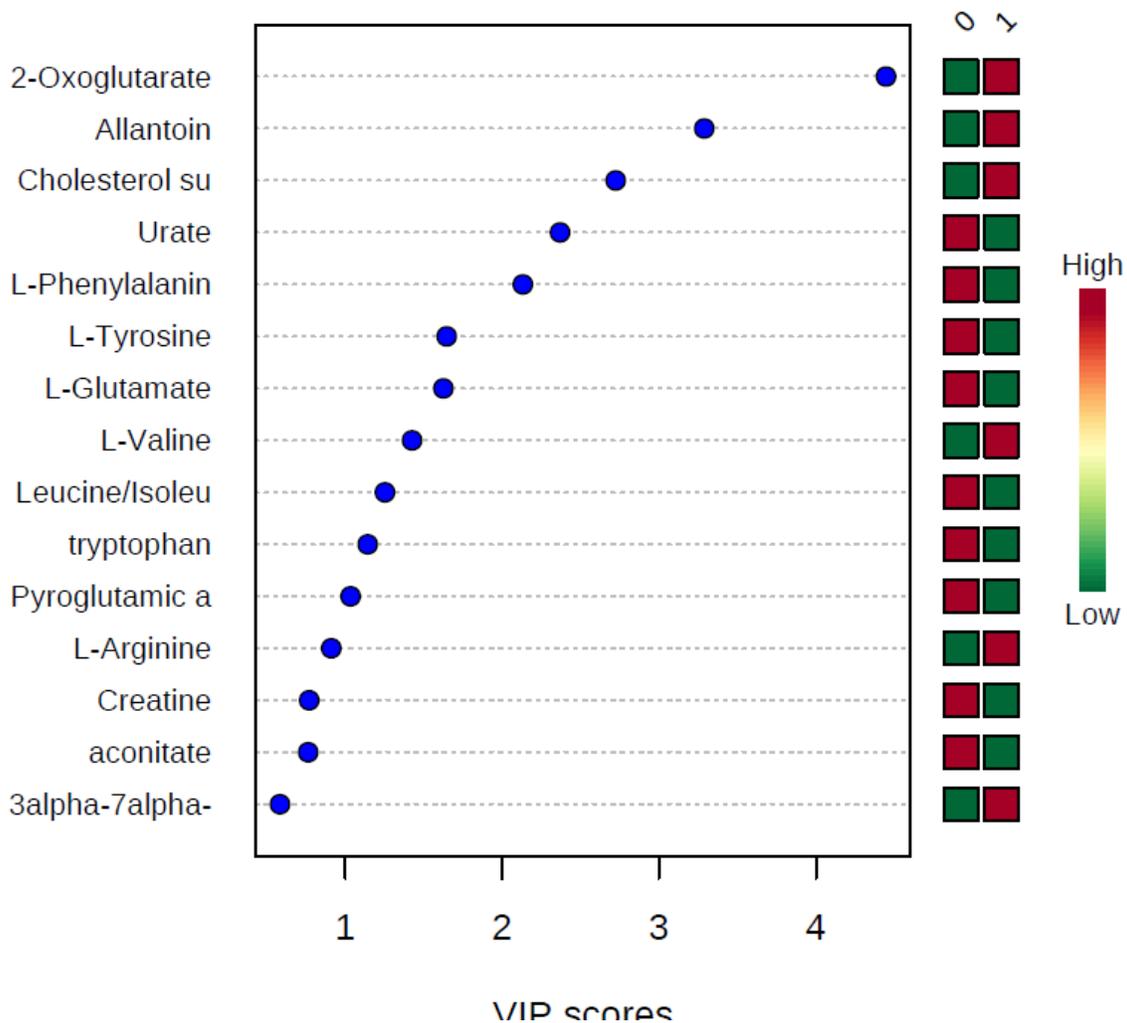
Metabolomic profile associated with pre-breeding puberty status in range beef heifers

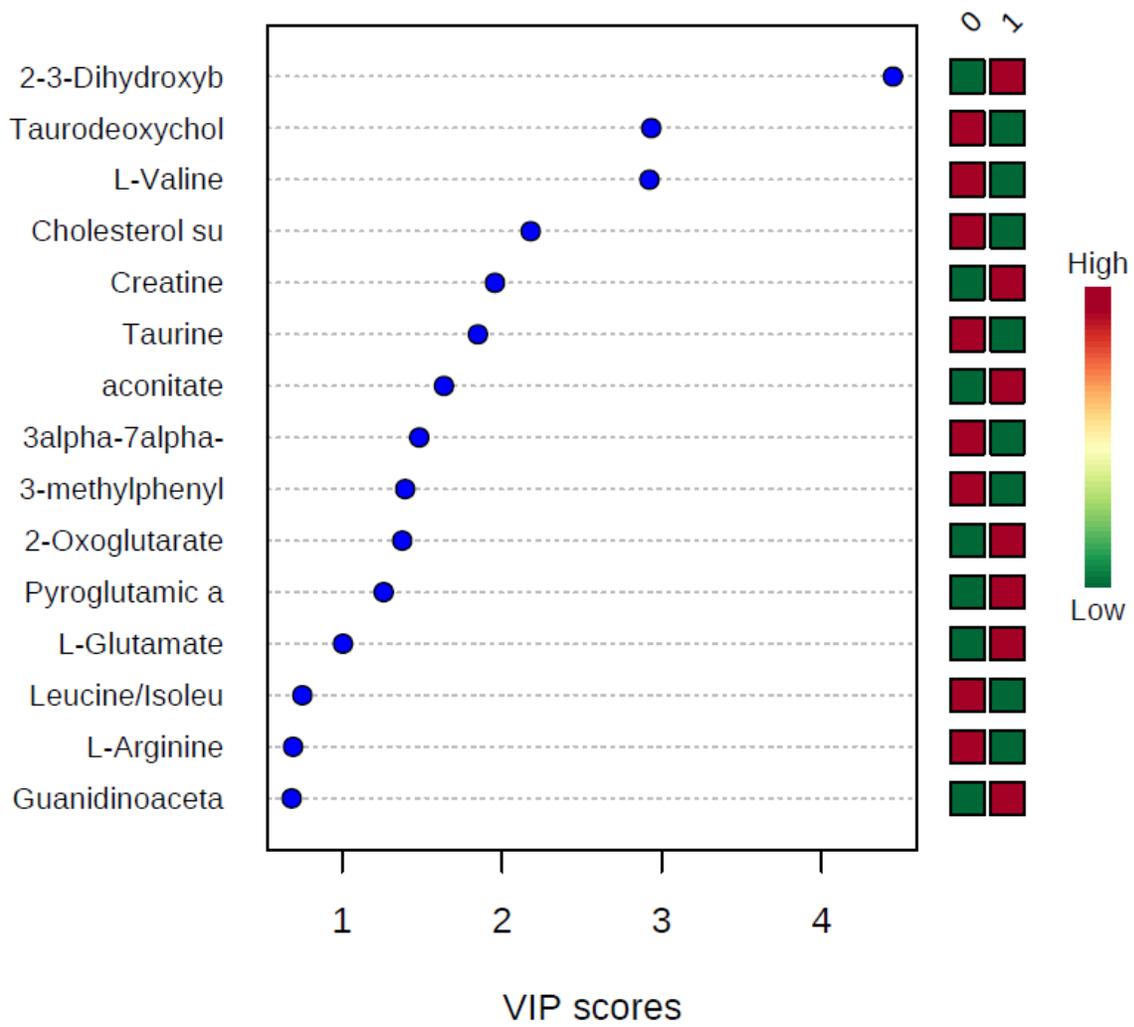
Authors: **Joslyn K. Beard**, Waseem Abbas, Jacki A. Musgrave, Rick N. Funston, Samodha C. Fernando, and J. Travis Mulliniks

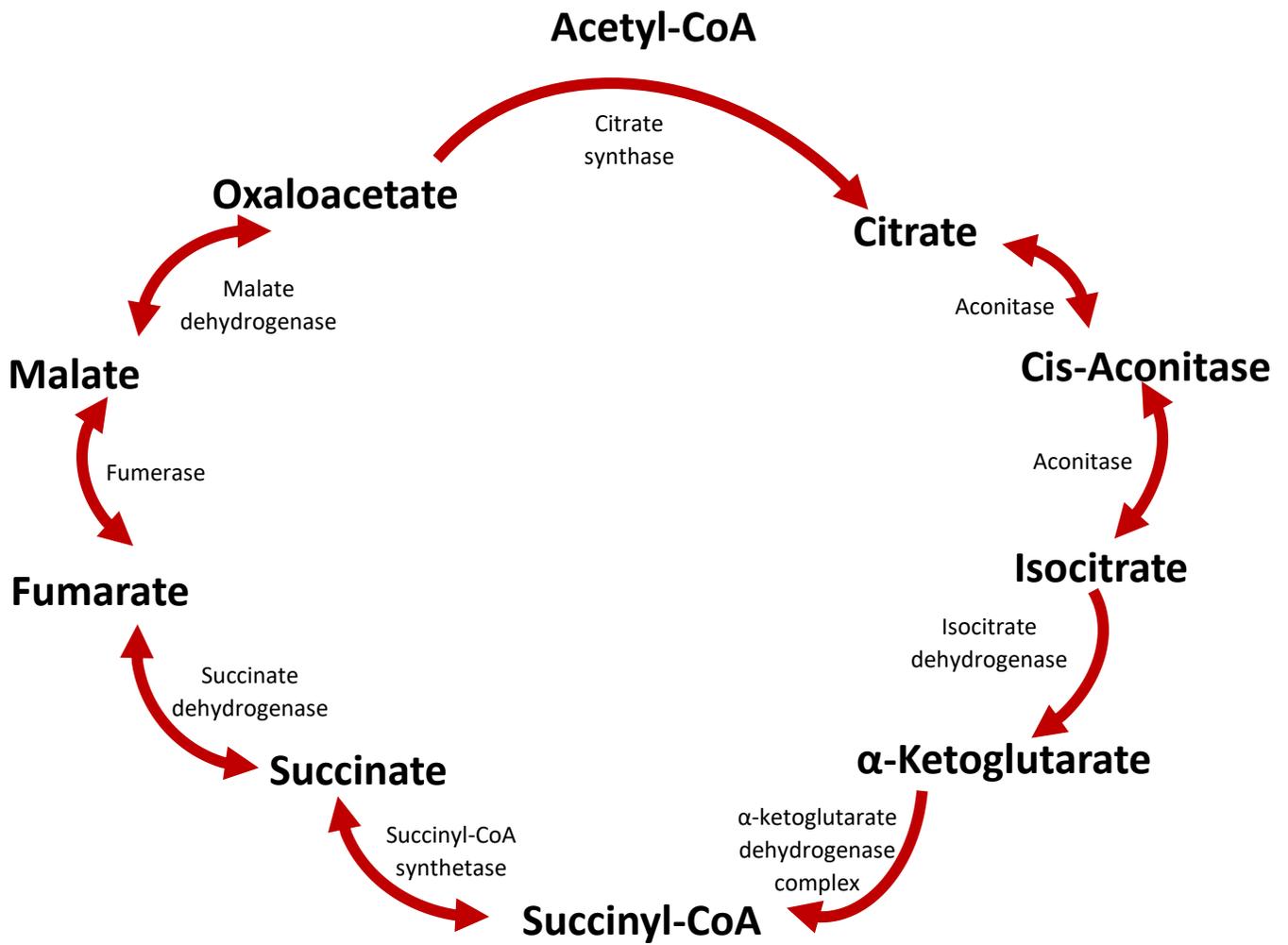
Funding:

Objective: Determine differences in serum metabolites using a metabolomics approach in pubertal and non-pubertal range beef heifers in March- and May-calving herds.

Results: Metabolite data were normalized by using proportions and analyzed by partial least square discriminant analysis (PLS-DA), principal component analysis and support vector machine using the MetaboAnalyst. The PLS-DA model identified metabolites related to branched chain-amino acids metabolism, lipid metabolism, carbohydrate metabolism, and steroidogenic biosynthesis to be different in pubertal and non-pubertal heifers.







Effect of Rumen Undegradable Protein and Glucogenic Precursor Supplementation on Postpartum Cow Performance

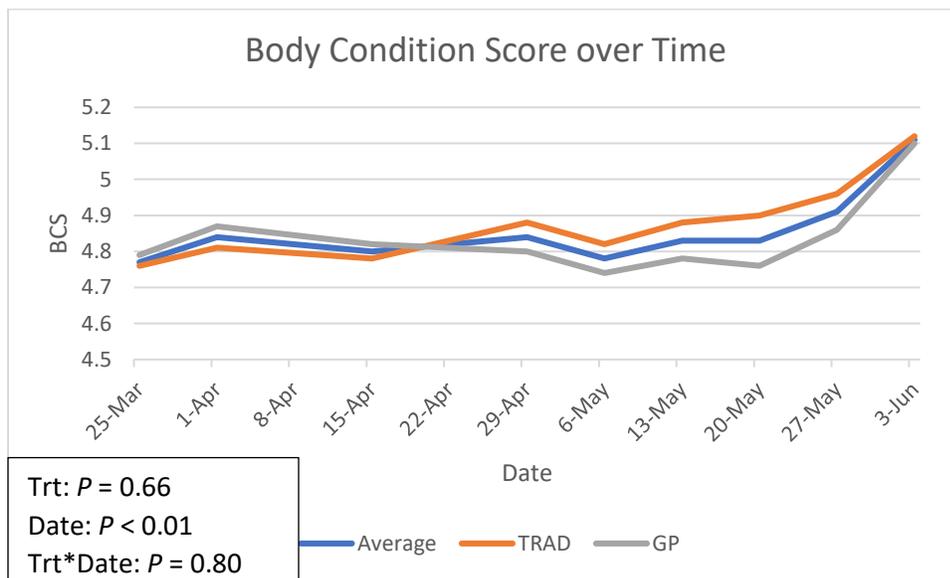
Tasha King, Joslyn Beard, Jacki Musgrave, and Travis Mulliniks

Hypothesis: Providing a glucogenic precursor supplement postpartum will improve reproductive performance in young cows on a forage-based diet.

Treatments: Cows were stratified by initial BW and randomly assigned to a supplementation treatment upon calving. Supplementation was provided at a rate of 2 lbs/hd/d with supplementation treatments being: a) traditional distillers grains cake (TRAD) and b) distillers grain cake with calcium propionate (GP). Cows were weighed and received a body condition score (BCS) weekly.

Results: No difference in BW was observed throughout the supplementation period or between treatments ($P > 0.05$). Body condition score was not affected by treatment ($P = 0.66$) or treatment by week ($P = 0.80$). Throughout the supplementation period, an effect of week on BCS was observed ($P < 0.01$), with cows starting supplementation at a BCS of 4.8 and ending with an average BCS of 5.1. No difference in 60-d milk yield was observed ($P = 0.68$). At weaning, no difference in cow BW was observed ($P = 0.39$), however there was a tendency ($P = 0.10$) for the TRAD to have a greater BCS than the GP cows. Pregnancy rate was not affected by treatment ($P = 0.75$). Calves were weaned at an average weight of 452 lbs and did not differ between treatments ($P = 0.84$).

Further Analysis: Blood samples were also taken weekly starting 45-d postpartum to measure glucose, insulin, and β -hydroxybutyrate concentration. Liver biopsies were conducted and glucogenic enzyme concentration will be analyzed. An acetate tolerance test was conducted allowing for determination of acetate utilization.



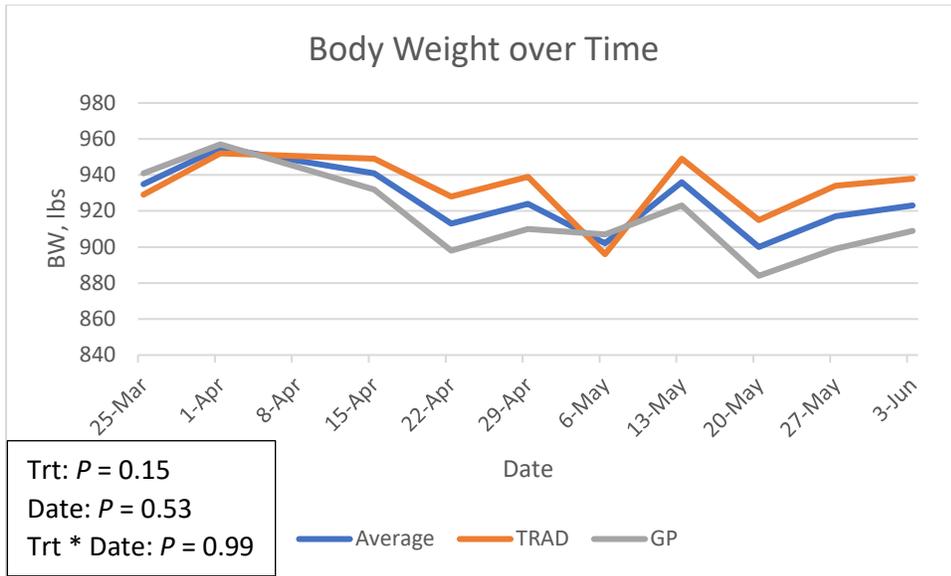


Table 1. Cow and calf performance at weaning.

	TRAD	GP	SEM	<i>P</i> -value
Cow Wt, lbs	974	943	25.4	0.39
Cow BCS	5.12	4.93	0.08	0.10
Pregnancy Rate, %	76	72	0.09	0.75
Calf Wt, lbs	451	454	9.94	0.84

Effect of supplemental rumen undegradable protein and glucogenic precursors on digestibility and energy metabolism in sheep

Tasha King, Joslyn Beard, Mitch Norman, Hannah Wilson, Jim MacDonald, and Travis Mulliniks

Objective: To determine the effect of supplemental glucogenic potential (GP) on forage digestibility, serum metabolites, and energy utilization of a forage diet.

Treatments: Supplements were designed to supplement increasing amount of GP: (1) no supplementation (CON; 0 g), (2) 40 g of calcium propionate (CAP; 30 g of GP), (3) 70 g of blood meal + 100 g of feather meal (BF; 40 g of GP), or (4) combination of CAP and BF (COMBO; 70 g of GP). Four periods were utilized to allow each lamb to receive each treatment once.

Results: Wethers on BF and COMBO supplementation had greatest DM and OM total tract digestibility ($P \leq 0.01$). Supplementation did not affect ($P = 0.93$) NDF digestibility. Serum glucose concentrations were not affected ($P = 0.98$) by supplementation. However, SUN concentrations were increased ($P < 0.01$) for BF and COMBO compared to CAP and CON. Acetate half-life did not differ ($P = 0.39$) due to supplementation. Area under the curve (AUC) for acetate was affected ($P = 0.04$) by supplemental treatments. No supplementation had a greater ($P \leq 0.04$) acetate AUC than BF and COMBO and tended ($P = 0.08$) to be greater than wethers receiving CAP. Glucose AUC were not affected ($P = 0.80$) by supplementation. These results suggest that RUP supplementation will improve digestibility and nutrient utilization in wethers consuming forage-based diets. Supplementation of a glucogenic precursor in the form of a propionate salt without additional RUP supplement had no effect on forage digestibility and a tended to have a decreased acetate AUC. These results suggest that for an improvement in energy efficiency protein requirements must be met.

Further Analysis:—Completion of analysis will look at digestible energy, ruminal ammonia and VFA concentrations, insulin and amino acid concentrations, and overall glucogenic enzyme concentration in the liver.

Table 1. Total tract digestibilities for wethers supplemented with glucogenic precursors fed a forage-based diet.

	Supplementation Treatment				SEM	P-value
	CON ¹	CAP ²	BF ³	COMBO ⁴		
DM						
Total intake ⁵ , kg	5.17 ^d	5.26 ^c	5.82 ^b	6.07 ^a	0.11	< 0.01
Digestibility, %	37.4 ^b	36.6 ^b	43.0 ^a	42.9 ^a	0.98	< 0.01
OM						
Total intake, kg	4.73 ^d	4.84 ^c	5.55 ^b	5.66 ^a	0.10	< 0.01
Digestibility, %	42.6 ^b	43.6 ^b	49.8 ^a	49.8 ^a	1.11	< 0.01
NDFD_{om}⁶						
Total intake, kg	3.50	3.50	3.49	3.49	0.08	0.98
Digestibility, %	44.8	45.2	45.8	45.3	1.28	0.93
ADF						
Total intake, kg	2.32 ^b	2.31 ^b	2.47 ^a	2.48 ^a	0.07	< 0.01
Digestibility, %	35.6 ^{bc}	35.4 ^c	39.2 ^a	38.5 ^{ab}	1.31	0.03

^{a-d}Means within a row with different superscripts differ ($P < 0.05$).

¹CON: No supplementation.

²CAP: Supplementation of 40 g of NutroCal (Kemin Industries Inc., Des Moines, IA).

³BF: Supplementation of 70 g of blood meal + 100 g of feather meal.

⁴COMBO: Supplementation of 40 g of calcium propionate + 70 g of blood meal + 100 g of feather meal.

⁵Total intake = basal diet + supplementation.

⁶NDF_{om} = ash-free NDF.

Table 2. Effect of supplement on acetate tolerance test for wethers consuming a forage- based diet supplemented with glucogenic precursors.

Acetate tolerance test response	Supplementation Treatment				SEM	P-value
	CON ¹	CAP ²	BF ³	COMBO ⁴		
Acetate half-life, min	39	33	26	31	6	0.39
Acetate AUC ⁵	298 ^a	242 ^{ab}	205 ^b	228 ^b	24.3	0.04
Glucose AUC	310	310	326	316	15.7	0.80

^{a,b}Means with differing superscripts are different ($P < 0.05$).

¹CON: No supplementation.

²CAP: Supplementation of 40 g of NutroCal (Kemin Industries Inc., Des Moines, IA).

³BF: Supplementation of 70 g of blood meal + 100 g of feather meal.

⁴COMBO: Supplementation of 40 g of calcium propionate + 70 g of blood meal + 100 g of feather meal.

⁵AUC: area under curve

Table 3. Impact of glucogenic precursor supplementation on serum metabolites of wethers fed a forage-based diet.

Measurements	Supplementation Treatment				SEM	<i>P</i> -values		
	CON ¹	CAP ²	BF ³	COMBO ⁴		Trt	Time	Trt x Time
Jugular Glucose mg/dL	55.4	54.1	55.8	55.8	1.93	0.87	< 0.01	0.57
Saphenous Glucose mg/dL	56.7	54.8	55.5	58.0	1.84	0.47	< 0.01	0.16
Jugular SUN ⁵ , mg/dL	11.3 ^b	10.6 ^b	25.9 ^a	25.5 ^a	1.12	< 0.01	< 0.01	0.23
Saphenous SUN, mg, dL	11.6 ^b	11.2 ^b	25.7 ^a	25.2 ^a	1.09	< 0.01	< 0.01	0.13

^{a,b}Means with differing superscripts are different ($P < 0.05$).

¹CON: No supplementation.

²CAP: Supplementation of 40 g of NutroCal (Kemin Industries Inc., Des Moines, IA).

³BF: Supplementation of 70 g of blood meal + 100 g of feather meal.

⁴COMBO: Supplementation of 40 g of calcium propionate + 70 g of blood meal + 100 g of feather meal.

⁵SUN = serum urea N.

The Influence of Cow Body Weight on Steer Progeny Performance

Author: Robert L. Ziegler, UNL Graduate Student and Travis Mulliniks, Range Nutritionist

Objectives: This study was focused on evaluating the influence of cow body weight on steer progeny performance from birth to harvest. Cow-calf records collected at the Gudmundsen Sandhills Laboratory from 2005 to 2017 were analyzed. Only mature cows (5 years old or older) were evaluated. Cow body weight was collected at weaning and was adjusted to a common body condition score 5. Table 1 highlights the difference in cow body weights analyzed.

Table 1: Summary of Age and Cows Adjusted Body Weight at Weaning

Number of Cows	Average Age	Average Weight	Max Weight	Min Weight	Range
864	6.45	1104	1422	787	635

Results: The influence of cow body weight on steer progeny performance is reported in table 2 below. Steer body weight from birth to harvest showed a significant positive correlation as cow body weight increased, but no influence on steer carcass performance was observed. One hundred pound increase in cow body weight increased steer birth weight by 2.5 pounds, weaning weight by 4.96 pounds, 205-d weight by 8.98 pounds, and average daily gain by 0.46 pounds. Similarly, increasing cow body weight by 100 pounds resulted in an additional 7.20 pounds when the steers entered the feedlot, 10.5 pounds at reimplant, 10.3 pounds final live weight, and 6.48 pounds of hot carcass weight. In contrast to steer body weight, cow body weight did not affect steer carcass performance including marbling, backfat, yield grade or rib eye area.

Table 2: Coefficients used for estimating the influence of cow body weight on steer progeny performance

Dependent variable	Estimate ¹	SE	P - value
Birth Weight	2.50	0.34	<0.01
Weaning Weight	4.96	1.62	0.01
Adjusted 205 d weight	8.98	1.64	<0.01
Pre-weaning ADG ²	0.46	0.008	<0.01
Entry body weight ³	7.20	3.12	0.04
Reimplant body weight ⁴	10.5	3.51	<0.01
Final body weight ⁵	10.3	3.61	0.01
Hot Carcass Weight	6.48	2.28	0.01
Marbling	0.14	0.07	0.07
Backfat, in	-	-	0.97
Yield Grade	0.04	0.05	0.47
Rib eye area, in sq	0.01	0.09	0.90

¹ Estimate = regression coefficient used to evaluate increasing cow body weight 100 pounds on steer progeny

² ADG= average daily gain

³ Entry body weight = steer body weight at feedlot entry

⁴ Reimplant body weight = steer body weight taken approximately 100 days prior to harvest

⁵ Final body weight = calculated using a common dressing percentage of 63%

Future Work: The influence of cow body weight on her reproductive performance, and her daughters' reproductive performance will be evaluated.