AGRICULTURAL RESEARCH FOUNDATION
INTERIM REPORT
FUNDING CYCLE 2017 – 2019

TITLE: Feeding essential fatty acids to late-gestating cows to optimize performance and health responses of the offspring

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SUMMARY: Nutritional management of beef cows during late-gestation has direct implications on performance of the *in utero* offspring (Marques et al., 2016A – funded by the Oregon Beef Council). More specifically, maternal nutrition is a major extrinsic factor programming nutrient partitioning and consequent development/function of fetal organ systems associated with health, production, and reproduction. However, all of the research conducted to date evaluating this subject focused on energy and protein nutrition, and little is known about the potential impacts of supplementing essential fatty acids to gestating cows on offspring development and performance. Our research group recently demonstrated that supplementing beef cows during the last trimester of gestation with rumen-protected sources of omega-3 and omega-6 fatty acids enhanced performance of the *in utero* offspring (Marques et al., 2016B - funded by the Agricultural Research Foundation). In that study, 100 Angus cows received daily either 200 g of omega-3 + omega-6 mix (100 g of Prequel + 100 g of Strata; Virtus Nutrition, Corcoran, CA), or 200 g of saturated control fat (EnergII from Virtus Nutrition). Treatments were mixed with 400 g of soybean meal and fed to beef cows during their last trimester of gestation. After calving, all cows and calves were managed similarly, without fatty acid supplementation. Cow and calf performance were similar among treatments until weaning. However, growth performance in the feedlot as well as carcass size and marbling were substantially increased in calves born from cows supplemented with the omega-3 + omega-6 mix. These results are novel and suggestive of fetal programming/epigenetic effects from supplementing the omega-3 + omega-6 mix to gestating beef cows. Accordingly, essential fatty acids are known to stimulate cell differentiation and development in developing tissues (Mangrum et al., 2016). Hence, we speculate that essential fatty acid supplementation increased hyperplastic development of muscle and intramuscular adipose cells of calves during gestation, which translated into greater cell hypertrophy and tissue growth (i.e. ADG, carcass size and marbling) when calves were exposed to a high-concentrate anabolic feedlot diet. However, the physiological mechanism underlying these epigenetic outcomes still need to be properly identified to validate this nutritional strategy and foster its adoption by the beef industry. In addition, omega-6 are the specific fatty acids linked with fetal cell differentiation and development (Mangrum et al., 2016), and supplementing a fatty acid source based on omega-6 only might be more advantageous than the omega-6 + omega-3 mix utilized by Marques et al. (2016B).

OBJECTIVES: Determine the effects of feeding essential fatty acids to pregnant beef cows during the last trimester of gestation on epigenetic responses, growth, health, and carcass characteristics of the offspring

PROCEDURES: One hundred and four Angus-Hereford cows were ranked by body weight, body condition score, and allocated to one of two treatments at 195 days of gestation: 1) Control: 200g/cow/day of a rumen protected source of non-essential fatty acids (EnergyBooster, Milk Specialties, Eden Prairie, MN), or 2) Essentiom: 200g/cow/day of a rumen protected source of essential fatty acids (Essentiom Church and Dwight Co., Inc., Princeton, NJ).
Cows were maintained in two adjacent pastured from day 0 (start of treatments administration) until calving, and each pasture contained the same number of animals from each treatment group (per pasture: Control, n = 26 and Essentiom, n = 26).

Immediately after calving, dam and calf were brought to a working facility where body weight (BW) and blood samples were collected from the pair. From the dam, samples of the colostrum and placenta were also collected (when feasible; colostrum n = 103; placenta, n = 38) and body condition score (BCS) was assessed. From the calf, a muscle biopsy was collected at time of birth and an additional blood sample was collected 24h after birth to assess antibody absorption from colostrum ingestion. Treatment administration was ceased after calving and cows and calves were moved to a different pasture and managed as a single group. Calves were branded and at approximately 30-45 days of age.

At weaning, when calves where on average 208 days of age, calf BW was assessed in two consecutive days, dam BW was also recorded and dam BCS assessed by two trained technicians. For calf body weight the average between the two days was utilized and for dam BCS, the average between two evaluators.

SIGNIFICANT ACCOMPLISHMENTS TO DATE: Calves were weaned in October (2018) and shipped to a commercial feedyard for growing and finishing (Lighting Feeders, Nyssa, OR). Results from calving and weaning are reported in Tables 1 and 2. Project will be completed when calves are slaughtered in (August 2019), and a full report provided including all performance, carcass characteristics, and analyses of biological samples collected during the experiment.

Table 1. Calving results (February to March 2018).

Item	**Control**	**Essentiom**	**SEM**	***P-value***
Dam BW, kg	1197	1220	21	0.45
Dam BCS	4.7	4.9	0.1	0.08
Gestation length, d	277.3	277.0	0.6	0.71
Calf BW, kg	81.3	82.0	1.2	0.71

Table 2. Weaning results (October 2018).

Item	Control	Essentiom	SEM	*P-value*
Dam BW, kg	1250	1239	20	0.71
Dam BCS	5.2	5.1	0.08	0.43
Calf age, d	208.8	208.7	0.07	0.66
Calf BW, kg	575	581	9	0.68

ADDITIONAL FUNDING RECEIVED DURING PROJECT TERM: None

FUTURE FUNDING POSSIBILITIES: Depending on the outcomes, this research may have implication on animal welfare, health, and reproduction, and serve as preliminary data for larger funding opportunities including USDA-NIFA (AFRI Foundational Program).