FINAL REPORT – Project # P0038431 (FCEB # 9)

Title: Impact of Insulin-Like Growth factor 1 (IGF-1) on fetal development during the first trimester of pregnancy

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Relevance to Florida Cattle Industry: Developing strategies to alter fetal development and reduce potential pregnancy loss during pregnancy are essential to increasing calf survival in the Florida cattle industry. Therefore, focusing on fetal programming utilizing recombinant bovine somatotropin (bST) to beef females during the first trimester may improve embryo and fetal health with an overall increase in efficiency and profitability of beef production systems in Florida.

Objective: To determine the effects of biweekly administration of 500 mg of slow-release bST to increase IGF-1 on fetal development during the first trimester of pregnancy.

Methods: A total of ninety-seven *Bos taurus* beef heifers were exposed to the 7-day CO-Synch + CIDR ovulation control protocol and then artificially inseminated. At fixed-time artificial insemination (TAI; day 0 of the experiment) heifers were randomly assigned to receive one of two treatments: single subcutaneous injection with 500 mg of bST in the neck at TAI and then biweekly to day 57 of the experiment (BST; Figure 1); or an untreated control (CONT). Blood samples were collected on days -0, 22, 50, and 64 relative to TAI for analysis of concentrations of plasma IGF-1. Body weight of heifers was assessed on d -9, -3, 0, 15, 22, 29, 43, 50, 57, 64, and 77. Pregnancy was determined via transrectal ultrasonography on d 29 and d 64 after TAI. On day 85 after TAI heifers were euthanized and a subset of pregnant heifers (n = 7 for BST, n = 5 for CONT) were retained for assessment of fetal and placental characteristics. Heifers were harvested and complete gravid reproductive tracts and liver tissue were collected for analysis. Specific fetal measurements assessed were brain weight, crown to nose length, crown to rump length, heart girth, fetal body weight, eviscerated body weight, liver weight, and umbilical cord diameter, whereas extraembryonic measurements were fetal fluid volume, fetal membrane weight, placentome weights, and placentome number. In addition, maternal tract parameters of gravid uterine weight, empty uterine weight, ovarian weight, and corpus luteum weight were recorded.

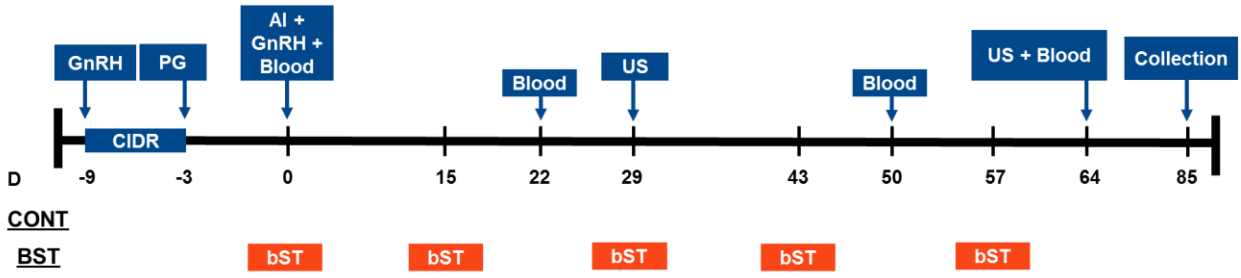

Figure 1. Schematic of treatments.

Results: Overall, mean change in body weight and ADG (0.95 kg ±0.27) of the heifers from TAI to d 77 did not differ between treatments ($P > 0.05$) (Table 1). Likewise, no differences were detected between treatments with regards to heifer carcass quality grade, carcass yield, or carcass weight. Mean concentrations of IGF-1 were greater ($P < 0.001$) in BST (346.50 ± 27.7 ng/mL) treated than CONT (134.70 ± 32.8 ng/mL) heifers. Mean placental weight (66.46 g), fetal membrane weight (0.256 kg), uterine weight (1.42 g), as well as ovarian and corpus luteum weights (15.1 g and 4.8 g, respectively) did not differ ($P > 0.05$) between treatments. Similarly, fetal crown to rump length, fetal weight, heart girth, and liver weight did not differ between treatments ($P > 0.05$). However, extraembryonic samples collected from heifers receiving bST (521.6 ± 22.9 g) resulted in greater ($P = 0.027$) quantities of fetal fluid compared to CONT heifers (429.6 ± 27.14 g). There was also a tendency for BST heifer reproductive tracts to have fewer placentomes ($P = 0.084$) and greater umbilical diameter ($P = 0.091$) than CONT heifers. Therefore, although concentrations of IGF-1 were increased in heifers that received biweekly administration of bST from TAI to day 57 of gestation, overall fetal development parameters did not differ between treatment. However, there was increased fetal fluid and a tendency for increased umbilical diameter and decreased placentome number in the BST heifers resulting in a physiological response in extraembryonic development due to stimulation by the GH and IGF system.

Conclusion: The administration of 500 mg of slow-release recombinant bovine somatotropin from TAI to day 57 of gestation has no current implications on overall fetal growth; however, based on these data there could be a potential benefit to placental function.

Table 1. Extraembryonic, maternal, and fetal measurements

	CONT (n = 5)	BST (n = 7)	SEM
Fetal membrane weight, kg	0.27	0.24	0.134
No. of placentomes	73	54	6.8
Placental weight, g	73.61	61.30	6.754
Fetal fluid, mL	430	522	25
Gravid uterine weight, g	1.31	1.49	0.078
Empty uterine weight, kg	0.64	0.53	0.057
Ovarian weight, g	15.86	14.34	1.691
Corpus luteum weight, g	4.94	4.62	0.372
Brain weight, g	2.72	2.34	0.269
Crown-nose length, cm	3.84	4.08	0.243
Crown-rump length, cm	13.18	13.28	0.237
Fetal BW, g	60.08	59.40	2.464
Heart girth, cm	9.20	9.22	0.147
Liver weight, g	3.27	3.01	0.243
Umbilical cord diameter, mm	6.66	8.90	0.831

BUDGET FOR FLORIDA CATTLE ENHANCEMENT FUND- BUDGET JUSTIFICATION					
PROJECT TITLE: Impact of Insulin-Like Growth factor 1 (IGF-1) on fetal development during the first trimester of pregnancy - Project # P0038431 (FCEB# 9)					
DETAILED LINE ITEM DESCRIPTION	QTY	% Complete	TOTAL	EXPLANATION/JUSTIFICATION OF DELIVERABLE	COMPLETION DATE
Blood sample analysis in heifers	Various	100%	$ 4,800.00	Immulite analysis of P4 samples, Immulite analysis of IGF-1 samples, and ELISA anlysis of PEG	9/1/2017
Sample analyses in fetal tissues	Various	100%	$ 5,720.00	Collection and analyses of fetal blood samples to be analyzed for IFG-1, and fetal tissue collection and mRNA extraction	9/1/2017
Materials and supplies for blood and ti	Various	100%	$ 3,201.34	Blood and tissue collection tubes, syringes, reagents for ELISA and Immulite,purchase of bST	9/1/2017
Research animal per diem	Various		$ 18,772.00	Research animals housed at the NFREC Beef Unit	9/1/2017
IDC	N/A		$ 3,805.66		
GRAND TOTAL: (equal to percentage of completion)			**$ 36,299.00**		