Final Technical Report

FCEB Project #50

Project Name: Predicting Puberty in Brahman Heifers and Bulls: can we predict early puberty at weaning?

Final Technical Report

Principal Investigator: Mario Binelli, PhD

1. Main Objective

The Main Objective of this proposal was to identify molecular markers present in the blood of pre-pubertal heifers and bulls that are predictive of early attainment of puberty. The project directly addressed the Program Area Priorities 2 (Calf Weaning Rate: improve pregnancy attainment of cows and heifers) and 7 (*Bos Indicus* genetics).

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2. Situation and Specific Objective

One main challenge associated with *Bos indicus* genetics is a delayed attainment of puberty, compared to *Bos taurus* animals. Indeed, data collected in the University of Florida Beef Research Unit indicate that while 31% (27/86) of the cross-bred yearling heifers that entered the 2019 breeding season having attained puberty, only 1.5% (1/62) of pure bred Brahman yearling heifers were pubertal. A similar low proportion was observed for yearling Brahman bulls. Notwithstanding, 13% (8/62) of the yearling Brahman heifers became pregnant to a single artificial insemination. Interestingly, Brahman heifers that did become pregnant varied in age (12 to 16 months) and weight (530 to 775 lb) at the beginning of the breeding season. This variability indicated that there was potential for the selection of early maturing genetics within the Brahman population. However, attainment of puberty and fertility was not associated tightly with the common phenotypic traits of weight and age. Thus, there is a critical need to discover alternative markers that are predictive of puberty attainment. This rationale is also applicable to Brahman bulls. The specific objective of this proposal was to discover non-genomic molecular markers that will be used to predict early puberty in Brahman heifers and bulls.

3. Approach

The study design was identical for heifers and bulls except that animals were managed separately according to sex after weaning and data analyzes was also according to sex. Experiment started in the Fall of 2023 when Brahman calves were weaned. Sample and data collection were concluded in the Spring of 2024. Laboratory and data analyses were carried out

from Spring to Summer 2024. Sixty Brahman (*Bos indicus*) heifers and forty Brahman bulls were used in this experiment. After weaning, animals were housed in paddocks cultivated with Bahiagrass at the UF beef units. Animals have been monitored on a monthly basis until the beginning of the breeding season (14-months of age). During this period, the animals were body condition scored, weighted and measured. In addition, blood samples were collected 90 and 30 days prior to the beginning of the breeding season for later metabolomic analysis.

Heifers: during the breeding season, heifers were synchronized, artificially inseminated and exposed 14 days later to clean up bulls for 90 days. Pregnancy was checked by ultrasound 30 post-AI to determine the proportion of heifers becoming pregnant along the breeding season and ovaries were checked for the presence of a corpus luteum. At end of the breeding season, females were separated in two groups: heifers that had attained puberty (**Pubertal group**) and heifers that remained immature (**Pre-pubertal group**). Puberty status was defined considering a combination of the following criteria: (i) presence of a corpus luteum at 14 months; (ii) expression of estrus in response to the synchronization protocol; and (iii) pregnancy on day 30 of the breeding season. Pre-pubertal status will be defined considering combination of the following criteria: (i) Reproductive Tract Score 1 to 3 at the end of synchronization protocol; (ii) no expression of estrus in response to the synchronization protocol; (iii) not-bred at end of the breeding season; and (iv) absence of a corpus luteum along the breeding season.

Bulls: at the beginning of the breeding season (approximately 14 months of age), semen was collected from bulls via electroejaculation and analyzed using standard parameters of quality, including sperm concentration, motility and vigor. Bulls that achieve the desired parameters of fertility were considered to have attained puberty early, while bulls that do not achieve the desired parameters in both tests were considered as pre-pubertal.

Based on these criteria, 12 heifers and 10 bulls from each of the Pubertal and Pre-pubertal groups were selected and their blood samples were screened for molecular markers, using metabolomics approaches.

Sample and data collection: blood samples were collected both from heifers and bulls, 90 and 30 days prior to the beginning of the breeding season and plasma was extracted. Metabolomic analysis was performed on samples collected at weaning from heifers (n=12/group) and bulls

(n=10/group) classified as pubertal or pre-pubertal. On heifers, reproductive tract score (RTS) evaluations were performed by transrectal palpation and ultrasound scanning of the ovaries. On bulls, semen analysis was conducted by light microscopy. Samples collected from pubertal and pre-pubertal heifers (n=66) and bulls (n=30) from prior years were identified and were also sent for analysis.

4. Final Report

Heifers and bulls were weaned in September 2023 and blood samples were collected. Ovarian ultrasonography and reproductive tract score of females and semen tests in bulls were conducted as planned. Blood samples were stored and sent for analyses after the determination of attainment of puberty, as proposed originally. Metabolomics analyzes were conducted and are on the process of bioinformatics.

5. Conclusion

Project was conducted as expected. Final analyses are underway.

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Invoice Date:	08/15/2024
Invoice Period:	05/01/2024 - 07/31/2024
Principal Investigator:	Binelli,Mario
Award Begin Date:	10/30/2023
Award End Date:	07/31/2024
UF FEIN:	59-6002052

Sponsor Award ID:	50
Award Title:	Predicting Puberty in Brahman Heifers and Bulls: can we predict early puberty at weaning?
Award Amount:	$72,948.00

Invoice #	I000130485
UF Award #	AWD15779
Primary Project #	P0324531
Primary Department:	60090000
Current Invoice Amount:	$57,353.37

Description	Current	Cumulative
Personnel - Salary	$9,577.91	$14,756.55
Personnel - Fringe Benefits	$1,681.71	$2,443.73
Tuition	$448.72	$4,487.29
Materials and Supplies	$21,070.00	$21,070.00
Contractual Services	$6,550.00	$6,550.00
Animal	$11,880.00	$11,880.00
Direct Cost	$51,208.34	$61,187.57
Facilities and Administrative Costs	$6,145.03	$7,342.56
Total	$57,353.37	$68,530.13

For billing questions, please call 352.392.1235
Torres,Kannika S kannika@ufl.edu
Please reference the UF Award Number and Invoice Number in all correspondence

By signing this report, I certify to the best of my knowledge and belief that the report is true, complete, and accurate, and the expenditures, disbursements and cash receipts are for the purposes and objectives set forth in the terms and conditions of the federal award. I am aware that any false, fictitious, or fraudulent information, or the omission of any material fact, may subject me to criminal, civil, or administrative penalties for fraud, false statements, false claims or otherwise. (U.S Code Title 18, Section 1001 and Title 31, Sections 3729-3730 and 3801-3812).

Kannika Torres

Certifying Official

Payment History	
Cumulative Invoices:	$68,530.13
Payments Received:	$11,176.76
Outstanding Balance:	$57,353.37
Note: Outstanding balance includes current invoice amount	

FOR UF USE ONLY Additional Projects: N

Project ID	Deptid	Department Name	Current	Cumulative
P0324531	60090000	AG-ANIMAL SCIENCES	$57,353.37	$68,530.13