

Final Technical Report
FCEB Project #24

Genetics of immune competence in beef cattle

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Co-Principle Investigators: Corwin Nelson, João Bittar, Oscar Rojas, Raluca Mateescu

1. Main objective

Producing and raising healthy calves is integral to the profitability and success of a cow-calf operation. Genetic factors underlying immune response and feasibility to select for increased immune competence in purebred Brahman and Brahman influenced cattle have yet to be investigated. The ***long-term*** goal of this research is to provide the Florida beef cattle industry with novel genomic strategies for *improving animal's ability to cope with disease*, named immune competence, which have direct impact on production and health-related costs. The ***main objective*** of this multi-year study is to *investigate potential genetic factors underlying the variation in immune competence in purebred Brahman and Brahman influenced cattle*.

2. Significance

Unraveling genetic factors underlying calves' immune response provides opportunities for the **development and implementation of novel genetic selection strategies to improve immune competence and disease resistance** in a purebred and Brahman influenced cattle.

3. Approach

Taking advantage of the genetic diversity of the UF Multibreed Angus-Brahman beef research herd we assessed Brahman influence on immune response. Both humoral and cell mediated immunity to novel antigen were quantified and used as proxy for immune competence in beef cattle. A total of 166 Multibreed Angus-Brahman replacement heifers born in 2022 (89 females) and 2023 (77 females), plus 60 purebred Brahman born in 2023 had the development of immunity to a foreign antigen (keyhole limpet hemocyanin – KLH) evaluated. On day 0, heifers were intramuscularly vaccinated, and a booster was given 14 days later. Plasma blood samples were collected at day 0, 14 and 28 to determine KLH-specific antibody immunity. At day 28, delayed-type hypersensitivity test (DTH) was performed to evaluate cell-mediated immune response, primarily against intracellular pathogens. For that, heifers were intradermal vaccinated with control solution (1 site) and KLH (2

sites), and the skin fold was measured at and 24 h post injection on each site (Figure 1). The DTH responses were measured by changes in skin-fold thickness 24 h after intradermal injections

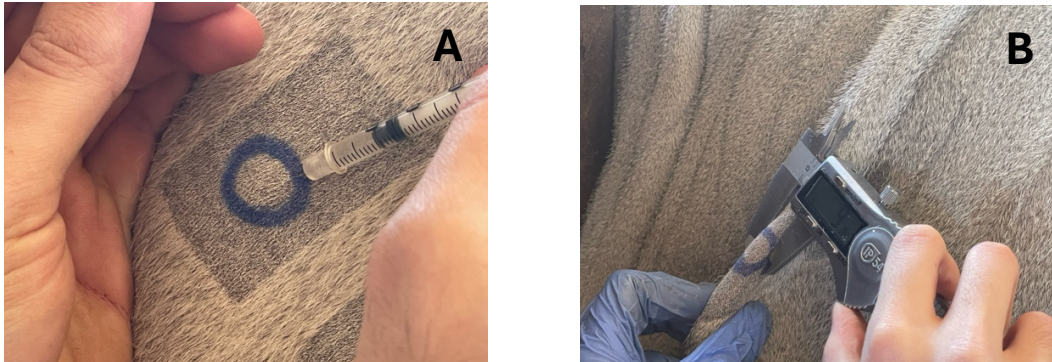


Figure 1. Images of intradermal injection (A) and skin fold measurement with digital caliper (B).

4. Preliminary results

Figure 1 shows the development of antibody-mediated immunity after first (day 0) and second (day 14) exposure to novel antigen between animals with different proportion of Brahman breed. There is a clear breed effect on humoral response to foreign antigen with significant differences observed between animals with different proportion of Brahman breed (Figure 2). Notably, the concentrations of anti-KLH IgG decreased with Brahman proportion.

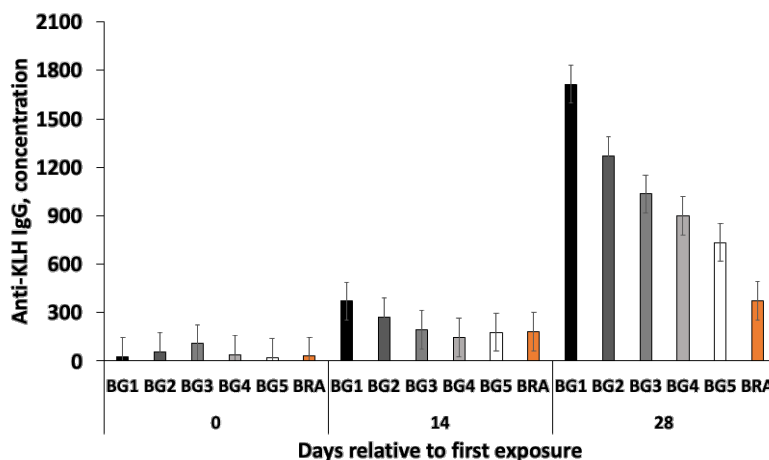


Figure 2. Measurement of anti-KLH IgG antibody per breed group gradually ranging from 1 (0-19% Brahman) to 5 (80-100% Brahman).

Curiously, substantial variability on antibody-mediated immune response was observed not only between animals from different breed compositions, but also

within purebred Brahmans (Figure 3). ***This results indicates that additional genetic factors besides breed influence immune response in beef cattle.***

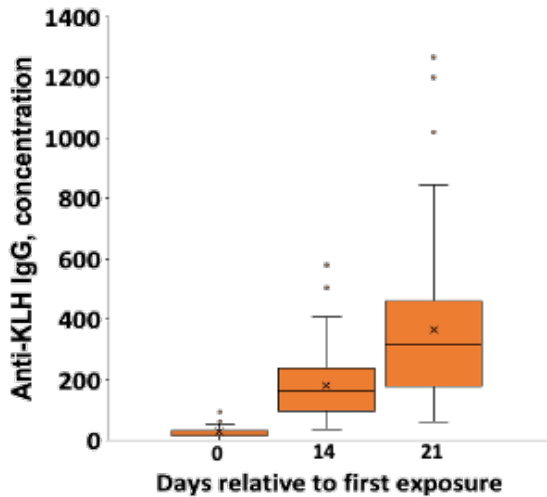


Figure 3. Box plots of anti-KLH IgG antibody level overtime within purebred Brahmans and anti-KLH IgG antibody concentration per breed group gradually ranging from 1 (0-19% Brahman) to 5 (80-100% Brahman).

Lastly, sire with more than three daughters with antibody immune response had their progeny immune performance plotted in Figure 4. Interestingly, sire B progeny showed the highest humoral response evaluated by anti-KLH IgG concentration, followed by the daughters of sires A and I.

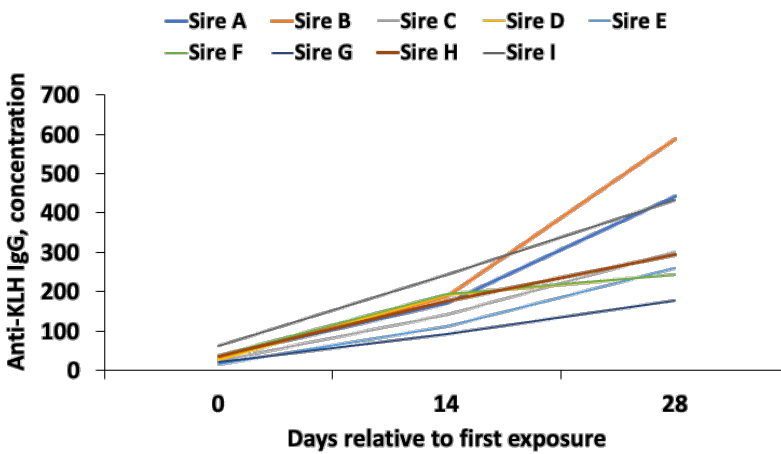


Figure 4. Average concentration of anti-KLH IgG antibody in progeny per sire with more than 3 daughters with humoral response record.

Development of cell-mediated immunity was determined by delayed-type hypersensitivity responses measured by changes in skin-fold thickness 24 h after intradermal KLH injections. Similar to antibody-mediated response, animals with high percentage of Brahman breed presented smaller changes in skin-fold thickness (Figure 5).

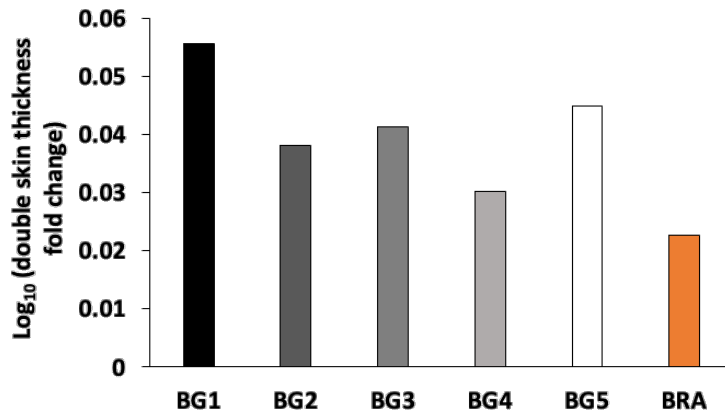


Figure 5. Cellular response based on change in skin fold thickness after exposure to KLH antigen per breed group gradually ranging from 1 (0-19% Brahman) to 5 (80-100% Brahman).

These findings bolster the hypothesis that there are genetic factors underlying the immune response variation in cattle of different genetic compositions which likely has an important implication for how they resist different pathogens.

5. Educational outcomes

In addition to its scientific contribution, the present project offered training to a graduate student directly involved in all activities concerning this proposal, and several other graduates and undergraduates. All students were trained for proper animal handling, blood sample collection, lab protocols (i.e., ELISA), and data compilation and analysis.

6. Conclusion

The project has been conducted as successfully. Humoral and immune responses to novel antigen showed variability great within and across breed. Genetic factors, in addition to breed, seems to influence immune response in purebred and Brahman influenced cattle. There is evidence of sire effect in differences in humoral and cellular responses. Additional data are needed to confirm the feasibility of selection for enhanced immunity and the identification of genomic regions and genes underlying immune response in Brahman and Brahman influenced cattle.

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 Principal Investigator: Marcondes De Rezende, Fernanda
 Award Begin Date: 10/30/2023
 Award End Date: 07/31/2024
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 Award Amount: \$45,773.00

Invoice #	I000130497
UF Award #	AWD15805
Primary Project #	P0324621
Primary Department:	60090000
Current Invoice Amount:	\$4,976.08

Description	Current	Cumulative
Personnel - Salary	\$2,812.28	\$8,391.60
Personnel - Fringe Benefits	\$463.51	\$1,342.96
Tuition	(\$2,466.18)	\$4,038.57
Materials and Supplies	\$3,169.09	\$13,564.20
Animal	\$0.00	\$11,808.14
Domestic Travel	\$464.25	\$1,216.02
Direct Cost	\$4,442.95	\$40,361.49
Facilities and Administrative Costs	\$533.13	\$4,843.38
Total	\$4,976.08	\$45,204.87

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

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Cumulative Invoices:	\$45,204.87
Payments Received:	\$40,228.79
Outstanding Balance:	\$4,976.08
Note: Outstanding balance includes current invoice amount	

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Project ID	Deptid	Department Name	Current	Cumulative
P0324621	60090000	AG-ANIMAL SCIENCES	\$4,976.08	\$45,204.87