2019 Reciprocal Meat Conference – Animal Welfare

Meat and Muscle Biology™

Predicting Early Stages of Beef Respiratory Disease Using Thermal Imaging Technology

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Keywords: animal, meat quality, thermal, welfare
Meat and Muscle Biology 3(2):1

Objectives

The objective of this research was to utilize thermal imaging technology to estimate body temperature, so that an early stage of BRD can be detected.

Materials and Methods

Ninety-two steers were restrained in a squeeze chute that is housed in an indoor handling facility on 6 separate occasions. At least one image was taken of each side of the head using a thermal infrared camera (FLIR E8 WiFi, FLIR, Wilsonville, OR). The distance at which the images were taken was approximately 1 m from the steer. The rectal temperature was used as the control method to compare thermal imaging data. After thermal image acquisition, images were analyzed using the FLIR ResearchIR Max software (v. 4.40.8.28, FLIR, Wilsonville, OR), with the regions of interest being the eye and nasal cavity.

Results

The analysis focused on minimum (MIN), maximum (MAX), mean, standard deviation (SD), and range of temperatures in the regions of interest. The REG procedure in SAS (v. 9.4, SAS Institute, Inc., Cary, NC) was used to perform stepwise regression to predict rectal temperature from the outdoor temperature (OTEMP) and all imaging features. When OTEMP was greater than –17.8°C, the regression model contained OTEMP, left nasal MAX, left nasal SD, and left eye MAX temperature and right eye temperature range, with an R^2 of 0.24. When OTEMP was above freezing (0°C), the regression model contained left nasal temperature range, right eye temperature range, and average nasal mean temperature, with an R^2 increase to 0.50. When using all data, the regression model fit left nasal MAX, right nasal MIN, average nasal mean, and left eye MAX temperatures and right eye temperature range, with an R^2 of 0.08. These results show that thermal imaging technology has higher prediction accuracy in warmer temperature ranges than extreme cold conditions.

Conclusion

More validation research on this thermal imaging technology needs to be conducted at warmer temperatures since all the current data was collected on cold winter days and a large portion of U.S. cattle are reared in more temperate and warmer areas than North Dakota such as Nebraska, Kansas, Texas, Oklahoma, and Florida. Overall, these results show promise for using thermal imaging technology to help detect BRD in an earlier stage by detecting fever before other clinical signs of BRD are present.