South Dakota State University
Department of Animal Science

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Meats & Human Nutrition

Investigation on the use of a FLIR (forward looking infrared) camera to detect relationships between internal and surface temperatures of beef carcasses during chilling

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Objective

The objective of this study was to collect preliminary data on the efficacy of using thermal imaging technology as a means to assess beef carcass chilling.

Study Description

Infrared Thermography (IRT), commonly referred to as Thermal Imaging, is defined as a noninvasive, quantitative diagnostic tool that involves the precise measurement of infrared radiation, or heat, that is emitted from an object. IRT has become an accepted methodology in biomedical, medical and veterinary education studies. IRT provides the opportunity for the early detection of pathological conditions such as pain located in the legs or hooves of cattle and horses. To determine the efficacy of this technology in carcass chilling measurement temperature data loggers were inserted deep into the round, loin, and chuck of beef carcasses (n=51) 50 minutes postmortem. The data loggers tracked internal temperature of carcasses located in the blast chiller for 24 hours. A C3 FLIR camera (640 x 480-pixel) was used to capture thermal images at 0, 3, 6, 12, and 24 hours postmortem on the fat (external) and bone (internal) side of the carcass at the round, loin, and chuck. A FLIR camera provides the ability to capture images for individual temperature readings at various timepoints. From each picture, the maximum and minimum temperatures were collected for each location and time point. Data were analyzed using the PROC CORR procedure of SAS (SAS Inst. Inc., Cary, NC). Statistical significance was considered at an alpha of $P < 0.05$ and trends at $0.05 \leq P < 0.10$.

Take home points

For the chuck, split side temperature at 3 hours was positively correlated with internal temperature at 0 ($R^2 = 0.363$, $P = 0.009$), 3 ($R^2 = 0.456$, $P = 0.001$), 6 ($R^2 = 0.559$, $P = 0.0001$), 12 ($R^2 = 0.504$, $P = 0.0002$), and 24 hours ($R^2 = 0.432$, $P = 0.002$) respectively. For the loin, split side temperature at 0 hours was positively correlated with internal temperature at 3 ($R^2 = 0.424$, $P = 0.002$) and 6 hours ($R^2 = 0.362$, $P = 0.009$). The use of a FLIR camera in slaughter facilities can capture rapid images as carcasses are moving along the rail, which could help predict the chilling rate once in the blast chiller.

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Keywords: beef, chilling, FLIR, temperature, thermal imaging