

Leg infrared surface temperatures and tibia morphology of broilers with normal and abnormal gaits

Anna Magnaterra*¹, Randy Mitchell², Zoie McMillian¹, Ashlyn Synder¹, Shawna Weimer¹
¹University of Maryland, ²Perdue Foods LLC

Background

Controlling issues related to leg health in broiler chickens is an important welfare concern. It is not uncommon for boiler chickens to have an abnormal gait, which could indicate a variety of welfare concerns including skeletal abnormalities, infectious or noninfectious lameness. Gait scoring (GS) is a useful measure to understand a bird's leg health and welfare status but gait scoring presents a serious challenge due to the subjectivity of the test. This brings a need for more quantitative measures of leg health.

Objective

Through this study we were able to compare quantitative measures of leg health and bone morphology between broilers with normal and abnormal gaits.

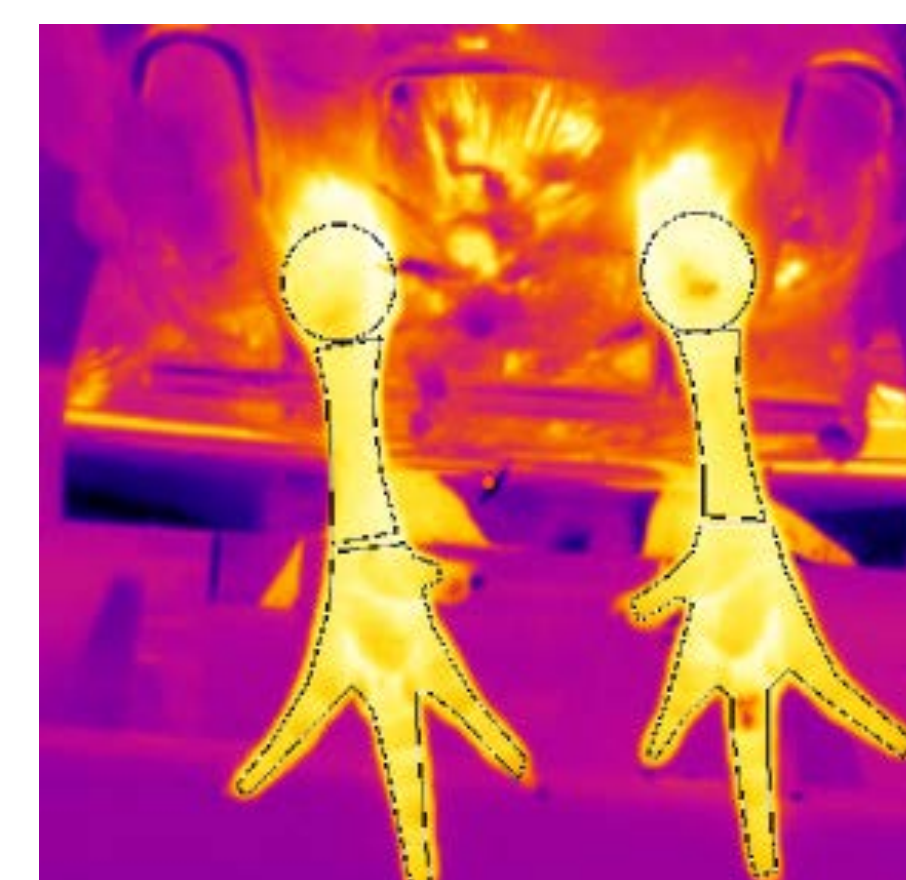
Materials & Methods

On d51, live and post-mortem measures were collected from 120 randomly selected conventional broiler chickens from 20 pens (N=6 birds/pen).

Live observations and measures :

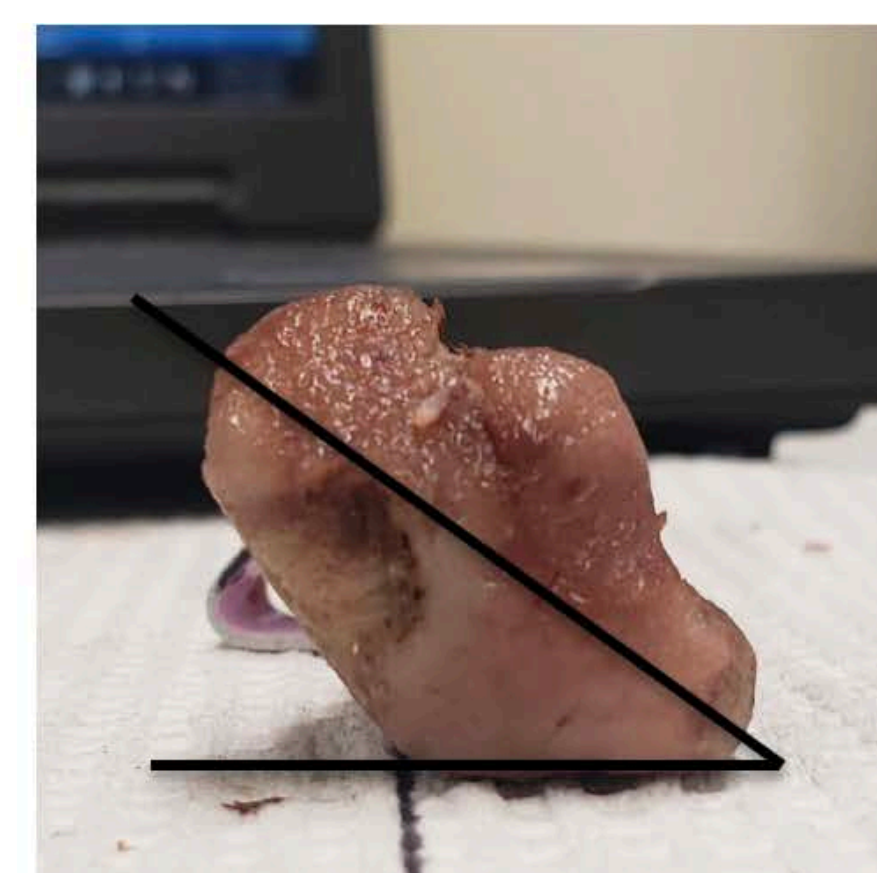
- GS (binomial scale, where 0 was a normal gait and 1 was an abnormal gait)
- Body weight (BW)

- Infrared thermal (IR) image of the legs

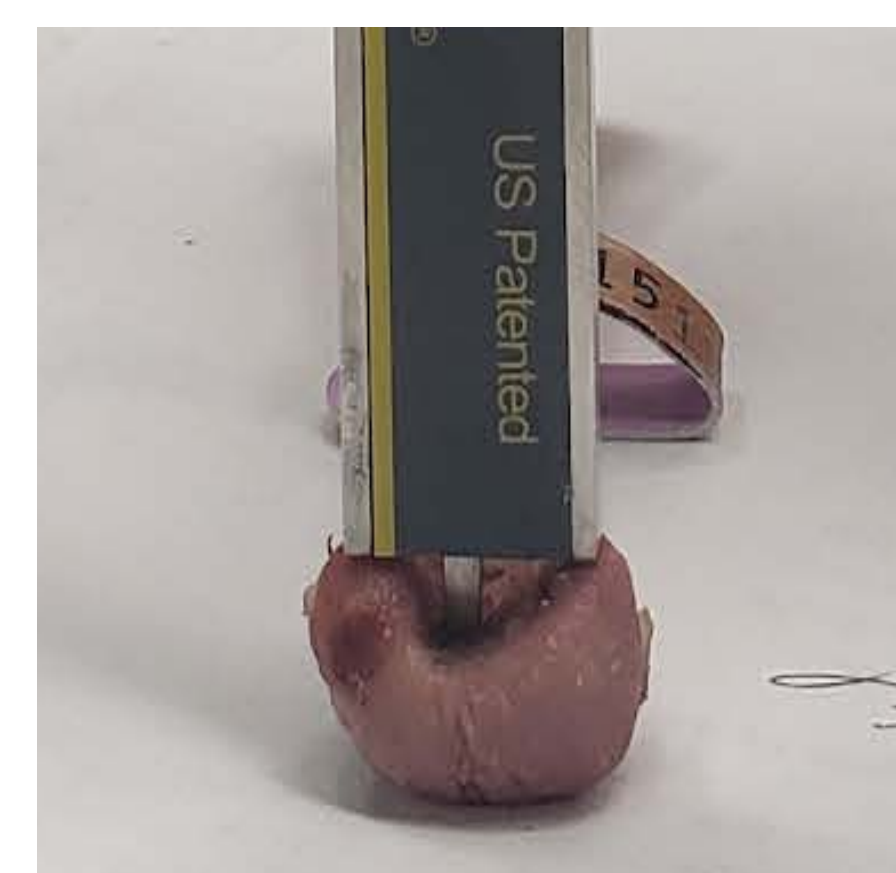


Post-mortem morphological measures of the right and left tibia:

- Total length



- Proximal head angle



- Depth of the proximal and distal intercondylar areas



- Width at proximal and distal tibia heads, and 10%, 25%, 50%, 75%, 90% proportion of total length

Statistical Methods

Means and deltas of both legs and tibiae were calculated for each bird. Data was analyzed in JMP using a paired t-test for the fixed effect of GS (0, 1) for the data collected in the materials and methods.

Results

There was no effect of BW or length of the tibia on GS. IR measures showed an effect ($P \leq 0.05$) of GS on the mean temperature of the hock and shank for GS 1 birds (hock=36.95°C, shank=36.29°C) compared to GS 0 (hock=37.36°C, shank=37.01°C). For both the hock and shank the temperature decreased for increasing GS.

Although, there did not appear to be a difference between GS and delta of width of the tibia, there was an effect of mean tibia width at 75% and 50% of total length were greater ($P \leq 0.04$) for GS 1 birds (75%=14.31mm, 50%=10.43mm) compared to GS 0 (75%=13.89mm, 50%=10.10mm).

When looking at the proximal head there was a tendency for the mean tibial angle of GS 1 birds to be greater ($P=0.06$) than GS 0. In addition the mean delta angle of the proximal tibial head for GS 1 birds was greater than GS (GS 1 Δ =6.19°), GS 0 (Δ =3.79°; $P=0.001$), while the mean delta depth of the proximal medial intercondylar area of GS 1 birds (0.36mm) was less than ($P=0.03$) than GS 0 (0.49mm).

Results

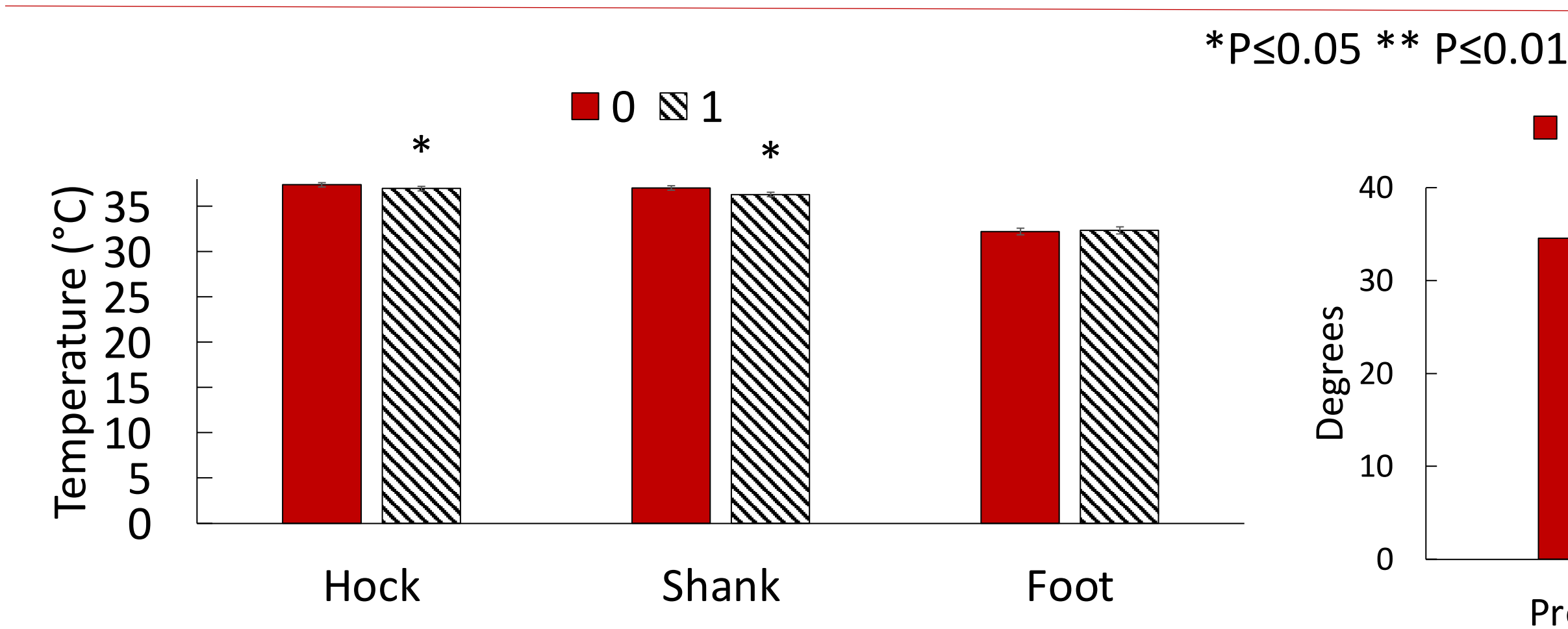


Figure 1: Mean IR temperature(°C) measures of hock, shank, and foot

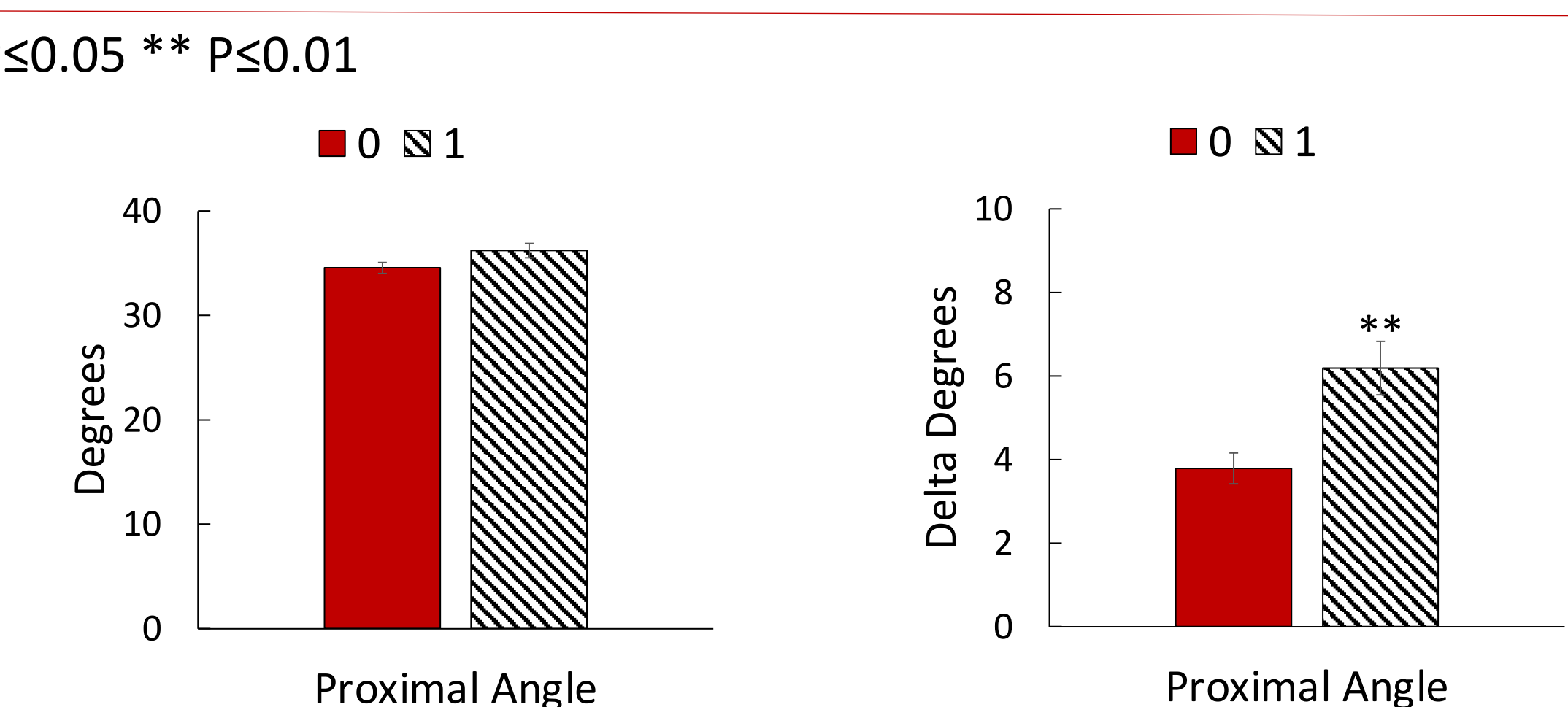


Figure 2: a) Mean proximal tibial angle measures. b) Mean of the absolute value of the delta difference between left and right proximal tibia angle.

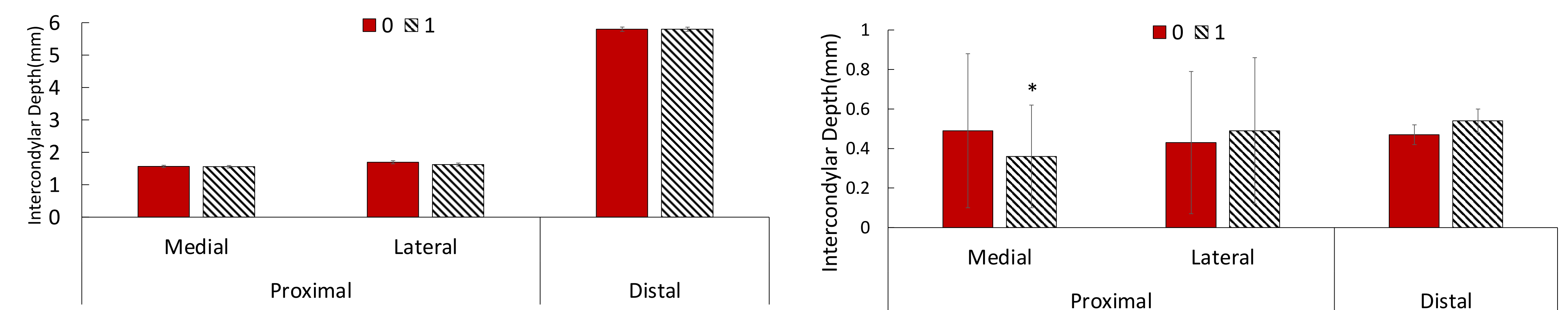


Figure 3: a) Mean tibia intercondylar depth(mm). b) Mean of the absolute value of the delta difference between left and right tibial intercondylar depth per bird.

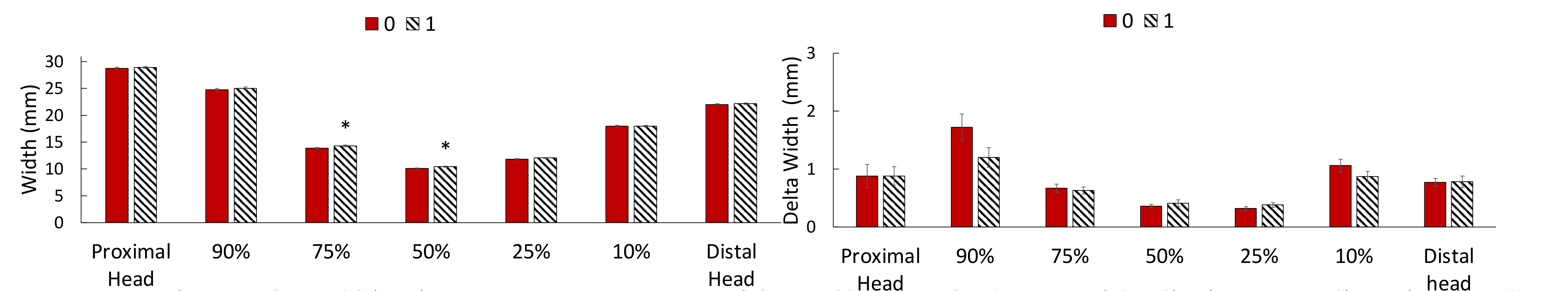


Figure 4: a) Mean tibia width(mm) at 90%,75%, 50%,25%,10% of the total length in the direction of distal(0%) to proximal(100%) end on the bone. b) Absolute value of the mean delta difference between left and right tibial width per bird.

Conclusions

- Infrared thermography leg temperatures and tibia bone measurements show potential as quantitative measures of broiler leg health.
- Direct morphological measures can provide valuable insight on physiological differences, which arise with increased GS, while mean IR temperature provides a quantitative indirect measure of leg health.
- Future studies focused on proximal head measures and the delta difference between the left and right bone can help create quantitative measures of leg health for individual birds.

Acknowledgements

This project was completed on farm at Perdue Foods LLC. A special thank you to Randy Mitchel at Perdue Foods LLC for the opportunity to collaborate on improving welfare for broilers.

