Season 3, Episode 10: **Gender Effects on Heat Stress**

Dr. Josh Selsby, Iowa State University, discusses heat stress and how it impacts barrows and gilts differently.

Background

Traditionally, heat stress has been shown to cause oxidative stress within the cells of gilts. However, an experiment conducted by Dr. Josh Selsby, and his lab group, could not detect oxidative stress in the skeletal muscle of the barrows on trial. This led Dr. Selsby, and a team of researchers, to evaluate the heat stress response of barrows versus gilts. Ultimately, these experiments have shown there is a difference in the way barrows and gilts respond. Heat stress results in behavioral changes such as reduced activity, panting and lying down. Blood is shunted to extremities, leaky gut and reduced feed intake are observed. Heart, kidney and muscle damage also occurs.

Research

An experiment was conducted with barrows and gilts in one room being subjected to the same heat stress conditions. After 24 hours both barrows and gilts superficially appeared to respond similarly to the stress; although barrows had improved feed efficiency compared to gilts. Further examination showed significant differences in muscle tissue based on sex. At day 7, gilts had a cooler rectal temperature compared to barrows, and both had the same feed efficiency. This means barrows were able to maintain growth efficiency despite an elevated core temperature. It appears, barrows may be a more heat resistant sex.

Powerhouse

Mitochondria are known as the powerhouse of cells, producing adenosine triphosphate (ATP) which is essential for cellular function. When damaged they mass produce free radicals and heat. During the heat stress experiment, mitochondrial function was impaired at 24 hours in both barrows and gilts. The way in which the mitochondria were breaking, or becoming dysfunctional, in gilts relied on a process that produces free radicals. This was not the case for barrows. Free radicals cause damage to structures, such as proteins, and ultimately impair the way a cell can function. Further observation of mitochondrial structure revealed gilts were creating massive mitochondria while barrows did not. At day 7, the mitochondrial structure of barrows and gilts started to look more similar.

Looking to the future

The team is now looking to collect production level data from commercial swine operations. This will help determine if differences exist, at the system level, between the performance of barrows and gilts. In the end, these findings could result in recommendations for managing barrows and gilts separately. For example, separate sex housing where cooling systems are implemented for gilts. Additionally, therapeutics such as mitochondrial targeted antioxidants may be warranted for gilts. Not only do today's pigs grow faster, but they also produce more heat doing so. Hot weather events have also increased in duration. Heat stress is an issue that will continue to afflict swine production systems and producers may need to consider managing barrows and gilts separately.

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