Australasian Pork Research Institute Ltd APRIL

PROJECT SUMMARY

Project Number and Title: 6A-101: HEAT TOLERANCE IN LACTATING SOWS: DIETARY STRATEGIES, METABOLIC BIOMARKERS AND MICROBIOME SIGNATURE

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Aims and Objectives:
The main aim of this project was to improve the lactating sows' compensatory mechanisms to cope with high environmental temperatures via dietary manipulations.

Objectives:

1) Test selected dietary strategies (i.e., flavours, cooling agents and reduced dietary protein levels) to increase the heat tolerance of lactating sows.
2) Identify changes in metabolism and microbiome (i.e., biomarkers) associated with heat tolerance in lactating sows, that may explain individual variations.

Key Findings:

- The use of a low protein diet improved the feed intake and reduced the sow's internal body temperatures and respiration rate.
- Pro-inflammatory molecules (e.g., arachidonic acid) and previously described heat stress biomarkers (e.g., cholesterol) were reduced in lactating sows fed a low protein diet, indicating reduced metabolic stress due to environmental hyperthermia when compared to those sows fed a standard protein diet.
- The low protein diet enhanced the gut microbiome vitamin B_{12} synthesis pathway (pivotal for ATP production and radical oxygen species detoxification), indicating this group was better adapted to cope with the metabolic stress produced by the high environmental temperatures.
- Long chain fatty acids, glycerophospholipids, mineralocorticoids and amino acids were the most abundant types of metabolites altered during heat stress. Consistent with these results, a negative correlation between the abundance of proteins related to AA and lipid metabolism in the liver and feed intake reduction during heat stress was identified.

Applications to Industry:

- Low protein diets can be used in lactating sows to improve feed intake and reduce body temperatures during summer/hot weather conditions.
- Changes in the blood level of fatty acids, glycerophospholipids, mineralocorticoids and amino acids, such as tryptophan, arachidonic acid and pregnanolone, can be used as potential indices of heat tolerance in lactating sows to identify individuals at higher risk of heat stress.