RESEARCH ABSTRACT
ANIMAL SCIENCE

Title: Effects of genetics and dietary fiber on production variables in response to repeated exposures to heat stress – **NPB #14-243**

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Scientific Abstract:

two abstracts summarizing the body of work completed:

1) Rauw, W.M., E. J. Mayorga, S. Lei, J. C. M. Deckers, J. F. Patience, N. K. Gabler, S. M. Lonergan and L. H. Baumgard. 2017. Effects of genetics on growth and feed intake in response to repeated exposure to heat stress. J. Anim. Sci. 95(Suppl.5):029. (Abstr.). doi: 10.2527/asamw.2017.029

Heat stress (HS) accounts for over $900 million loss in the U.S. swine industry annually resulting from poor reproduction, slower growth rates and reduced feed efficiency. Genetic selection for improved lean tissue growth rates in commercial pig lines may increase susceptibility to heat stress. Study objectives were to investigate the effects of genetics on growth and feed intake in response to repeated exposures to HS. A total of 31 animals from three genetic lines (commercial, high feed efficient, low feed efficient) where subjected three separate times to a 4-dHS load which was preceded by a 9-d thermal neutral (TN) adaptation period and alternated by 7-d of TN conditions: 1-TN adaptation, 2-HS, 3-TN, 4-HS, 5-TN, 6-HS, and 7-HS. Body weight was recorded at the beginning and end of each period and ad libitum feed intake was recorded daily. Average daily body weight gain (BWG) and average daily feed intake (FI) were calculated for each period. Feed efficiency was estimated as BWG/FI. Data was analyzed with a mixed model including a repeated statement. BWG was more than 20% lower during HS compared to TN periods ($P < 0.05$). Commercial pigs grew faster than both efficient and inefficient pigs ($P < 0.0001$); the Line × Period interaction showed that the effect of line was significant only in TN periods 1, 3, 5, and 7 ($P < 0.0001$) but not in HS periods 2, 4, and 6. Feed intake decreased more than 15% in HS compared to TN periods ($P < 0.0001$). Pigs of the commercial line ate more than pigs of both the efficient and the inefficient line ($P < 0.0001$); pigs of the inefficient line ate more than pigs of the efficient line ($P < 0.05$). BWG/FI was less during HS and decreased from 0.32 to 0.03 in the commercial line, from 0.21 to 0.06 in the efficient line and from 0.19 to 0.07 in the inefficient line between periods 5-TN and 6-HS ($P < 0.0001$).

Heat stress negatively affected BWG, FI and BWG/FI in all three lines. Commercial pigs ate more and grew faster than the efficient and inefficient line, but also had a larger drop in BWG/FI after repeated periods of HS.

2) Rauw, W.M., E. J. Mayorga, S. Lei, J. C. M. Deckers, J. F. Patience, N. K. Gabler, S. M. Lonergan and L. H. Baumgard. 2017. Effects of genetics on thermal regulatory responses to repeated heat stress exposures in pigs. J. Anim. Sci. 95 (Suppl.5):029 (Abstr.). doi: 10.2527/asasmw.2017.009

Pigs experiencing heat stress (HS) have poor reproduction, slow growth rates and reduced feed efficiency accounting for over $900 million loss in the U.S. swine industry annually. In addition, HS negatively impacts animal welfare. Some evidence suggests efficient and fast growing pigs may be more susceptible to HS. Study objectives were to investigate the effects of genetics on respiration rate (RR) and skin (ST) and rectal temperatures (RT) in response to repeated exposures to HS. A total of 97 animals from three genetic lines (commercial, low residual feed intake (RFI), high RFI) where subjected three separate times to a 4-d HS load which was preceded by a 9-d thermal neutral (TN) adaptation period and alternated by 7-d TN conditions: 1-TN adaptation, 2-HS, 3-TN, 4-HS, 5-TN, 6-HS, and 7-TN. RR, ST and RT were measured daily in all periods. RR, ST , and RT increased in the HS periods compared with TN conditions (95 vs 39 breaths per minute (bpm), 37 vs 33 ^{0}C, and 39.6 vs 39.2 ^{0}C, respectively; $P < 0.0001$). RR was positively correlated with ST in TN condition ($r = 0.27$, $P < 0.0001$), but not during HS ($r = 0.03$) suggesting pigs have more problems coping when temperatures rise. Overall, pigs from the low RFI line had decreased RR (63 ± 1 bpm) than commercial pigs (68 ± 1. bpm) and high RFI lines (69 ± 1. bpm $P < 0.01$); commercial pigs had increased ST (36 ± 0.1 ^{0}C) than low (35 ± 0.1 ^{0}C) and high RFI pigs (35 ± 0.1 ^{0}C) and high RFI pigs had increased ST compared to low RFI pigs ($P < 0.01$); pigs from the commercial line had increased RT (39.7 ± 0.02 ^{0}C) compared to pigs from the low (39.3 ± 0.02 ^{0}C) and high RFI lines (39.4 ± 0.02 ^{0}C; $P < 0.0001$). The results indicate that faster growth in commercial pigs results in a stronger response to heat stress whereas low RFI pigs may deal slightly better with HS than high RFI pigs.