

Title: Impact of in utero heat stress on subsequent growth, composition and reproduction – NPB #13-022

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Scientific Abstract:

Large White x Landrace gilts (Choice Genetics USA) were artificially inseminated and housed under thermoneutral (GTN; 18-22°C) or heat stress (GHS; 28-34°C) conditions throughout gestation, then lactated ~21d under TN conditions. At weaning, GHS and GTN gilts were housed together in pens of 22-25 gilts per pen. Barrows were double stocked here until approximately 25kg, then 80 barrows were individually housed and fed in attempt to correct impact of *in utero* heat stress: a corn soybean meal diet that met (100%) or exceeded (110%) NRC lysine requirements; in the last 30 days barrows received a diet with 0 (CTL) or 7.4 ppm Paylean (PAY) until 121 kg. Weight, average daily gain (ADG), and feed disappearance (FD) were recorded. Week one weight was greater ($P=0.03$) in HS barrows (2183.00 ± 60.48 vs 1999.01 ± 59.66 g) but tended to be reduced ($P=0.08$) in HS barrows in late finishing (121.58 ± 1.47 vs 125.26 ± 1.49 kg). In both grower ($P=0.04$) and finisher ($P=0.05$) phases, FD was greater in HS barrows (2.22 ± 0.05 vs 2.08 ± 0.05 ; 3.29 ± 0.08 vs 3.00 ± 0.08 , respectively). PAY barrows had reduced ($P<0.0001$) ADG (0.96 ± 0.04 vs 0.75 ± 0.04 kg/d). In later finishing phases GHS pigs had greater LEA ($P = 0.03$; 40.13 ± 0.66 vs 38.15 ± 0.65 cm²); and PAY increased LEA at slaughter (54.89 ± 1.06 vs 48.85 ± 1.04 cm²). HS barrows had lower temperatures, which were increased by 110% lysine and PAY, indicating GHS barrows have the potential to maintain lower body temperatures and produce greater LEA at slaughter. Carcass quality measures were recorded, and a chop was used to determine pork quality measures. PAY increased HCW (100.24 ± 1.19 vs 99.36 ± 1.18 kg, $P=0.02$); LEA (54.89 ± 1.05 vs 48.85 ± 1.04 cm², $P<0.01$); pH (5.62 ± 0.02 vs 5.56 ± 0.01 , $P=0.01$); and reduced b* (8.15 ± 0.19 vs 8.66 ± 0.18 , $P=0.05$). PAY 110% barrows had reduced 10th rib backfat ($P=0.04$) compared to CTL 110% barrows (20.16 ± 1.26 vs 23.94 ± 1.23). 110% PAY barrows had greater LEAN compared to 100% CTL, 110% CTL, and 100% PAY barrows (54.61 ± 0.71 vs 52.16 ± 0.69 , 51.48 ± 0.69 , and 52.51 ± 0.69 %, $P<0.05$). At slaughter, samples were collected from the longissimus dorsi (LD) and semitendinosus (ST) for ATPase assay. The number and size of primary and secondary muscle fibers were determined. GHS increased secondary fibers in LD (58.17 ± 1.17 vs 60.90 ± 1.06 μ m; $P=0.09$) and ST (67.70 ± 1.36 vs 72.74 ± 1.40 μ m; $P=0.01$). GHS interactions with PAY were also found. There were positive correlations between shear force and LD primary ($r=0.31$, $P=0.01$) and secondary ($r=0.27$, $P=0.04$) and ST primary fibers ($r=0.30$, $P=0.03$). Heat stress during gestation altered muscle development, resulting in increased muscle fiber size at harvest and a

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tougher product. Rectal, ear, and rump temperatures and respiration rate (RR) were recorded twice weekly from 3 to 6 months of age for gilts (n=165). Room temperature ranged over time and time of day from 23.01°C-29.78°C. GHS pigs maintained body temperature with less effort, having lower RR (15.04±0.13 vs 15.83±0.15 breaths per min for GHS and GTN, respectively, P<0.001). Higher room temperatures at the time of measurement were associated with increased RR (12.28±0.49-19.62±0.49 breaths per min; P<0.001), though this did not differ by treatment. Gilts aged 193-198d were transported to Virginia Tech (TAREC). Estrus was recorded and synchronized to facilitate 68 litters born in four farrowing groups. GHS gilts tended to eat more during lactation (5.42±0.115 vs 5.12±0.114 kg/d; P=.07) with no effect on lactation weight loss. Numbers born, born alive or stillborn did not differ significantly by treatment, though numerically all favored GTN gilts (12.06±0.72 vs 12.94±0.72; 11.32±0.67 vs 11.76±0.67; 0.53±0.15 vs 0.47±0.15 for GHS vs GTN, respectively). GHS gilts tended to have lower piglet survival than GTN gilts (88.9±.02% vs 93.9±.02%; P=.08). A numerical non-significant difference of almost one piglet was observed favoring GTN gilts for total piglets weaned per litter (9.91±0.53 vs 10.85±0.53).