

consistent blood sampling time is necessary for determination of metabolite concentrations in neonatal beef calves, especially in pre-colostral samples. These data suggest that circulating metabolites at neonatal sampling times are more related after colostrum consumption.

**Key Words:** colostrum, metabolites, neonates  
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**317 Relationships between pig birth weight and expression of the immediate early gene EGR-1 in umbilical cord Wharton's jelly.** J. M. Morton\*, T. Rathbun, D. L. Davis, *Kansas State University, Manhattan.*

In humans the expression of EGR-1 in umbilical cord Wharton's jelly has been related to birth weight. In umbilical cords of small for gestational age (SGA) babies the expression of EGR-1 is increased compared to normal weight contemporaries. Expression of EGR-1 appears to indicate prenatal programming resulting from growth restriction. It is known that SGA babies develop slower compared to normal sized babies and in many ways are comparable to small birth weight pigs. Therefore we investigated whether EGR-1 expression in pig umbilical cord Wharton's jelly is related to birth and weaning weights. Fifty-seven umbilical cords were collected from 5 litters (PIC; 326 × 1050), along with birth and weaning weights. Wharton's jelly tissue was snap frozen and stored (−80°C) until RNA was extracted (Trizol method), RNA quantity determined using the Nanodrop method and quality was evaluated with an Agilent Bioanalyzer. Quantitative PCR was used to determine expression of EGR-1 compared to 18S and the data converted to relative expression using RNA from newborn pig testis as a calibrator. Birth weight ( $P < 0.003$ ) and wean weight at d 21 ( $P < 0.026$ ) were correlated negatively with EGR-1 expression. Larger pigs had decreased expression of EGR-1 compared to smaller pigs. The umbilical cords from the 14 pigs with the lowest expression of EGR-1 (bottom quartile) included only one pig with a birth weight < 1.11 kg while the top quartile included 9 pigs weighing less than 1.11 kg at birth ( $P < 0.002$ , chi square). In response to rising global demands for pork, swine producers have increased litter sizes and this has resulted in more small pigs at birth. We have identified that pigs with a birth weight below 1.11 kg have increased mortality rates by weaning age (3–4 wk). These pigs do not grow as well as their heavier contemporaries and result in lower value carcasses. Expression of EGR-1 in umbilical cords of low birth weight pigs appears to reflect prenatal programming comparable to that identified in SGA babies.

**Key Words:** pigs, prenatal programming, EGR-1  
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**318 Impact of cyclical heat stress during follicular development on ovarian TLR4, PI3K and steroidogenic proteins in synchronized post-pubertal gilts.** A. A. Al-Shaibi\*, B. J. Hale, C. L. Hager, J. W. Ross, L. H. Baumgard, A. F. Keating, *Iowa State University, Ames.*

Heat stress (HS) is caused by the sustained elevation of core body temperature due to high ambient temperatures. HS is associated with seasonal infertility, which results in economic losses for the swine industry. Hyperinsulinemia and metabolic endotoxemia are physiological hallmarks of HS, both of which potentially modulate ovarian function via the toll-like receptor 4 (TLR4), the receptor for LPS, and/or the phosphatidylinositol-3 kinase (PI3K) pathways. Our previous findings demonstrated that HS enhanced phosphorylation of ovarian AKT (pAKT), increased TLR4, steroidogenic acute regulatory protein (StAR), and aromatase (CYP19A) protein abundance in pre pubertal gilts exposed to 7 or 35 d of HS. The current study investigated whether HS also altered TLR4, PI3K and enzymes involved in steroid hormone production in heat-stressed, post-pubertal gilts. The estrous cycles of 12 post-pubertal gilts were synchronized using Matrix®, administered orally for 14 d, followed by exposure to thermal neutral conditions (TN; 20.3°C ± 0.1°C) or cyclical HS conditions (26–32°C) during follicular development (5 d) preceding ovulation. Both TN and HS gilts were limit-fed 2.7 kg/d for the duration of the study. HS gilts had increased ( $P = 0.01$ ) average rectal temperatures (39.8°C ± 0.2°) compared to the TN controls (38.8°C ± 0.2°) demonstrating hyperthermia in response to elevated ambient temperatures. Gilts were euthanized and ovaries collected for protein isolation and analysis. The abundance of ovarian pAKT, StAR, CYP19A and TLR4 were determined using western blotting. No impact ( $P > 0.05$ ) of HS on protein abundance of CYP19A or StAR was observed. TLR4 was increased ( $P < 0.05$ ) in ovaries from HS gilts relative to the TN controls. Additionally, HS decreased ( $P < 0.01$ ) phosphorylation of ovarian AKT, relative to TN gilts. These findings demonstrate that ovarian signaling is altered by HS: activation of TLR4 indicates an ovarian response to elevated, systemic LPS, while decreased pAKT may reflect reduced altered PI3K activity. These data provide mechanistic insight into ovarian physiological alterations that could contribute to seasonal infertility in post-pubertal swine. This work was supported by the Iowa Pork Producers Association.

**Key Words:** Heat Stress, TLR4, PI3K, AKT, Endotoxemia  
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