calves) and primiparous (n = 18; BW = 552 ± 15 kg; BCS = 5.0 ± 0.1; gestation length = 276.1 ± 0.8 d; 7 bull and 11 heifer calves) dams were monitored for time to stand and vigor score at 10 min of age (scored 1 = very weak to 5 = extremely vigorous). Calf weight and body size (shoulder to tailhead length, heart girth, abdominal girth, and cannon circumference) were measured at 20 ± 15 h of age. Ponderal index was calculated as birth weight (kg)/length (cm)^3. Calf jugular blood samples were obtained at 0 h (pre-suckling but post-standing) and analyzed for serum glucose, blood urea nitrogen, creatinine, albumin, total protein, and globulin. Expelled placentas were collected, rinsed, dissected to determine cotyledon number, and dried to determine dry weight. Data were analyzed using a mixed model containing the effect of parity. Calf sex was included in the model for body size measurements when $P < 0.25$. Placentas from multiparous dams tended to have greater ($P \leq 0.08$) whole placental and inter-cotyledonary weight. Calves from multiparous dams weighed more ($P = 0.04$) and had greater ($P = 0.006$) abdominal girth at birth. Serum creatinine at 0 h was greater ($P = 0.047$) in calves from primiparous than multiparous dams. All other energy and protein metabolites were not different ($P \geq 0.17$) between parities. Additionally, parity did not affect ($P \geq 0.70$) calf vigor. These results indicate that fetal growth and whole placental weights are likely affected by dam parity. However, because most 0 h energy and protein metabolites were not affected by parity, its influence on calf nutrient availability may be more evident earlier in gestation than at birth.

Key Words: parity, fetal growth, placenta

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143 Heat Stress Mitigation Strategies for Boars and Impact of Most Effective on Sperm Parameters.

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Thermal conditions were measured with temperature and humidity sensors (Onset® Hobologgers) in eleven commercial boar studs in five states. Large White x Landrace F1 boars (n=12; Choice Genetics®) were exposed to representative summertime conditions (heat stress, HS; 22 to 25°C) and heat wave conditions (HW; 25 to 32°C) utilizing the Brody Environmental Chambers at the University of Missouri. Neck and testicular drippers (1 gph) with and without forced air (100 cfm) were applied directly to each boar in a Latin square design with three day periods. Nooyen's® Cool Sow Floor was tested with each boar under HS and HW using a switchback design with a seven day period. Shoulder, ear, scrotal, and rectal temperatures as well as respiration rate at 0700 and 1500 hours were recorded. Boars were implanted surgically with two temperature sensing telemetry devices (Anipill® Temperature Implant): one implanted between the peritoneum and the body wall (core temperature); the other sutured between the testicular tunics (testicular temperature). Boar temperatures were analyzed using PROC MIXED (SAS 9.4). Least squares means were calculated after nonsignificant effects and interactions were removed in a stepwise fashion. The treatment most effective at creating the largest difference between treatment and control was the combination of drippers and fans on both scrotum and neck. Subsequently, this was applied to six boars (TRT) and six received no cooling (control) with all under HS. The implanted device data showed that the treatment boars had significantly lower testicular temperatures than control (32.90°C vs. 33.90°C, p-value = 0.002). However, core temperature did not vary significantly between boars. After two months boars were slaughtered and sperm collected from the epididymides of each boar. Sperm analysis was conducted using an image based flow cytometer measuring DNA fragmentation (TUNEL) ubiquitination (anti-ubiquitin/UBB antibody), surface glycosylation (lectin LCA), and acrosomal abnormalities (lectin PNA). Critical thresholds for each trait were identified as percentage of sample: TUNEL less than 5%, UBB less than 30%, LCA less than 10% and PNA greater than 50%. Cooling was effective at mitigating the impact of heat stress on sperm quality parameters, with a higher proportion of TRT boars meeting sperm quality targets (n TRT vs n CONTROL, 6 vs. 4 for TUNEL, 4 vs. 2 UBB, 4 vs. 2 LCA, and 4 vs. 1 for PNA respectively). Even under relatively mild thermal stress representative of commercial boar studs in the US, opportunities to improve sperm quality through cooling exist.

Key Words: swine, heat, sperm

GRADUATE STUDENT ORAL COMPETITION: PHD I

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144 Evaluation of Phase-Feeding Strategies and Lysine Specifications for Grow-Finish Pigs on

	MAX	STD	STD/MAX	2-PHASE	SEM
d 0 to 117					
ADG, kg	0.876[ab]	0.855[b]	0.870[ab]	0.880[a]	0.006
ADFI, kg	2.29	2.26	2.28	2.29	0.022
G:F	0.382	0.379	0.381	0.385	0.003
HCW, kg	94.2	92.7	94.0	94.6	0.810
Lean, %	57.0	56.6	56.6	56.7	0.222
Feed cost/kg gain, $	0.468[a]	0.454[b]	0.464[a]	0.469[a]	0.003
IOFC, $/pig	65.08	65.41	65.72	65.42	0.827

[ab]$P<0.05$.

Growth Performance and Carcass Characteristics. M. B. Menegat*, S. S. Dritz, M. D. Tokach, J. C. Woodworth, J. M. DeRouchey, R. D. Goodband, *Kansas State University, Manhattan, KS*

The objective of this study was to compare phase-feeding strategies for grow-finish pigs using the estimated Lys requirements for optimal growth and feed efficiency compared to a standard strategy. A total of 1,188 pigs (PIC 359 × 1050, initial BW 28 ± 0.8 kg) were used in a 117-d growth trial with 27 pigs per pen and 11 pens per treatment in a randomized complete block design. Treatments consisted of: MAX, a 4-phase feeding program with Lys levels for maximum growth (1.13, 0.96, 0.82, and 0.77% standardized ileal digestible (SID) Lys in phases 1-4, respectively); STD, a standard 4-phase feeding program for optimal income over feed cost (IOFC; 1.02, 0.87, 0.76, and 0.67% SID Lys in phases 1-4, respectively); STD/MAX, a 4-phase feeding program with standard Lys levels in early finishing and Lys levels for maximum growth in late finishing (1.02, 0.87, 0.82, and 0.77% SID Lys in phases 1-4, respectively); and 2-PHASE, a 2-phase feeding program based on average estimated Lys requirements for maximum growth with 0.96% SID Lys for phases 1-3 and 0.77% SID Lys during phase 4. The 4 phases were from approximately 27-50, 50-72, 72-100, and 100-127 kg BW. Pigs fed the 2-PHASE regimen had increased ADG ($P<0.05$) compared to pigs fed the STD regimen, and feeding either the MAX or STD/MAX regimen was intermediate. There was no evidence for differences in ADFI, G:F, final BW, or in carcass traits (HCW, yield, backfat, loin depth, and lean percentage). The STD feeding program resulted in the lowest ($P<0.001$) feed cost per pig and feed cost per kg of gain. Revenue and IOFC were similar across the feeding programs. In conclusion, feeding Lys levels for maximum growth and efficiency in either a 2- or 4-phase feeding program results in the same growth performance and feed cost. Thus, feeding a simpler 2-phase program may have benefits in reducing feed manufacturing costs and increasing overall economic return. Also, this suggests the range in Lys specifications tested herein can be utilized in grow-finish diets without compromising IOFC.

Key Words: feeding regimen, finisher, swine

145 Tributyrin Supplementation to Neonatal Piglets Enhances Muscle Growth through Modified Satellite Cell Behavior. R. L. Murray*, W. Zhang, M. E. Iwaniuk, C. H. Stahl, *University of Maryland, College Park, MD*

The sustainability of the swine production relies on efficient lean growth. Postnatal muscle growth is dependent on myonuclear accretion and subsequent protein accumulation. Altering the ability of muscle resident stem cells (satellite cells, SC), which provide for nuclear accretion, to progress through their myogenic lineage can have lifelong effects on muscle growth. The use of butyrate, a histone deacetylase (HDAC) inhibitor, has promoted satellite cell myogenesis *in vitro*. In animal models, dietary butyrate has improved growth performance, but the impact of dietary butyrate on SC activity and the direct promotion of muscle growth have not been examined. In two studies, we utilized dietary tributyrin, a prodrug of butyrate, to examine the potential of butyrate as a muscle growth promoter in neonatal piglets. Study 1, 30 neonatal piglets (24 ± 6h old) were fed a commercial milk replacer supplemented with 0.25% or 0.5% butyric acid (on a dry matter basis) in the form of tributyrin for 20d. Muscle tissue and SC were then harvested from the *Longissimus dorsi* (LD) to assess muscle growth and SC myogenesis. Tributyrin treatment increased the myogenic potential of SC based on increased myotube formation and an upregulation of myogenin gene expression. Also, piglets receiving the higher dietary tributyrin inclusion rate had significantly increased myonuclear accretion ($P<.05$), further indicating the potential for enhanced muscle growth. However, at the end of this study, there were no significant improvements in growth performance parameters. In order to further assess muscle growth potential, tributyrin supplementation during the pre-weaning and nursery phases was examined in a 2x2 factorial design. Piglets (30, 24 ± 6h old) received milk replacer with or without tributyrin (0.5% butyric acid) for 20d then were weaned onto a dry diet either with or without tributyrin for 37d. At trial completion (58d of age), LD muscle samples were collected at the 12th rib to assess muscle growth. Piglets who received tributyrin during the neonatal phase had 8% greater final body weight ($P<.05$) and a 9% increase in overall ADG ($P<.05$). These piglets also had larger loin eye area and greater muscle fiber cross-sectional area (assessed