

Animal Behavior and Well-Being 1

175 Effects of oxytocin administration in early life on the behavioral and physiological stress response of swine. J. L. Rault^{*1}, C. S. Carter², J. P. Garner¹, J. N. Marchant-Forde³, B. T. Richert¹, and D. C. Lay³, ¹*Department of Animal Sciences, Purdue University, West Lafayette, IN*, ²*Department of Psychiatry, University of Illinois at Chicago, Chicago*, ³*USDA-ARS-Livestock Behavior Research Unit, West Lafayette, IN*.

The swine industry is moving toward the group-housing of sows. However, group-housing can result in increased aggression and social stress, with detrimental effects on swine health and productivity. In contrast, positive social relationships can reduce the adverse effects of social stress. This could be mediated by oxytocin (OT), a neuropeptide underlying social behavior, possibly by buffering the hypothalamic-pituitary-adrenal (HPA) axis. We hypothesized that stimulating the oxytocinergic system of piglets early in life, by chronic postnatal OT administration, could provide long-term protective effects against social stress. In each of 6 litters, 2 piglets per litter received 0.25 mL (24 IU or 50 µg) of OT intranasally (OT) and 2 control littermates received 0.25 mL of saline (SAL) on postnatal d 1, 2 and 3. Each piglet was weaned at d 19 and mixed into a pen with 4 unfamiliar piglets. This social mixing was repeated from the nursery to growing phase at 8 wk of age. On each occasion, we collected videos to analyze behavior and blood samples to analyze cortisol, adrenocorticotrophic hormone (ACTH), and immunological parameters over 3 d post-mixing. The pigs were then submitted twice to a resident-intruder test at 10 wk of age, and finally to a dexamethasone-corticotrophic releasing hormone (Dex-CRH) challenge at 11 wk of age. Results were analyzed using a mixed model in SAS. Pigs given OT had higher ACTH concentrations than SAL pigs 24 h after weaning ($P < 0.05$) and mixing at 8 wk ($P < 0.1$). Yet, cortisol concentrations did not differ between treatments ($P > 0.1$). The Dex-CRH challenge revealed that OT pigs were less responsive to dexamethasone than SAL pigs ($P < 0.05$). At 24 h after weaning, OT barrows had a higher neutrophil:lymphocyte ratio compare with other pigs ($P < 0.05$). The behavior of OT pigs did not differ from SAL pigs after mixing ($P > 0.1$), nor did weight gain from birth to slaughter ($P > 0.1$). Administrating OT in early life modified the HPA axis. Contrary to our prediction, OT may have dysregulated the negative feedback loop of the HPA axis, leading to detrimental consequences in coping with social stress.

Key words: group-housing, oxytocin, behavior

176 Flavor preferences in sucking piglets conditioned by prenatal flavor exposure through the maternal gestation diet. J. Figueroa^{*}, D. Solà-Oriol, R. Davin, X. Manteca, and J. F. Pérez, *Universitat Autònoma de Barcelona, Bellaterra, Barcelona, Spain*.

Volatile compounds of the maternal diet are known to be transmitted to the gravid uterus during pregnancy. Such uterine experience may affect later olfactory preferences. The aim of this study was to examine the influence of prenatal flavor exposure via mother's diet in the flavor preferences on sucking piglets. During late gestation (14d) 20 sows were assigned to one of 2 treatments; a flavored diet (Anis, 0.075% or Vanilla, 0.15%; $n = 10$) and an unflavored diet ($n = 10$). Eighty male/female piglets coming from these 20 sows (4 piglets/litter) were used to test their attraction for 3 olfactory stimuli (triple-choice feeding test) using a Triple-U-Testing Arena (TUTA) located in an isolated room at d 14, 21 and 26 (2-postweaning days) after farrowing. Olfactory cues tested included strips impregnated with anis, vanilla, and water in the

middle as negative control. The mother's gestational feed flavor (MFF) and control flavor (CF) were identified in each sow depending on the flavored pregnancy diet. The position of MFF and CF were rotated in each test. Piglets were tested in litter-pairs. Each test lasted 7 min, during which, the time spent by piglets in nasal contact with each strip was measured by direct observation. The average of the 2 couples per sow was analyzed using the GENMOD procedure of SAS. Piglets born to flavor-treated sows showed preferential responses toward MFF at d 14 (3.6 s/couple), 21 (3.8 s/couple) and 26 (2.9 s/couple) as compared with CF (0.7, $P < 0.001$; 0.55, $P < 0.001$ and 0.11, $P < 0.01$ s/couple) and water (0.3, $P < 0.001$; 0.95, $P < 0.01$ and 0.2, $P < 0.001$ s/couple). No different preferences were observed among flavors for control piglets. These results show that prenatal exposure to flavors via maternal diet influences piglet's preferences, probably through a positive association between the flavor and the hedonic power of the uterine experience. These preferences acquired before birth are highly resistant to extinction. This may help to spark interest for novel feeds by reducing neophobia, such as during sucking or weaning period occurs.

Key words: amniotic fluid, flavors, preference

177 Preference in weanling pigs for sweet or umami taste after in utero exposure. S. J. Chavez^{*1}, E. van Heugten¹, I. Ipharraguerre², and G. B. Huntington¹, ¹*North Carolina State University, Raleigh*, ²*R&D Feed Additives, Lucta S.A., Barcelona, Spain*.

Weaning is a very stressful time transitioning the pig from a milk diet to solid feed. The addition of familiar flavors to the piglet diet has reduced stress and improved animal performance during the first several days post-weaning. The objectives of the experiment were to investigate the role of taste perception associated or not with increased nutrient supply in determining preference after weaning and determine if the taste of gestation or lactation diets influence weanling preference. Twenty sows in second or greater parity were randomly assigned to 1 of 5 diets and blocked into a sweet or umami group with a control (CON) in each group. The sweet group consisted of the CON, sucrose (SU), and non-caloric sweetener (SW), while the umami group consisted of CON, monosodium glutamate (MSG), and glutamate-free umami additive (UM). The SU was added at 5.0% of the diet, SW at 0.1%, MSG at 1.5%, and UM at 0.05%. Sows were fed 2.27 kg/d of their respective treatment diet beginning on d 10 of gestation. At farrowing, sows were given a lactation diet in the same treatment, while pigs were cross-fostered across treatments within sweet or umami groups. Pigs were weaned at 21-d and placed into pens (1.73m x 0.83m) of 2–4 pigs/pen with 2 feeders/pen. Pens were given 3-d double-choice preference tests. Data were analyzed using the t-Student test with significance at $P < 0.05$. In the sweet group, when SU was provided, pigs chose SU over 75% of the time for all preference tests that included SU. In the umami group, when MSG was provided, pigs chose MSG 80% of the time for all preference tests with MSG. Pigs in the UM group preferred ($P < 0.02$) MSG over CON, preferred ($P < 0.03$) MSG over UM, but there was no preference ($P > 0.16$) for UM over CON. The SU and SW pigs preferred ($P < 0.02$) SU over CON, control pigs preferred ($P < 0.01$) SW over CON, and SU and control pigs preferred ($P < 0.02$) SU over SW. In conclusion, pigs had a stronger preference for sweet and umami tastes associated with increased nutrient supply, which likely resulted from the expected interplay between chemosensory perception and post-ingestive effects.

Key words: preference, sweet, umami

178 The effects of group size on aggression when mixing unacquainted sows in indoor pens. J. N. Marchant-Forde^{*1}, J. P. Garner², A. K. Johnson³, R. M. Marchant-Forde², and D. C. Lay Jr.¹, ¹USDA-ARS, West Lafayette, IN, ²Purdue University, West Lafayette, IN, ³Iowa State University, Ames.

As the US swine industry moves toward group housing sows, it is important to increase our understanding of aggression. Sows fight at mixing and this project aimed to determine the amount and type of aggression observed when unacquainted York × Landrace sows were mixed in pairs or in 2 established sub-groups of 3. Treatment 1 (PR) used 11 pairs of sows mixed into a 6.2 m² pen. Treatment 2 (GP) used 14 unacquainted groups of 3 sows, with 2 groups mixed into a 19.2 m² pen. Behavior was recorded continuously for 60 min post-mixing and all-occurrences sampling was used to extract social interactions. The data were analyzed to determine the number of social interactions that did or did not contain aggressive components (i.e., pushing, knocking or biting) and fighting defined as interactions that contained 10 or more reciprocated, aggressive component actions. Within each interaction, data were analyzed to determine the number of component actions and the number of aggressive component actions. The data were compared using a GLM, with treatment as a fixed effect. The number of social interactions was higher in groups (54.3 ± 3.7) than pairs (20.9 ± 2.9, $P < 0.001$). The number of interactions that contained aggression was similar (15.4 ± 1.8 v. 10.3 ± 1.5, $P > 0.05$), but GP interactions contained more aggressive components (26.4 ± 2.4) than PR interactions (6.8 ± 0.4, $P < 0.001$). All PR pairs fought and aggression escalated from pushes, to knocks, to bites. In GR mixing, 13.7 ± 0.4 of the 15 possible pair combinations interacted socially, of which 8.1 ± 0.8 interacted aggressively and 4.0 ± 0.4 fought. A higher proportion of unacquainted pairs engaged in aggressive interactions (0.71 ± 0.11) and fighting (0.43 ± 0.04) than acquainted pairs (0.29 ± 0.07 and 0.02 ± 0.02 respectively, both $P < 0.05$). Bites were delivered first, then knocks, then pushes. The results indicate that sows mixed in pairs appear more circumspect, but that escalation and fighting appear inevitable, whereas in group mixing, aggression is more immediate, but not universal. The results further our understanding of aggression at mixing and will help us to determine best practice for producers.

Key words: pigs, aggression, mixing

179 Glucosamine:chondroitin or ginger root extract have little effect on articular cartilage in swine. D. C. Lay Jr.^{*1}, J. N. Marchant-Forde¹, B. T. Richert², and K. A. McMunn¹, ¹Livestock Behavior Research Unit; Agricultural Research Service-USDA, West Lafayette, IN, ²Purdue University, West Lafayette, IN.

Sows are culled at a high rate from breeding herds due to musculoskeletal problems and lameness. Research in our laboratory has shown that even first-parity sows have significant amounts of osteochondritic lesions of their articular cartilage. Glucosamine chondroitin and ginger root extract have both been proposed as cartilage building supplements. Gilts (n = 30) were assigned to receive a daily dose of 1,500 mg glucosamine + 1,200 mg chondroitin complex (GC sows); 300 mg ginger root extract; or serve as controls. All gilts started on treatments at 3 mo of age and were maintained on diets through 2nd parity. After weaning, they were slaughtered to evaluate their articular cartilage. Cartilage was scored on scale from 0 to 4, defined as smooth to severely damaged. Hooves were scored on a scale from 0 to 3, defined as minimum cracks to deep splits. Cartilage thickness was measured by weighing 4, 6 mm biopsies taken from the articular cartilage. In addition, cross sections on the head of the femur and humerus

were used to measure cartilage thickness. Cortical bone thickness was measured on both the femur and the humerus. Blood samples were collected every 4 wk (3 times) during gestation to measure differential leucocyte counts and erythrocyte sedimentation rate. Cartilage on the head of the humerus was thicker ($P < 0.02$) for sows on ginger root supplement compared with sows on control diets, with GC sows being intermediate ($P < 0.05$). However, no other measures of the quantity or thickness of cartilage or bone were different between treatments ($P > 0.10$). Osteochondritic lesions were evident in 100% of the animals on study. Erythrocyte sedimentation rate only tended to be slower for control sows compared with either supplemented group ($P < 0.12$); while mean corpuscular volume was lower ($P < 0.02$) for controls compared with gingerroot sows with GC sows intermediate. These data indicate that the level and duration of these supplements used in this study are not effective in making appreciable differences in the joint health of swine, and thus will not prove effective in increasing sow longevity and soundness through 2 parities.

Key words: swine, lameness, cartilage

180 Market pig transport losses, surface temperatures and trailer air temperatures with medium or heavy bedding on the trailer. A. Sapkota^{*1}, B. L. Davis¹, A. Butters-Johnson², and J. J. McGlone¹, ¹Texas Tech University, Lubbock, ²Iowa State University, Ames.

The USA Trucker Quality Assurance program calls for the use of bedding in the trailers during transport of market pigs. Level of bedding typically varies with season and weather. The amount of bedding used during transportation of market weight pigs is not based on available science. Bedding use in different quantities may be both an economic and animal welfare concern. The objective of this study was to evaluate different amounts bedding during cold weather transport of market pigs (outside air temperatures -13.4 to 13.9 C). Trailers (n = 32 loads of approximately 165 pigs each) were fit with 6 (M) or 12 (H) bales (1 bale = 0.2 m³) of wood shavings to be used in the trailers during transportation (representing depths of 16 and 26 mm). Measures included surface temp of pigs at finishing site and at packing plant, changes in temp. inside truck during loading, trip, stops during trip, wait at plant, unloading, and number of dead on arrival (DOA), killed on arrival (KOA), dead in pen (DIP), non-ambulatory non-injured (NANI), non-ambulatory injured (NAI). Pigs were transported for 225 to 450 min. Trucks were 60% to 95% boarded (vents in the sides of trailers blocked). Statistical model included effects of bedding level, observer, bedding*observer interaction, and unloading times and boarding as covariates. Trailers at times arrived at farm sites with bedding frozen. During pig loading, inside trailer temp. increased 0.32 and 0.18 C/min for H and M, respectively ($P < 0.001$). During transport, H trailers increased ($P < 0.001$) inside air temp. (0.01 C/min) while M trailers did not increase inside air temp. (-0.008 C/min). Inside trailer air temp. when trailers arrived at the plant were 9.5 ± 1.9 C warmer ($P < 0.01$) for H than M trailers. Rates of DOA+KOA+DIP were 0.5 ± 0.2 and 0.1 ± 0.1 for H and M trailers ($P > 0.05$). Surface temp. of pigs upon arrival were 20.3 ± 1.4 C and 19.7 ± 1.6 C for H and M trailers ($P > 0.05$). More data are needed to clarify effects and data collection is ongoing. More bedding may provide a warmer inside air temp. but may pose a risk of increased pig deaths during cold weather transport.

Key words: pigs, animal welfare, transport

181 Brain lesions and time to death resulting from application of a non-penetrating captive bolt to anaesthetized nursery piglets. T. M. Casey-Trott¹, R. Brooks², P. V. Turner¹, S. G. Nykamp¹, M. Litman¹, S. T. Millman², and T. M. Widowski*¹, ¹University of Guelph, Guelph, Ontario, Canada, ²Iowa State University, Ames.

A previous study indicated that a non-penetrating captive bolt (NPCB) was effective for euthanasia of 100 neonatal piglets based on immediate and sustained insensibility until full cardiac arrest. The objective of the current study was to assess the brain lesions caused by a NPCB in 20 piglets in 4 weight classes (n = 5 piglets: 3, 5, 7, or 9 kg) as compared with brain lesions of the neonatal piglets from the previous study. Since this was a novel technique for piglets ≥ 5.5 kg, they were anaesthetized with 71.4 mg/ml ketamine, 14.3 mg/ml xylazine and 1.4 mg/ml butorphanol 0.2 mL/kg IM before NPCB application to ensure insensibility. The NPCB was placed on the frontal bone between the eyes and fired twice in rapid succession, followed by one shot to the back of the skull behind the ear. Piglets were monitored for rhythmic breathing, neuromuscular leg spasms, and heart beat until full cardiac arrest. Macroscopic, histological, and CT scans were scored

post mortem to assess degree of skull fracture and hemorrhage. One piglet required an additional shot following a misfire due to presence of rhythmic breathing. Breathing was immediately absent in all other piglets. Leg spasms ceased in 148 s (± 12.4 SE). An alternative method (sodium pentobarbital 100 mg/kg) was required for one piglet due to sustained heartbeat. All other piglets reached full cardiac arrest in 371 s (± 17.9 SE). Moderate to severe macroscopic damage was reported in $\geq 90\%$ of piglets. Histological analysis showed moderate to severe subdural (SD) hemorrhage and mild to moderate parenchymal (P) hemorrhage. Fracture displacement (FD) averaged 9.38 mm (± 0.84 SE). In comparison to the brain lesions of neonatal piglets, damage was less severe in anaesthetized piglets (Mann-Whitney test for ordinal data: SD: $P = 0.007$; P: $P = 0.041$) despite greater FD (t -test: $P = 0.019$). Although brain damage in the anaesthetized piglets was less severe than that of the conscious neonates, the NPCB still caused parenchymal brain lesions and effectively induced cardiac arrest. The next trial will test the effectiveness of the NPCB on conscious piglets up to 9 kg.

Key words: euthanasia, piglet, brain lesion