

Animal Behavior and Well-Being IV

728 A comparison of three animal welfare assessment programs on Canadian swine farms. A. N. Roberts^{*1}, P. Lawlis², R. Bergeron³, and T. M. Widowski¹, ¹University of Guelph, Guelph, Ontario, Canada, ²Ontario Ministry of Agriculture and Food, Woodstock, Ontario, Canada, ³University of Guelph Alfred, Alfred, Ontario, Canada.

Standard measures used in animal welfare assessments include animal-based measures (ABM) obtained by observing animals (e.g., body condition score and health measures), resource-based measures (RBM) obtained by observing facilities (e.g., non-slip flooring in walkways), and management-based measures (MBM) obtained by interviewing farmers and checking records (e.g., written euthanasia plan). It is widely accepted that it is easy to train assessors to use RBMs and MBMs with good reliability, whereas ABMs are considered to be more direct measures of animal welfare but more difficult to achieve good agreement among assessors. However, few measures have been systematically tested. Our objectives were to investigate inter-observer reliability (IOR) of different measures used in 3 current pig welfare assessment programs [PQA Plus, USA; Canadian Animal Care Assessment (ACA); and European Welfare Quality (WQ)] and to determine the concordance of scores across the 3 assessments. Data were collected on 5 grow-finish farms using a group of 10 trained assessors who conducted assessments on the same farms simultaneously. Individual dichotomous MBMs used in the assessments were analyzed quantitatively for inter-observer reliability using the kappa statistic. The kappa values for the ACA and PQA were 0.882 and 0.808 ($P = 0.05$) respectively, showing a very high level of agreement for data from 4 assessors present on all 5 farms. Overall results (ACA and PQA = Pass/Fail, WQ = Excellent, Enhanced, Acceptable or Not Classified) on 20 individual farrow-to-finish farms done by 2 observers were compared qualitatively to determine concordance among the 3 assessment programs in scoring individual farms. For 4 sample farms WQ scores (using primarily ABMs) categorized the welfare of the pigs on those farms as "Enhanced" whereas ACA and PQA (using primarily record-keeping MBMs) resulted in Failing scores for those same farms. These results indicate that MBMs are, in fact, highly reliable, but may not be concordant with ABMs. Results of this study can be used to identify the best measures and revise training programs for on-farm animal welfare assessments.

Key Words: animal welfare assessment, swine

729 A role for serotonin in piglet preweaning mortality. R. L. Dennis^{*}, K. A. McMunn, D. C. Lay Jr., and H. W. Cheng, *Livestock Behavior Research Unit, USDA-ARS, W. Lafayette, IN.*

Improving piglet survivability rates is of high priority for swine production as well as for piglet well-being. Dysfunction in the serotonin system has been associated with growth deficiencies, infant mortalities or failure to thrive (FTT) in human infants. The aim of this study was to examine the role of serotonin in infant mortality and FTT in piglets. Umbilical blood was collected at birth from a total of 60 piglets from 16 litters for analysis of serotonin (5-HT) and tryptophan (the amino acid precursor to 5-HT) concentrations. Piglets were then followed for 48 h to determine early survival. Brain samples were also taken at 8 h after birth from healthy and FTT piglets ($n = 4$). The raphe nucleus, the center for brain 5-HT biosynthesis, was dissected out and analyzed for 5-HT and 5-HIAA (a major metabolite of 5-HT) concentrations. Data were analyzed by ANOVA using SAS 9.2 software. Piglets that died

within 48 h of birth ($n = 14$) had significantly lower umbilical blood 5-HT concentrations at the time of their birth compared with their healthy counterparts ($n = 46$; $P = 0.003$). However, no difference in tryptophan was detected ($P = 0.38$). In the raphe nucleus FTT piglets had a higher concentration of 5-HIAA ($P = 0.02$), and seemingly higher concentrations of 5-HT ($P = 0.07$), compared with healthy piglets. Our results show evidence of serotonergic dysfunction, at both the central and peripheral levels, accompanying early piglet mortalities. These data suggest a possible route for intervention, via the serotonin system, to improve piglet survivability. However, further research is required to validate this hypothesis.

Key Words: serotonin, preweaning mortality, swine

730 Effects of alternative farrowing systems on sow productivity and piglet growth, behavior, and mortality. L. A. Mack^{*1}, S. P. Rossini¹, S. J. Leventhal², and T. D. Parsons¹, ¹University of Pennsylvania, School of Veterinary Medicine, Kennett Square, ²University of Delaware, Newark.

Throughout gestation and lactation, commercial sows are usually housed in crates that limit locomotion and natural behavior. Welfare concerns are motivating housing changes during gestation. In lactation, farrowing crates present similar welfare challenges as gestation crates for the sow; however lactational housing also affects piglet welfare. A better understanding of various farrowing systems could benefit both the sow and piglets. Sows and litters were housed in either: (1) a standard farrowing crate, 1.0 m²/sow ($n = 19$); (2) a hinged crate that when opened 2 wk after parturition provided turn-around space for the sow, 1.6 m²/sow ($n = 19$); or (3) a thinly bedded pen, 6.0 m²/sow ($n = 20$). Performance data was collected through lactation. At 27.26 \pm 0.59 d of age, 2 female piglets per litter from the standard crate and pen treatments were separately observed in a 3.24 m² open field arena containing a novel food, a strawberry-filled cookie. The following day, the same pigs were placed in the arena along with an unfamiliar sex-, age-, and treatment-matched pig for a 5 min social behavior test. Data were analyzed using PROC GLIMMIX (SAS 9.3) with treatment, sow parity, and their interactions as main effects. Neither gestation length nor litter size differed. At 12.8%, 9.1%, and 1.3%, the percentages of stillborn pigs and mummies did not statistically differ between standard crates, hinged crates, or pens, respectively. Litter birth weights were greater in standard crates than pens ($P = 0.05$). However, neither growth rates nor litter weaning weights differed. At 29.4%, penned litters had greater preweaning mortality than standard (10.3%, $P < 0.001$) or hinged (15.2%, $P = 0.005$) crated litters. Crated piglets ate/rooted at the cookie less ($P = 0.04$) and defecated more ($P = 0.04$) than penned piglets in the isolation test. In the social test, crated piglets attempted more escapes ($P = 0.04$) and were in physical contact with the other pig longer ($P = 0.02$) than penned piglets. Housing litters in pens increased piglet mortality, but decreased fearful behavior suggesting that with improvement pen housing may offer better sow and piglet welfare.

Key Words: swine, housing, welfare

731 Establishing boarding level requirements while transporting finishing pigs from farm to packing plant. A. Sapkota^{*1}, A. K. Johnson², and J. McGlone¹, ¹Laboratory of Animal Behavior, Physiology and Welfare, Texas Tech University, Lubbock, ²Department of Animal Science, Iowa State University, Ames.

The Trucker Quality Assurance Handbook published by the National Pork Board suggests use of different boarding levels depending on outside air temperature. The objective of this study was to evaluate boarding levels over different outside air temperatures. Average air temperature was $8.8 \pm 0.30^{\circ}\text{C}$ (range: -0.6 to 23.3°C ; $n = 301$). Outside RH was $71.7 \pm 1.12\%$ (range: 19 to 100%; $n = 301$). Outside temperature was divided into 3 bins: $<5^{\circ}\text{C}$, 5 to 10°C , and $>10^{\circ}\text{C}$ and boarding levels were also divided into 3 bins low % (0–30%), medium (31–60%) and high ($>61\%$). Measures included average wait time at plant, skin surface temperature on 10 randomly selected pigs in each trailer at the packing plant, number of dead on arrival (DOA), non-ambulatory non-injured (NANI), non-ambulatory injured (NAI), and total losses (TL). PROC GLM was conducted in SAS 9.3 and the statistical model included effect of boarding level using trailers as experimental unit, and outside air temperature and bedding level as covariates. Average wait time at the plant before unloading was 43.7 ± 1.74 min (range: 0 to 161 min; $n = 234$). Average DOA, NANI, NAI, and TL were 0.3 ± 0.04 , 0.12 ± 0.02 , 0.04 ± 0.01 , and $0.46 \pm 0.05\%$, respectively ($n = 302$). The DOA, NANI, and NAI were not affected by boarding level ($P > 0.05$) when outside air temperature and bedding levels were used as covariates. The TL was higher when boarding percentage was low compared with medium and high (0.92, 0.22 and 0.23, respectively; $\text{SEp} = 0.18$; $P < 0.05$) when temperature was $<5^{\circ}\text{C}$. When air temperature was lower than 5°C , the low level of boarding increased transportation losses. However, variations in boarding level (medium and high boarding) from 5 to 10°C did not affect pig losses.

Key Words: pig, boarding, welfare

732 Bedding level on trailers during warm weather and effects on transport losses of market weight pigs. R. K. Kephart^{*1}, A. K. Johnson¹, K. J. Stalder¹, T. W. Huiatt¹, A. Sapkota², and J. J. McGlone², ¹Iowa State University, Ames, ²Texas Tech University, Lubbock.

Bedding is provided on the trailer to reduce slips and falls, provide comfort, and absorb pig waste. However, during warm weather, incorrect bedding levels may result in heat stress. To determine the relationship between bedding levels on the trailer and transport losses in market weight pigs, 76 trailers ($n = 19,599$ pigs) were used in a randomized design. In June and July of 2011 in the Midwestern US, 3 or 6 bags of wood shavings/trailer ($0.2 \text{ m}^3/\text{bale}$) were randomly assigned. Ten pigs/load had surface temperature (ST; average $32.6 \pm 3.1^{\circ}\text{C}$) measured laterally near the midline with a dual laser infrared thermometer. During loading, ambient temperature (average $26.9 \pm 5.7^{\circ}\text{C}$) and relative humidity (average $73.3 \pm 19.1\%$) were measured using a mini thermo-anemometer. Temperature humidity index (THI) was then calculated using the following equation (NOAA, 1976): $T - \{[0.55 - (0.0055 \times \text{RH}_{\text{dec}})](T - 14.5)\}$. Pigs were transported (average 2.6 ± 0.7 h) to a commercial plant. Pigs/trailer (average 173 ± 3 pigs) and average weight of pigs on that trailer (average 121.8 ± 5.7 kg) were used to calculate density of pigs on the trailer (Fitzgerald, 2009): (pigs/trailer)(average weight)/(m^2 floor space in trailer). At the plant, the number of non-ambulatory (sum of fatigued and injured) and dead (sum of dead on arrival and euthanized on arrival) were recorded. Total losses (TL) were summed from dead and non-ambulatory pigs. Data were analyzed using PROC GLIMMIX of SAS; trailer of pigs was the experimental unit. The THI, transport time, ST, and density were used as covariates. Site was used as a random effect. There was no difference between bedding levels for non-ambulatory ($P = 0.12$), dead ($P = 0.94$), or TL ($P = 0.40$). Since bedding adds substantial costs to transport and there is no evidence of deleterious effects of decreased bedding level on the pig performance, less bedding may

be used when transporting market weight pigs during warm weather in the Midwestern US.

Key Words: bedding, market-weight pig, transport losses

733 Measuring the efficacy of flunixin meglumine for lame sows using nociceptive threshold tests. M. D. Pairis-Garcia^{*1}, S. T. Millman⁴, L. A. Karriker², K. J. Stalder¹, J. F. Coetzee³, and A. K. Johnson¹, ¹Animal Science, Iowa State University, Ames, ²Swine Medicine Education Center, Iowa State University, Ames, ³Cyclone Custom Analyte Detection Services (CYCADS), Iowa State University, Ames, ⁴Veterinary Diagnostic and Production Animal Medicine, Iowa State University, Ames.

Lameness in breeding swine has a large negative economic impact and is a welfare concern. In the US, flunixin meglumine (FM) is labeled for the control of pyrexia associated with swine respiratory disease. Although FM is not labeled for pain in pigs, it can be used to alleviate pain under AMDUCA. Pressure algometry and thermal tests are non-invasive methods to quantify pain sensitivity using nociceptive thresholds (NT) to provoke withdrawal responses of lame and sound limbs. The objective of this work was to determine the effects of FM on NTs in lame sows. Lameness was induced in 24 mature mixed parity sows (241.4 ± 15.5 kg) on Day 0 using a chemical synovitis model during 2 trials (T1, T2). Two treatments were compared: FM (2.2 mg/kg) and sterile saline (S; comparable volume to FM administered) with 12 sows receiving FM in T1 and 12 in T2. On D1 and D2 each sow was injected IM in the neck with FM or S. Data were collected at the following time points (TP): baseline (D0; TP0), 24 h post lameness induction (D1; TP1), 48 h post lameness (D2; TP4), 72 h post lameness (D3; TP7) and resolution (D7; TP8). On D1 and D2 data were collected one h after treatment (TP2, TP5) and 8 h after treatment (TP3; TP6). For each TP, pressure algometry was measured on sound and lame limbs with 3 replicates at 3 landmarks (cannon, medial claw, and lateral claw). Thermal tests were collected with 3 replicates using a radiant stimulus positioned 3 cm above the coronary band of the lateral claw. Data were analyzed using PROC MIXED of SAS. Flunixin meglumine increased pressure algometer NT at TP4, TP6 and TP7 ($P < 0.005$) but did not differ within the first 24 h of lameness compared with S. Thermal test NT was greater for FM treated sows at TP7 (TP7; $P = 0.01$). In conclusion, administration of FM increased NT of sows after lameness induction although complete resolution of pain sensitivity did not occur.

Key Words: flunixin meglumine, lameness, swine

734 Barrow approachability to a human when selected for feed efficiency. J. Colpoys^{*1}, N. Gabler¹, A. Keating¹, S. Millman², J. Siegford³, and A. Johnson¹, ¹Animal Science, Iowa State University, Ames, ²Veterinary Diagnostics and Production Animal Medicine, Iowa State University, Ames, ³Animal Science, Michigan State University, East Lansing.

The objective of this study was to determine if divergent selection for residual feed intake (RFI) influenced barrows' approach to a novel human. Twenty low-RFI (high FE) and 20 high-RFI (low FE) barrows (BW 49 ± 9.2 kg) from 8th generation Yorkshire RFI selection lines were randomly selected and evaluated once over a 4-wk period using a human approach test (HAT). The HAT arena measured $4.9 \text{ m long} \times 2.4 \text{ m wide}$, with black corrugated plastic walls 1.2 m high . The arena floor was divided into 4 zones; zone 1 being the human while zone 4 was furthest from the human and was the point where the pig entered the arena. Between 1300 and 1700 h pigs were moved individually from

their home pen and into a weigh scale for 1 min. Pigs then entered the HAT arena and were video recorded for 10 min. Video was then continuously scored by one observer for latency, duration, and total number of escape attempts (defined as front 2 legs off the ground, may include a jump). Latency, duration, and total number of zone visits were also collected. Data were analyzed with PROC GLIMMIX and the experimental unit was the barrow. Latency to show the first escape attempt and total length of time attempting escape did not differ between selection lines ($P > 0.11$). However, low-RFI attempted escape fewer times compared with high-RFI barrows ($P = 0.0007$). Latency to enter zones: low-RFI barrows tended to take longer entering zone 3 ($P = 0.06$), took longer to enter zone 2 ($P = 0.004$), but did not differ entering zone 1 when compared with high-RFI ($P = 0.26$). Duration of time within a zone: low-RFI barrows spent more time in zone 1 compared with high-RFI barrows ($P = 0.03$). For all other zones there was no difference in time spent in the zones ($P > 0.23$). Number of visits: low-RFI barrows visited zone 3 less often over the testing period compared with high-RFI barrows ($P = 0.01$). For all other zones there was no difference in number of visits ($P > 0.10$). These data suggest that differences exist in the response to a novel stressful situation between barrows of different RFI lines. Therefore, the ability of livestock to recognize and cope with stress may be related to RFI and feed efficiency.

Key Words: human approach, residual feed intake, pig

735 Measuring the efficacy of meloxicam for lame sows using nociceptive threshold tests. M. D. Pairis-Garcia^{*1}, S. T. Millman⁴, L. A. Karriker², K. J. Stalder¹, J. F. Coetzee³, and A. K. Johnson¹, ¹Animal Science, Iowa State University, Ames, ²Swine Medicine Education Center, Iowa State University, Ames, ³Cyclone Custom Analyte Detection Services (CYCADS), Iowa State University, Ames, ⁴Veterinary Diagnostic and Production Animal Medicine, Iowa State University, Ames.

Lameness in breeding swine has a negative economic impact and is a welfare concern. In the EU, meloxicam is labeled for use in non-infectious locomotor disorders in swine. Pressure algometry and thermal tests are non-invasive methods to quantify pain sensitivity using nociceptive thresholds (NT) to provoke withdrawal responses of lame and sound limbs. The objective of this work was to determine the effects of meloxicam on NTs in lame sows. Lameness was induced in 24 mature mixed parity sows 241.4 ± 15.5 (mean BW kg \pm SD) on d0 using a chemical synovitis model and a repeated measures design comparing responses for each sow during baseline (d -1), most lame/treatment (d 1; d 2), recovery (d 3) and resolution days (d7). Two treatments were compared: meloxicam (1.0 mg/kg) and sterile saline (IM injection). Pressure algometry was measured on sound and lame limbs with 3 replicates at 3 landmarks (cannon, medial claw, and lateral claw). Thermal tests were collected on sound and lame limbs with 3 replicates using a radiant stimulus positioned 3 cm above the coronary band of the lateral claw. Data were analyzed using PROC MIXED of SAS with sow (group \times trial) as the random effect, replicate (round \times time point \times leg injected) as a repeated measure and treatment, leg injected, round, time point and its interaction with treatment and leg injected as a fixed effect. Following 8h after initial treatment administration to 72 h after lameness induction, sows on the meloxicam treatment had higher pressure algometry NT compared with those on saline (0.83 ± 0.03 kgf; $P < 0.01$). Sows on the meloxicam treatment had higher thermal NT compared with those on saline (2.07 ± 0.11 s; $P < 0.01$) immediately following drug administration. In conclusion, meloxicam mitigated pain sensitivity between 8 to 72 h post lameness for sows induced lame using a chemical synovitis model when pain sensitivity was evaluated with pressure algometry. Thermal NT tests revealed differences between treatments immediately after meloxicam administration suggesting that this NT tool may not be as sensitive when compared with pressure algometry.

Key Words: meloxicam, lameness, swine