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SYMPOSIA AND ORAL SESSIONS

Animal Behavior and Well-Being: Animal Behavior and Well-Being 2

729 Behavior-nutrition interaction in swine. J. N. Marchant-Forde*, *USDA-ARS, West Lafayette, IN*.

Swine nutrition management aims to maximize output for minimal input. With the breeding sow, the aim is to maximize reproductive output, with easy farrowing, large and heavy litters, good lactation, and quick recovery and re-breeding. For the wean-to-finish pig, the aim is to maximize growth efficiency, with pigs growing as fast as potential allows on as little food as possible. Under commercial conditions, the pig can meet its daily energetic requirements quickly with a highly nutritious, uniform food source, which may or may not be accessible ad libitum and which may or may not be accessible by all animals at the same time. Under natural conditions, the pig is a foraging omnivore, spending a large proportion of the day rooting and searching for a varied, relatively low energy food source, usually eating in groups. Thus, some aspects of nutrition management in commercial production depart from the nutritional strategy of the wild pig, negatively affecting well-being. For example, with sows, there may be issues of chronic hunger, as the sow is fed her daily ration in a single meal. Also, feeding system design may influence aggressive behavior in group housing, as food becomes a limited resource and subject to competition. At weaning, piglets are weaned abruptly and undergo a sudden change from milk-only diet to solid food, impacting gut morphology and also behavior, as the pigs adapt to the change. Their ability to cope with weaning can be influenced by the pre-weaning management and weaning age. With growing and finishing pigs, there may be issues with feed availability as it pertains to the number of pigs per feeding space, placement of feeders within the pen and group size. The physical properties of the feed (ingredients, particle size, pelleting versus meal versus mash) may impact the behavior, health and well-being of the pigs. The diet may contain feed additives, such as repartitioning agents and growth promoters, some of which may affect the pigs′ physiology and behavior, again leading to potential well-being concerns. Overall, a clearer understanding of how behavior interacts with nutrition can enable husbandry to be adjusted to better safeguard and improve swine welfare and production.

Key Words: swine, behavior, nutrition

730 Effect of distance moved during loading, lairage time, and distance moved to stun on blood lactate concentration of pigs in a commercial slaughter plant. L. N. Edwards*[1], T. Grandin[1], T. E. Engle[1], M. J. Ritter[2], A. Sosnicki[3], B. A. Carlson[1], and D. B. Anderson[1], [1]*Colorado State University, Fort Collins*, [2]*Elanco Animal Health, Greenfield, IN*, [3]*PIC, Hendersonville, TN*.

Two studies were conducted to assess the relationship between management and blood lactate concentration (LAC) of pigs. A 2 × 2 × 2 repeated measures factorial design was used (Exp. 1, n = 64; Exp. 2, n = 144; pig = experimental unit) exploring distance moved at the farm (T1), lairage time (T2) and distance moved to stun (T3) on LAC of pigs in a commercial slaughter plant. Pigs were moved a short (15 m) or a long (46 m) distance (T1) during loading at the farm. Pigs were transported for approximately 2.5 h to the packing facility where they were rested for a short (30 min) or long (4.5 h) period (T2). After lairage, the pigs were moved a short (20 m) or long (300 m) distance to stun (T3). Pigs from each treatment subclass were equally distributed on each truckload. Pigs were electrically stunned and exsanguinated. A lactate analyzer was used to measure LAC at seven time points during the marketing process: baseline, post-load, pre-unload, post-unload, post-lairage, post-movement to the stunner and at exsanguination. In Exp. 1 and 2 LAC changed ($P < 0.0001$) during the marketing process; the highest LAC was observed at loading and exsanguination. Long distance moved during loading resulted in higher (8.3 & 6.0 mM; $P = 0.0001$) LAC during loading (Exp. 2). Unexpectedly, in Exp. 2, pigs rested for a longer period had higher LAC post-lairage (3.6 & 3.0 mM; $P = 0.02$), post-movement to stun (4.7 & 3.8 mM; $P = 0.01$) and at exsanguination (8.1 & 5.5 mM; $P = 0.0001$). In Exp. 1, pigs rested for a long period had greater increases (change between time points) in LAC during the immediate pre-stun handling (+5.6 & +3.6 mM; $P = 0.003$). Differences between experiments could be explained by difference in season, facility design and specifics of experimental protocols. Blood lactate was greater in pigs moving a short distance to stun (7.6 & 5.8 mM, Exp. 1; 7.2 & 6.0 mM, Exp. 2; $P < 0.04$) than those moving the long distance. This study emphasized the impact that pre-slaughter management has on LAC of pigs from farm to stun and demonstrates that the greatest handling stress is at loading and exsanguination.

Key Words: lactate, lairage, pre-stun

731 Validation of saliva sampling techniques in swine in order to assess stress responses. S. M. Hayne*[1], N. J. Cook[2], and H. W. Gonyou[1,3], [1]*Prairie Swine Centre, Saskatoon, SK, Canada*, [2]*Alberta Agriculture and Rural Development, Edmonton, AB, Canada*, [3]*University of Saskatchewan, Saskatoon, SK, Canada*.

Salivary cortisol is an outcome measure that can be used as an indication of what pigs are experiencing when exposed to various production methods. Saliva sampling has the potential to be a relatively non-invasive method of determining cortisol concentration. However, techniques have not yet been validated or standardized for use in grower-finisher pigs. The purpose of this study was to determine the effect that different sampling regimes have on salivary cortisol concentration. The first regime involved sampling individually housed pigs as many times as possible over 30 min. The second regime involved sampling individually housed pigs every 30 min for three hours. The third regime involved sampling pigs housed in groups of five. During group sampling, only one focal pig was sampled every 30 min for three hours. The other pigs were all sampled at the beginning and either at 30, 60, 120, 150 or 180 min (interval-sampled). Sampling difficulty was also recorded. For the pigs that were sampled intensively for 30 min, sampling difficulty did not have an effect on cortisol concentration ($P > 0.05$). However, cortisol concentration increased over time ($P < 0.05$). This could indicate that this sampling method is stressful for pigs. For individually housed pigs that were sampled every 30 min, cortisol concentration increased when sampling was difficult ($P < 0.05$). However, over time, cortisol concentration decreased ($P < 0.05$). This could indicate that the sampling method was

not stressful for the pigs. For group-housed pigs, cortisol concentration also increased when sampling was difficult (P<0.05), but did not change over time. The cortisol concentration did not differ between the focal and interval-sampled pigs in the group setting. Group/interval sampling appears to be the least stressful regime for collecting saliva samples. These results increase confidence that salivary cortisol concentration indicates a stress response to the situation being tested (for example, the effect of crowding) and not a response to the sampling procedure.

Key Words: cortisol, stress, pigs

732 Influence of season on the behaviour of market weight pigs transported 2 hours to slaughter. S. Torrey*[1], S. Hayne[2], R. Bergeron[3], L. Faucitano[1], T. Widowski[3], N. Lewis[4], T. Crowe[5], C. Dewey[3], and H. Gonyou[2,5], [1]*Agriculture and Agri-Food Canada*, *Sherbrooke, QC, Canada*, [2]*Prairie Swine Centre*, *Saskatoon, SK, Canada*, [3]*University of Guelph*, *Guelph, ON, Canada*, [4]*University of Manitoba*, *Winnipeg, MB, Canada*, [5]*University of Saskatchewan*, *Saskatoon, SK, Canada*.

There is evidence that season plays an important role in pig death losses during transportation, although little is known about the seasonal effects on pig behaviour after transportation, and whether there is an interaction between trailer design and season. This experiment was designed to examine the influence of season on unloading and lairage behaviour of market weight pigs transported on two different trucks. Over the course of 12 weeks during winter and summer, 3,192 pigs were transported for 2 h on either a three-deck pot-belly truck with internal ramps to upper and lower levels (PB; n=181 pigs per week in 8 experimental compartments; 0.40 m2/pig) or a double-decker hydraulic truck without internal ramps (DD; n=85 pigs per week in 4 compartments; 0.40 m2/pig) to a commercial abattoir. Pigs were unloaded by compartment at the abattoir and driven into lairage pens segregated by truck compartment. Behaviour during unloading (slips and falls), time to unload each compartment, and latency to rest (75% of pen lying) during the first hour of lairage were observed. Behaviour data were analyzed using the mixed model procedure in SAS, with season and truck as fixed effects and week within season as random effect. Data were weighted for the number of pigs in each compartment. Pigs took longer to unload in winter (P=0.04; summer: 59 ± 3s; winter: 68 ± 3s) and from the PB truck (P<0.001; PB: 74 ± 2s; DD: 53 ± 4s), although the seasonal effect tended to be more pronounced for pigs unloading from the DD (Season × Truck, P=0.08). During unloading, there were more slips and falls during winter (P<0.0001; summer 1.1 ± 1.6 slips/falls; winter: 8.0 ± 1.6 slips/falls) regardless of truck (P=0.66). Latency to rest in lairage was shorter (P=0.006) in winter (31 ± 2 min) than summer (40 ± 2 min) but there was no effect of truck (P=0.40) or truck by season (P=0.19). In summary, season influences unloading and lairage behaviour of market-weight pigs, making unloading more difficult in winter. These results may help interpret the variation in animal welfare and meat quality.

Key Words: pig, transportation, season

733 Effects of linoleic and α-linolenic acid intake on pig behaviour, and its relationship with brain DHA. J. E. Bolhuis, I. van Kerkhof, and W. J. J. Gerrits*, *Wageningen University*, *Wageningen, the Netherlands*.

Effects of linoleic acid (LA) and α-linolenic acid (ALA) on behaviour of individually housed pigs (15-30 kg BW) were studied. In a 2×2 factorial arrangement, 32 gilts from 4 litters were assigned to one of four dietary treatments, varying in LA and ALA intake. Differences between low and high intake levels were designed to be identical for LA and ALA: Low ALA and LA intakes were 0.15 and 1.30, and high ALA and LA intakes were 1.45 and 2.60 g/(kg $BW^{0.75}$.d), respectively. Intakes of saturated and mono-unsaturated fatty acids (FA), and other nutrients were kept constant. Pigs were subjected to an open field test (d 15) and a novel object test (d 16). In addition, behaviour in the home pen was observed using 2-min instantaneous scan sampling for 5 h per day (d 12 and d 18). After 28 d on the dietary treatments, pigs were sacrificed and brain tissues were sampled and analyzed for FA composition. The latencies to approach and touch the novel object were reduced by ALA intake, but at the low LA intake only (LA*ALA, P<0.05). The low LA-high ALA combination also tended to reduce standing alert in the open field (P=0.08). The percentage of time spent nosing in the open field, and exploratory behaviours in the home pen were reduced by LA intake (P<0.05). Although dietary treatments did not greatly influence DHA concentrations in the hippocampus and frontal cortex (P>0.05), DHA concentrations in the frontal cortex were positively correlated with explorative behaviour (r = 0.56, P<0.001). In conclusion, an increase in ALA intake, specifically at low LA intake levels, causes consistent changes in behavioural patterns, indicating reduced fear and increased exploration. It is unclear to what extent DHA concentrations in the brain are important for mediating these effects.

Key Words: DHA, pig, behaviour

734 The motivation of gestating sows for environmental enrichment in a stall. M. R. Elmore*[1], J. P. Garner[1], A. K. Johnson[2], R. D. Kirkden[1], E. G. Patterson-Kane[1], B. T. Richert[1], and E. A. Pajor[1], [1]*Purdue University*, *West Lafayette, IN*, [2]*Iowa State University*, *Ames*.

Sows are often housed in barren stalls during breeding and gestation. Providing environmental enrichments for which sows are highly motivated should improve welfare. The aim of this study was to compare the motivation of Yorkshire x Landrace gestating sows (32, n=8/reward) housed in standard gestation stalls for access to 1 of 4 rewards. Environmental enrichments: spent mushroom compost (C, 2.27 kg) or straw (S, 0.45 kg) were tested. Additionally, food (F, 0.91 kg) and an empty trough (T) were included as positive and negative controls, respectively. We predicted that enrichments for which sows were highly motivated would be similar to F and/or significantly different from T, while low motivation enrichments would resemble T. While in visual and olfactory contact with rewards, sows were trained to press an operant panel on an increasing schedule. The highest schedule pressed indicated motivational strength. Sows were given 1 hr to press the panel and 23 hr to interact with the reward. Data were analyzed using GLM and post-hoc Tukey tests. The C sows showed higher motivation (# of presses) for the reward (196.88 ± 46.38, LS means ± S.E.) than T (55.85 ± 46.75; P=0.017), S and T did not differ (P>0.05). The F sows pressed more than all other treatments (462.87 ± 46.38; all P<0.01). The C sows started pressing the panel more quickly (sec; 5.00 ± 156.40) than S (332.88 ± 156.40) and T (271.43 ± 157.70; P=0.069 and P=0.011, respectively), while F pressed more quickly (11.25 ± 156.40) than T (P=0.046); all other latency comparisons did not differ (P>0.05). The F sows used a higher proportion of the reward (1.00 ± 0.08) compared to C (0.80 ± 0.08) and S (0.70 ± 0.08; P=0.042 and P=0.007, respectively), C and S did not differ (P=0.682). Gestating sows housed in stalls were highly motivated for C and F, but showed low motivation for S and T. The C and F sows pressed the panel sooner, while F sows used a higher proportion of the reward, which may indicate increased motivation. The provision of

compost is of value to sows housed in barren stalls and may improve their welfare in production settings.

Key Words: enriched housing, gestating sows, motivation

735 Effect of premolar eruption on growth and behaviour of weaned piglets. A. L. Tucker* and T. M. Widowski, *University of Guelph, Guelph, ON, Canada*.

Standard profiles for the deciduous dental eruption of our `modern' commercial pigs have recently been shown to have later eruption as compared to reports from the 1970's. Additionally, premolar eruption was found to influence the amount of time young piglets spent at the creep feeder during the pre-weaning period, making dental eruption of interest to the commercial sector. The objectives of this study were to determine whether premolar eruption or occlusion at time of weaning at 28 days of age influenced piglets' growth or behaviour over the following 2 weeks. A total of 112 Yorkshire piglets (16 litters of 7 piglets) had their dentition examined the day prior to weaning (age 27 days) with eruption and contact between opposing premolars being scored as occurring or not. Weight was recorded at birth, weaning, and on days 3 and 7 after weaning. Behaviour data was collected from video recordings on days 2, 4, 6, 8, 10 and 12 after weaning using scan sampling every 5 min during three 2-hr time periods (0600:0800, 1100:1300, 1600:1800). Mixed model ANOVAs (SAS) were employed to test how premolar eruption and occlusion influenced piglet growth 3 and 7 days after weaning, while repeated measures ANOVAs were employed to examine associations between dentition and ingestive behaviours (time spent at the feeder and time spent at the drinker) and oral-nasal behaviours (rooting of the pen, rooting of pen-mates, belly nosing) over the following 2 weeks. By 27 days, all piglets had their maxillary p^3 and mandibular p_4 erupted. Occlusion between 3 opposing premolars was achieved by 48.2% of the population, and eruption of the mandibular p_3 and maxillary p^4 had occurred in 96.4% and 81.2% of the population, respectively. None of the dental measures influenced post-weaning growth rates ($P > 0.10$) or the performance of any behaviour ($P > 0.10$). This study demonstrates that variability in premolar eruption by 27 days of age is low and does not influence either the time spent in any behaviour over the following 2 weeks or growth in the first 3 and 7 days of weaning.

Key Words: teeth, feeding, weaning

736 Pen and stall-housed gestating sows prefer unlocked to locked free-access stalls. L. M. W. Jones*[1], J. P. Garner[1], J. N. Marchant-Forde[2,1], and E. A. Pajor[1], [1]*Purdue University, West Lafayette, IN*, [2]*USDA Livestock Behavior Research Unit, West Lafayette, IN*.

Animal controlled stalls, such as free-access stalls, provide sows with individual protection but also provide access to a common group area. Preference testing determines the extent to which sows prefer or are averse to different housing methods. The objective of our study was to determine if sows showed a preference for locked or unlocked free access stalls and if that was influenced by their housing background. Two experiments gave 32 sows from 2 different housing backgrounds a choice between locked and unlocked free access stalls. In the unlocked stall, sows could stay in the stall or use a 3.6 m^2 area outside the stall. The 1st experiment used 16 pen-housed sows while the 2nd experiment used 16 sows from standard gestation stalls. Sows were 2nd or 3rd parity and within the 1st mo of gestation. Pen location was balanced in both experiments. Other than housing background, the methodology for each experiment was the same. On d1, each sow was given 3 h to habituate to both sides of a T-maze. On d2, the sow was trained to each side of the maze twice, for 30 min. On d3, the 1st day of testing, sows experienced each side once before being tested with 8 free choices. During free choices, the time sows were kept in the chosen stall was reduced to 15 min. On d4, sows rested. On d5, the last 8 free choices were conducted. This resulted in a total of 16 free choices for each sow to demonstrate a preference. Data were analyzed, after angular transformation, using the mixed model procedure in SAS. In experiment 1, sows housed in pens showed a preference for the unlocked free access stall (10.000 ± 0.713, $P=0.0193$). In experiment 2, sows housed in standard gestation stalls also showed a preference for unlocked free access stalls (10.875 ± 0.464, $P=0.0002$). The results of both experiments demonstrated that regardless of housing background, sows had a strong preference for some characteristic of the unlocked free access stall, which might include access to space, and the freedom of choice and movement. These characteristics should be considered when designing sow housing systems.

Key Words: preference testing, sow housing, welfare

737 Making sense of fear testing– Validating common behavioral tests used in swine. D. C. Lay Jr.*[1] and J. P. Garner[2], [1]*Agricultural Research Service - USDA, West Lafayette, IN*, [2]*Purdue University, West Lafayette, IN*.

In lab animals, fear tests assay the influence of drugs, genes, and environments on an animal's fearfulness. Livestock welfare researchers have adopted many of these tests to measure the fearfulness of animals. Tests used to assess fear in swine include the Approach/Avoidance Test, Novel Object test, and the Startle test. These tests place animals in conflict situations where less fearful individuals should express fewer behaviors believed to be indicative of fear. For these data to be meaningful, the tests should be both reliable and valid. However, they have not been validated in swine. Although behaviors in these tests might resemble a fearful human in a similar situation, we do not know whether the behaviors measured are actually indicative of fear. In addition, welfare certification programs often include fear assessment in their auditing, although the methods may not be reliable or valid. This causes confusion for producers, who need accurate, conclusive information. Some members of the NC-1029-Applied Animal Behavior and Welfare committee designed research to address this problem. Three tests were chosen for validation: 1) Approach/Avoidance Test, 2) Novel Object Test, and 3) the Startle Test. Care was taken to replicate the tests as precisely as possible, controlling for: the size of the pigs, the gender, the size of the test pen, the color of clothes the researchers wore, time of testing, etc. Factor analysis (with varimax rotation) identified 7 factors with eigen scores greater than 1, accounting for 72% of the variation in behavior. Behaviors with loadings >0.4 were considered to be influenced by a factor. Factors labeled "elimination", "searching for contact", and "vocalization", loaded urination, defecation, vocalizations and number of squares crossed consistently across tests. In contrast, other purported measures of fear, such as distance and latency to approach a person or object, loaded consistently within tests, but onto separate factors between tests ("Object freezing", "object investigation", "human freezing", "human exploration"), indicating that these measures are specific to the test rather than generalizable indicators of fear.

Key Words: fear, swine, tests