

ABSTRACTS
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Animal Behavior, Housing, And Well-Being

1 The effects of exogenous ACTH on the growth performance, fat distribution and organ weights of growing pigs. R. Morrison*¹, P. Hemsworth², G. Cronin², and R. Campbell³, ¹University of Minnesota, MN, ²Victorian Institute of Animal Science, Werribee, Australia, ³United Feeds, Sheridan, IN.

Our objective was to study the influence of the stress response (chronic stress) on pig growth performance, fat distribution and organ weights. Neuroendocrine responses such as elevated concentrations of catecholamines, adrenocorticotrophic hormone (ACTH) and corticosteroids are known to have effects on pig growth performance. In order to study the effects of chronic stress on growth performance, 30 intact male growing pigs (Large White x Landrace - initial BW= 77.4 kg) were individually housed indoors in pens measuring 2.4 x 0.9 m from 19 to 22 weeks of age. Commercial male finisher diet (13.7 MJDE, 14.7% crude protein and 0.5g/MJDE available lysine) in a pelleted form was fed to the pigs ad libitum in single-spaced, dry-feed feeders. Two treatments commencing at 20 weeks of age were studied: ACTH-daily intramuscular injections of 100 IU ACTH/ml/pig and Control-daily intramuscular injections of 1 ml of saline. The treatments were administered for 21 consecutive days. Blood sampling was conducted on five pigs per treatment on days 18 and 19 of treatment, at 1300, 1400 and 1500 hours. The ACTH treatment was successful in causing sustained elevated plasma cortisol concentrations (303.5 vs 29.7nM; P<0.001). Pigs in the ACTH treatment were significantly heavier (111.5 vs 106.4 kg; P<0.05) at 23 weeks of age and they had a higher rate of gain (1.3 vs 1.1 kg/day; P<0.05) and daily feed intake (3.8 vs 3.0 kg/day; P<0.001) than the Control treatment. The pigs in the ACTH treatment also had significantly higher carcass fatness (16.7 vs 13.4 mm; P<0.001), heavier total viscera (10.6 vs 9.7 kg; P<0.01) and digestive system (8.2 vs 7.3 kg; P<0.01) and more visceral fat (1.0 vs 0.65 kg; P<0.01). These data suggest that stress physiology significantly affects pig growth performance, fat distribution and organ weights. More research needs to be conducted on effects of the stress response, particularly the magnitude of the stress response on pig growth performance.

Key Words: Pigs, Welfare, Stress Physiology

2 Using daily spraying of oil to control dust and odor in swine grow-finish confinement building. T. E. Socha* and B. S. Zimprich, North Dakota State University.

One hundred ninety-two pigs were allocated to 24 pens of eight pigs each. The room was divided into two parts with 12 pens in each half. Plastic was used to divide the room and both halves had the same fans to ensure the same amount of ventilation in each section. An oil mixture containing 10% vegetable oil and 90% water was sprayed each day for two minutes. Bi-weekly measurements were taken for ammonia levels and dust collections. Dust was collected using a filter on a vacuum and a filter on one of the exhaust fans. The pigs were weighed on test and off test to calculate daily gain. Feed was weighed into each feeder and feed efficiency was calculated. Lungs were evaluated at slaughter for the presence of lesions. The pigs were started on test at 37kg and removed at 113kg. The experiment was conducted for 12 weeks. The oil treated section had higher ammonia levels than the untreated section (8.41 vs 6.96 ppm; p < 0.05). There were no differences in the amount of dust collected by the vacuum or the exhaust fan between the treated and untreated sections. Feed efficiency did not differ but the oil treated section had lower ADG than the untreated section (790 vs 813 gm; p = 0.05). The pigs were examined for the presence of lung lesions. There was no difference in percent of lungs with lesions (36 vs 32 %) between the two groups. Daily spraying with an oil mixture did not improve the environment, pig performance or presence of lung lesions.

Key Words: Swine, Grow-finish, Dust Control

3 Boar Teasing Methods: Time to Mount and Semen Characteristics. K.A. Fischer*¹, T.J. Safranski¹, and S.L. Terlow², ¹University of Missouri, Columbia, MO, USA, ²Premium Standard Farms, Princeton, MO, USA.

Utilization of artificial insemination in swine has led to increased emphasis on boar productivity. Teasing methods, such as false mounting, are used to increase semen output of bulls but have not been examined in boars. This study evaluated effects of false mounting (FM) and allowing a boar to observe collection prior to its own collection, hot pen (HP), on time to mount the dummy (TTM) and ejaculate characteristics. Dalland L80 boars in a commercial stud in Texas were randomly

assigned to FM or HP in a 2x2 factorial arrangement. Data were collected on 181 ejaculates from 92 boars. FM boars would mount the dummy, thrust, be pushed off two consecutive times, and collected on their third mount. HP boars observed collection of another boar immediately prior to their own collection. Data were collected between June 25 and July 30, 2001 with a minimum 4d rest between collections. A model including HP, FM, HPxFM, collector, boar age, and date of collection was used to test effects on the dependent variables TTM, semen volume, concentration, total cell count, motility, and total motile cell count. TTM was recorded from the time the boar entered the collection pen until complete erection of the penis. TTM was decreased by HP (3.95 minutes versus 5.59 minutes, $P < 0.001$), but FM led to 1.12 additional minutes ($P < 0.05$) until the final mount. There was no interaction between HP and FM for TTM. Among the three technicians the total sperm cell count per ejaculate ranged from 77.26 to 92.38 billion cells ($P < 0.05$). No differences were found in semen volume (mean=279.90 ml), concentration (mean=313x10⁶ cells/ml), total number of cells (mean=83.3x10⁹ cells), motility (mean=86.51%), or total number of motile cells (mean=72.6x10⁹ cells). Failure to mount the dummy within 15 minutes occurred six times. These were either FM or the combination FM and HP. Allowing boars access to HP reduces TTM with no effects on ejaculate characteristics. FM increases TTM with no effect on ejaculates, but may result in some boars that cannot be collected.

Key Words: Boar, Tease, Ejaculate

4 Accounting for wind speed and solar radiation in the temperature-humidity index. M.S. Davis* and T.L. Mader, University of Nebraska.

Wind speed (WSPD) and solar radiation (RAD) are known factors contributing to the degree of heat stress to which feedlot cattle are subjected. However, the most commonly used indicator of heat stress for feedlot cattle (Livestock Weather Safety Index) uses only the temperature-humidity index (THI) and does not account for WSPD or RAD. Accurate adjustment to the THI equation based on WSPD and RAD are essential in determining level of heat stress. Therefore, visual assessments of heat stress based on panting scores (PS; 0 = no panting, 4 = severe panting) were collected at 1700 during three previously conducted summer studies. These data were combined into one data set and included 5520 observations. Treatments imposed during these studies were designed to reduce heat stress in feedlot cattle; however, their effect on panting score was minimal. A weather station, located in the facility where cattle were confined, recorded THI and WSPD (m/s). Solar radiation (W/m²) was recorded .7 km West and 1.7 km North of the facility. Temperature-humidity index averaged 79.7 ± 5.2 (range 63.9 to 86.2) at the time PS were assigned. A regression equation (RE) was developed using THI, WSPD, and RAD to predict PS ($PS = -6.317 + (0.097 \times THI) + (0.233 \times WSPD) + (0.0026 \times RAD)$). Using this equation, mean THI was entered into the equation and held constant, while WSPD and RAD were adjusted using mean values ± 1 std. err. The RE equation was then solved for THI using each calculated PS and mean values for WSPD and RAD. The calculated THI was then regressed against its corresponding WSPD and RAD value. The slopes of these lines (-2.400 and 0.027 for WSPD and RAD, respectively) represent the adjustments to the THI for WSPD and RAD. For instance, for each 1 m/s (2.24 mph) increase in WSPD, THI is reduced 2.4 units, and for each 100 W/m² decrease in RAD (25% increase in cloud cover) THI is reduced 2.7 units. Although, knowledge of THI alone is beneficial in determining the potential for heat stress, accurate adjustments for WSPD and RAD are essential to more accurately represent the degree of animal comfort.

Key Words: Temperature-humidity Index, Wind Speed, Solar Radiation

5 Behavioral responses of foals subjected to short term maternal separations. J. Bohm*, M. Leavitt, and A. Zanella, Michigan State University, East Lansing.

Foals may experience stress and poor welfare as a result of disease or inadequate husbandry procedures. A precise assessment of behavioral changes post-maternal separation has yet to be examined. Changes in body postures following a challenging situation may indicate the severity of the procedure. We measured behavioral responses in five foals,

three fillies and two colts, separated from their mothers for 10 min. We carried out behavioral observations for 2 hours before and 2 hours after bi-weekly separations between the ages of 15 and 75 days. Mares and foals were video recorded and tapes were analyzed using a scan sampling technique at 10 min intervals. Twelve scans were collected before and after separations. A transition was defined as a movement or change in position of the body from one plane to another. Proximity was measured in millimeters from a midpoint on the mare's head to a midpoint on the foal's head. Data from two independent observers were compared for total transitions (TT) and estimated distance between mare and foal (EDBMF) using Pearson's correlation coefficient. Both datasets yielded identical results for TT and EDBMF ($R^2 > 0.97$). The impact of maternal separation and age on TT and EDBMF was analyzed using ANOVA. Results are presented as mean \pm SEM. Foals showed a higher frequency of TT during the 2 hours post-maternal separation than in the 2 hours pre-separation (10.68 ± 0.236 and 9.6 ± 0.351 ; $P = 0.01$). EDBMF was not affected by maternal separations ($P > 0.3$). Age tended to affect TT post-maternal separation ($P < 0.1$). Further analysis revealed that foals showed higher frequencies of TT during the sixth separations than during the 3rd & 4th separations ($P < 0.05$). Overall, age did not affect EDBMF ($P = 0.34$). We demonstrated that behavioral transitions post-maternal separation may be related to the severity of the challenge. EDBMF yielded less convincing information than TT. The significance of these findings needs to be evaluated with caution given the limited number of animals observed and the artificial threshold imposed in the EDBMF measures by the stall design.

Key Words: Foals, Maternal Separation, Behavior

6 Immunomodulation by oral supplementation of ascorbic acid and beta-glucan to transported dairy calves. S.D. Eicher*¹ and T.R. Johnson², ¹USDA-ARS, West Lafayette, IN., ²Purdue University, West Lafayette, IN.

In previous work, a yeast cell-wall derivative (Energy-plus, Natural Chem Industries, LTD) worked synergistically with ascorbic acid (Stay-C, Roche Vitamins) to enhance growth in neonatal calves housed indoors in raised calf crates. Objectives of this study were: 1) to ascertain if these supplements would improve neonatal calves' innate immunity and ability to cope with transportation and 2) to compare the yeast cell-wall derivative with purified β -glucan from yeast cell-walls. Thirty-nine bull and heifer calves were blocked by sex and age, then assigned to treatments: 1) IG; 113 g Energy-plus and 250 mg Stay-C, 2) BG; 150 mg of a β -glucan fraction from yeast cell-walls equivalent to that contained in Energy-plus (Biopolymer Engineering) plus Stay-C, or 3) Cnt; a positive control given subcutaneous electrolytes, but no supplements. Calves were fed milk replacer at 4.45 kg/d with supplements in the milk replacer. Groups of calves (3 to 10 d of age) were transported for 4 h. After transport, treatments were started with calves housed in outdoor hutch. Jugular blood was collected pre- and post-transport, and d 3, 7, 10, 14, 21, and 28 post-transport for hematocrit determination, leukocyte counts, and neutrophil assays. Hematocrit percentages were least for BG compared to IG post-transport and d 21 ($P < 0.05$) and compared to IG ($P < 0.05$) on d 10 and both IG and Cnt on d 28 post-transport ($P < 0.05$). Leukocyte numbers were least for BG compared to IG on d 21 ($P = 0.06$) and d 28 ($P < 0.05$). On d 21 post-transport, granulocyte numbers tended to be greater ($P = 0.08$) for IG calves than for BG calves. Percentage of neutrophils positive for high CD18 expression was greater in the IG calves than for those of the BG or Cnt calves on d 28. Neutrophil phagocytosis was reduced in BG calves compared to Cnt calves ($P < 0.05$) and tended to be reduced compared to IG calves ($P < 0.10$) on d 28 and chemiluminescence was least in BG calves compared to the Cnt calves on d 28. These data showed that modulation by the supplements on innate immunity are not evident until 28 d post-transport. These data show that not all β -glucan containing products have the same effects on innate immunity.

Key Words: Dairy Transport, Innate Immunity, Neonatal Calf

7 Florfenicol concentration in serum and lung lavage fluid of beef cattle fed various concentrations of dietary fat in a 70% concentrate diet. G. C. Duff*¹, B. D. Hunsaker, A. C. Anderson², J. D. Roder², and D. A. Walker³. ¹The University of Arizona, Tucson, ²Texas Tech Health Science Center, Amarillo, ³Clayton Livestock Research Center, New Mexico State University.

Eighteen beef steers (British x Continental; average initial BW 329 kg) were used to evaluate effects of dietary fat (yellow grease) concentration on serum and lung lavage sample concentrations of florfenicol. Steers were assigned randomly to dietary fat concentrations and were housed in individual pens. Treatments were a 70% concentrate diet with 0% added fat (6 steers), 3% added fat (6 steers), and 6% added fat (6 steers). Steers were fed at approximately 2.25% (as-fed basis) of initial BW for 3 wk before sampling. Florfenicol (Nuflor; Schering-Plough Anim. Health) was administered s.c. at 40 mg/kg of BW in the neck. Serum and lung lavage samples were collected at 0, 6, 12, 24, 48, and 72 h after administration of florfenicol. Concentrations of florfenicol in lung lavage fluid and cells were non-detectable. In serum, no florfenicol concentrations were observed at 0 h. At 6 h, a quadratic response ($P < 0.05$) was observed with highest concentrations of florfenicol observed with the 3% added fat. No differences ($P > 0.10$) were observed at 12 h. At 24 h, however, a linear increase ($P < 0.05$) in florfenicol concentration was noted with added dietary fat. No differences ($P > 0.10$) were observed at 48 or 72 h. Results suggest that added dietary fat influences serum concentrations of florfenicol. However, methods more sensitive to small antibiotic concentrations need to be conducted to evaluate the effects of dietary fat on host tissue concentrations.

Key Words: Beef Cattle, Antibiotic, Dietary Fat

8 Dynamic model for behavior of outdoor gestating sows with seasonal ambient temperatures. H. A. Rachunyo, S. W. Kim*, and J. J. McGlone, Texas Tech University, Lubbock.

The influence of ambient temperature on behavior of outdoor pregnant sows were evaluated and modeled using 91 sows during 24 h observation in winter, spring, and summer seasons. Minimum and maximum temperatures ranged from -10.7 to 39.2°C for data collection. Each of the 0.4-ha pastures were divided into hub, middle, wallow, outside, and feeding areas to determine variations in use of regions within the pasture. A hut and wallow-pool were located in the middle section of each pasture. Sows had free access across all pasture regions. Behavioral parameters of interest included standing, lying, rooting, drinking, and feeding. Trained observers recorded the number of sows in each region and behavioral activity using a 10-min scan technique for 24-h periods. Data were analyzed using logistic regression procedures and the equations derived were utilized to construct dynamic models using Powersim[®] for: (1) active behavior (standing, rooting, feeding, and drinking); (2) wallowing behavior (standing, lying, drinking, and rooting around the wallow area); (3) rooting behavior; and (4) use of hut. During temperatures of 15°C and below sows engaged in active and rooting behaviors during mid-day whereas during higher temperatures active behaviors were higher during morning and evening h. During cool temperatures sows spent morning and late afternoon hours in the hut, while during high temperatures sows were more often in the hut or wallow during the middle of the day. Sows used the hut for approximately 59% during day and almost 100% during night. Outside region was used for 10% during daytime, especially for rooting, while the hub and the wallow regions were used less. Rooting activity was in the outside region during cool temperatures. These models are useful in identifying behavioral changes over a wide range of seasonal temperatures; in describing sow motivational changes over seasons, and helping adjust sow management, especially during adverse weather.

Key Words: Sow, Behavior, Dynamic Model

9 Effect of dietary cation-anion difference (DCAD) on stress responses in finisher swine exposed to a stress model system. D. J. Ivers*, R. K. McGuffey, T. A. Armstrong, D. J. Jones, D. H. Mowrey, L. F. Richardson, R. Seneriz, J. R. Wagner, K. L. Watkins, and D. B. Anderson, Elanco Animal Health, Greenfield, Indiana.

A study was conducted to investigate the effect of dietary cation-anion difference (DCAD = $\text{meq} (\text{Na}^+ + \text{K}^+ - \text{Cl}^-)$) on the stress responses and downer incidence in finisher barrows fed 20 ppm ractopamine-HCl and exposed to aggressive handling in a model system (Benjamin, et al, 2001). Four days prior to the scheduled handling, the pigs were assigned to either a high DCAD diet (HD, +481 meq/kg) or a low DCAD diet (LD, +81 meq/kg). Ninety-six barrows (high-lean genetic line) were used in this study and were handled in 16 groups of 6 pigs. Each group of pigs consisted of 3 LD and 3 HD pigs. The stress model course consisted of walking the pigs 4 laps (~300 m and ~6.5 min) in a room set up with a 36.6 m long aisle (2.1 m wide narrowing to .6 m for ~20 m). An electric prod and sorting panel were used to move the pigs through the course. Blood samples were collected and rectal temperatures were measured prior to handling, immediately post-handling, and 2 hr post-handling. The pigs were observed for cyanosis, dyspnea, muscles tremors, and abnormal vocalizations. Pigs that became non-ambulatory during the course or exhibited multiple signs of distress after handling were classified as downer pigs. Fewer ($P < 0.05$) downer pigs were observed on HD (18.8%) than LD (37.5%). Prior to and immediately after handling, blood pH, HCO_3^- , and base excess were higher ($P < 0.05$) for HD than LD, but blood lactate was not different ($P > 0.05$). Downer pigs had higher blood lactate and NH_4^+ , and lower pH, HCO_3^- , and base excess than non-downer pigs following handling. This study demonstrated that: 1) aggressively-handled pigs rapidly develop metabolic acidosis; 2) metabolic acidosis is more severe in downer pigs than non-downer pigs; and 3) increasing the DCAD level 4 days prior to handling improved the blood buffering capacity and resulted in fewer downer pigs after handling.

Key Words: Electrolyte, Stress, Swine

10 Physiological comparison of downer and non-downer pigs following transportation and unloading at a packing plant. D. J. Ivers, L. F. Richardson, D. J. Jones, L. E. Watkins, K. D. Miller, J. R. Wagner, R. Seneriz, A. G. Zimmermann, K. A. Bowers, and D. B. Anderson*, Elanco Animal Health, Greenfield, Indiana.

A study was conducted to physiologically characterize and compare downer and non-downer pigs following transportation and unloading at a Midwestern packing plant. The study had 70 pigs representing several genetic strains, barrows and gilts, and pigs having been fed diets with or without Paylean[®] (ractopamine-HCl). Pigs from the same truck were selected in pairs with one being a non-downer or normal pig and the other being a downer pig (non-ambulatory with no signs of physical injury). The pigs were observed for signs of stress such as cyanosis, dyspnea, abnormal vocalizations, and muscle tremors. Blood samples were drawn and assayed for blood gas measures and various blood chemical parameters. Glycolytic potential assays were conducted on muscle and liver samples. Skin biopsies were used to identify the presence of the porcine stress gene (RYR1). A false discovery rate controlling procedure was used in the statistical analysis to account for testing of multiple assay variables. Signs of stress were more frequently observed in the downer pigs than the non-downer pigs ($P < 0.05$). Downer pigs had higher blood lactate, NH_4^+ , Na^+ , K^+ , cortisol, epinephrine, and norepinephrine concentrations than non-downer pigs ($P < 0.05$). Base excess, pH, Ca^{2+} , HCO_3^- , partial pressure of CO_2 , and insulin were lower in downer pigs than non-downer pigs ($P < 0.05$). Only three downer pigs were classified as stress gene carriers. Gilts were leaner with less backfat than barrows ($P < 0.05$). Downer pigs had lower glycolytic potential in the *longissimus dorsi* and the high red fiber portion of the *semitendinosus* and lower liver concentration of the combination of glucose, glucose-6-phosphate, and glycogen than non-downers ($P < 0.05$). This study suggests the downer pig is in a state of metabolic acidosis and that the observed differences between downer and non-downer pigs are similar regardless of Paylean use or gender.

Key Words: Swine, Stress