

Animal Behavior and Well-Being: Livestock: Swine and Sheep

377 ASAS Centennial Presentation: Animal behavior as a discipline within the American Society of Animal Science: One hundred years of change and promise. W. R. Stricklin*, *University of Maryland, College Park.*

Animal science emerged as a discipline from a tradition of using animals for human needs. One hundred years ago, the majority of Americans lived on farms in close association with animals. Animal husbandry programs emphasized good stockmanship which assumed students had a general knowledge of animal behavior. Today, 2% of Americans live on farms and husbandry systems differ greatly from earlier ones. Thus, the need for animal scientists to teach animal behavior is increasingly recognized. Within ASAS behavior research grew slowly and was influenced by other disciplines. The psychology-based American discipline of Behaviorism began 100 years ago but continues to have influence. Behaviorism contended that only what animals do (behavior) can be measured, and concepts such as motivation, feelings, pain, etc. were dismissed on the basis of parsimony. Concurrently, the European-based discipline of Ethology viewed behavior as genetically adaptive. American animal scientists Jay L. Lush et al. researched genetic aspects of behavior, but this work lessened as Animal Breeding faded. Ethology clashed with Behaviorism's view that behavior arises strictly from development and learning. The Ethologists' contention that suffering results when genetically-based behavioral drives are thwarted was included in the 1965 British Brambell report, a document that continues to influence animal welfare discussions. More recent USA public concern for welfare resulted in federal research funding. However, because the funds were labeled "animal well-being," behavior was typically researched only as a dependent variable. Consequently, the arguably sorely needed, stand-alone research-based subdiscipline of Applied Behavior within American animal sciences is yet to be attained.

Key Words: Applied Behavior, Animal Welfare, Animal Science

378 The effect of the autosort system on swine well-being. A. E. DeDecker*, J. M. Suchomel, and J. L. Salak-Johnson, *University of Illinois, Urbana.*

Limited data exist on the impact that autosort, a behavior-based production system, has on pig well-being. The objectives of this study were to evaluate a) how different autosort floor layouts affect wean-to-finish pig behavior and physiology (Exp1) and more specifically b) how different food court layouts affect pig well-being (Exp2). At weaning, pigs were randomly assigned to a water court (WC; 20% floor space, n = 633), food court (FC; 40% floor space, n = 617), fast lane (FL; 12.5% floor space per zone, n = 630) autosort layout, or conventional large pen (CV; control, n = 609). Physiological measures were evaluated via blood samples pre- and post-transportation. Live behavioral observations were registered during a 3-wk training period and at loading. Scan sampling was used to determine the total number of pigs performing specific behaviors at a given time. Data were analyzed using Proc GLM and MIXED with repeated measures and Chi-Square (SAS). In Exp1, cortisol levels were higher among CV pigs than among autosort pigs pre-transportation ($P < 0.001$). Levels of IGF-1 were higher in the FC than all other treatments pre-transportation, while there was a differ-

ence pre- to post- transportation in the FC ($P < 0.04$). White blood cell counts and neutrophil-to-lymphocyte ratio were greater ($P \leq 0.06$) in CV pigs pre- and post- transportation than in certain autosort layouts. Floor layout influenced percent monocytes and eosinophils pre- and post- transportation ($P \leq 0.05$). Number of pigs engaged in and time spent eating or drinking, as well as training and loading behaviors, were significantly affected by treatment ($P \leq 0.05$). In Exp2, preliminary data indicate that pigs in a FC layout are less difficult and require less time to load than pigs from large and small CV pens ($P < 0.05$). Number of rears and prod use were greater in pigs from small CV pens than all other treatments ($P < 0.05$). During training, behaviors were different among treatments ($P < 0.05$). Floor layout influenced white blood cell counts pre- and post-transportation. These data indicate that autosort layouts can affect ease of loading, various behaviors, and physiological measures throughout wean-to-finish.

Key Words: Autosort, Cortisol, Pig

379 The motivation of dominant and subordinate gestating sows for an enriched group pen. M. R. Pittman*¹, A. K. Johnson², J. P. Garner¹, R. D. Kirkden¹, B. T. Richert¹, and E. A. Pajor¹, ¹*Purdue University, West Lafayette, IN*, ²*Iowa State University, Ames.*

The swine industry is under pressure to consider alternatives to gestation stalls, including enriched group housing. The importance of these alternatives from the sows' perspective is unknown. The aim of this study was to compare the motivation of dominant (D) and subordinate (S) gestating sows for access to a group pen with feeding stalls and the following enrichments, a rubber mat, cotton cords, compost and straw. Groups of 3 Landrace x Yorkshire sows (42) were mixed post-breeding and test sows (D, n=7; S, n=7) were identified. Sows were trained to press an operant panel to gain access to the enriched group pen in which they spent 23 h. The fixed ratio schedule (the number of times that the sow was required to press) was increased daily. The highest schedule reached was the measure of motivational strength. The behavior of the sows was also recorded throughout the experiment. Data were analyzed with ANOVA using GLM and post-hoc Tukey tests. Upon entering the pen, sows, regardless of social status, spent $43.8 \pm 3.64\%$ of observations using the enrichments (rope $0.06 \pm 0.02\%$, compost $21.4 \pm 3.09\%$, and straw $22.3 \pm 3.61\%$). The highest schedule pressed was not significantly different for D vs. S sows (41 ± 11.77 vs. 53 ± 11.74 ; $P > 0.10$). However, previous work has shown that this level of pressing is roughly equivalent to the motivation of a sow working to gain access to a food reward after consuming 50% of her ad lib (4 kg) intake suggesting access to the enriched pen was important to sows. There were no statistical differences between D and S sows in drinking, straw use or compost use (all comparisons, $P > 0.10$). D sows showed higher aggression compared to M sows ($P < 0.10$) and S sows ($P < 0.05$), while M vs. S sows was not significantly different ($P > 0.10$). Locomotion was lower in D sows compared to S sows ($P < 0.10$). In conclusion, D and S sows are equally motivated to gain access to an enriched group pen and behaved similarly within the space, spending almost half of their time in enrichment directed behavior.

Key Words: Gestating Sows, Motivation, Enriched Housing

380 Behavioral changes in young pigs infected with *Salmonella*. J. Higginson*¹, J. T. Gray², and S. T. Millman³, ¹University of Guelph, Guelph, ON, Canada, ²Des Moines University, Des Moines, IA, ³Iowa State University, Ames.

The objectives of this study were to determine if aggression, cleanliness, and exploratory behavior were altered when group-housed swine are infected with *Salmonella*. Twelve groups of 5 Landrace/Yorkshire weaned pigs (n=60 pigs) were housed in separate biosecure rooms. One pig per group was randomly selected as the seeder animal and given 10⁷-10⁸ CFU of *Salmonella typhimurium* orally on Day 0. All pigs were individually marked for identification and observers were blind to treatments. Fresh lesion scores and cleanliness scores were recorded daily on Day -1 through Day +6. Latency to approach a novel object was used as a measure of exploratory behavior, and was performed using 4 different objects on Days -1, +1, +3 and +6 with order of presentation balanced between groups. Preliminary analysis was performed using t-tests, comparing seeder animals to the mean of the undosed penmates. Infected pigs did not differ from their penmates for lesion scores (mean + S.E. was 0.25 ± 0.06 and 0.20 ± 0.04 for seeder and penmates respectively, P=0.54). Lesion scores did not differ relative to days. Similarly, seeder pigs did not differ from penmates for cleanliness scores (mean + S.E. 1.54 ± 0.19 and 1.60 ± 0.09 for seeders and penmates respectively, P=0.79). However, seeder pigs were significantly cleaner than penmates on Day +2 (1.03 ± 0.16 versus 1.54 ± 0.19, P<0.05). All pigs approached the novel object significantly faster on subsequent days (P<0.05), but there was no significant difference between seeders and non-seeders for this behavior. In conclusion, there was little evidence to support differences in behavior of animals infected with *Salmonella* relative to their healthy penmates for cleanliness, lesions scores or exploratory motivation.

Key Words: Sickness Behavior, Swine, *Salmonella*

381 The social behavior carried out by unacquainted sows on mixing may predict the likelihood of escalation into aggression. J. N. Marchant-Forde*¹, J. P. Garner², E. L. Schenck¹, A. K. Johnson³, and D. C. Lay Jr.¹, ¹USDA-ARS, West Lafayette, IN, ²Purdue University, West Lafayette, IN, ³Iowa State University, Ames.

Aggression is a major well-being challenge when housing sows in groups. Aggression can increase injuries and stress, whilst detrimentally affecting productivity and cost of production. The aim of this project was to determine the behavioral sequences associated with fight and non-fight interactions when two unacquainted sows are mixed. Twelve unacquainted multiparous sows were mixed in pairs immediately after weaning. Body weight, parity, litter of origin, and body length were measured 1 d prior to mixing. All sows were paired based on body weight and parity. Each pair was placed in a 6 m² pen, with 1.2m high solid walls to eliminate outside influences on behavior, for 1 hr during which behavior was video-recorded in real time. All social interactions were extracted from the video data by one experienced observer, using an ethogram containing 10 behaviors to describe each interaction. A new interaction was defined as ≥5 sec of non-contact from the end of the previous interaction. Aggressive interactions were defined as a bite to the body. To identify behaviors predictive of aggression, the first 20 behaviors in an observation, and the last 20 immediately preceding the first act of aggression were collated, to form non-aggressive and aggressive behavioral profiles respectively. Behavioral data were analyzed using a split-plot GLM, blocked by observation. Profiles

differed between the start of the observation and prior to the first fight (F_{9,95} = 4.89; P<0.0001). Bonferroni post hoc planned comparisons showed that 'nose-to-nose contact' decreased immediately before a fight (P=0.0001; alpha = 0.005), and 'no reaction to social behavior' was greater (P=0.0060; alpha = 0.005). In conclusion, nose-to-nose contact reduces the chance of aggression in sows, while a failure to respond to social behaviors increases it.

Key Words: Pigs, Aggression, Mixing

382 The effects of ractopamine, gender, and social rank on aggression and peripheral monoamine levels in finishing pigs. R. Poletto*^{1,2}, J. P. Garner¹, H. W. Cheng², B. T. Richert¹, and J. N. Marchant-Forde², ¹Purdue University, West Lafayette, IN, ²USDA-ARS-LBRU, West Lafayette, IN.

The aim of this study was to evaluate effects of a "step-up" ractopamine (RAC) feeding program on home pen aggression and peripheral levels of tryptophan (Trp), serotonin (5HT), dopamine (DA), norepinephrine (NE) and epinephrine (EP) in finishing pigs. Thirty-two pigs (16 barrows and 16 gilts) were assigned as either control (CTL) or RAC treatment (pen=4/gender). Treated animals were fed RAC at 5 ppm for 2 wk, then 10 ppm for additional 2 wk. The dominant and subordinate pigs in each pen were determined at assignment by the proportion of encounters won or lost over 36 h. Behavior in the home pen was continuously recorded once a wk (0800 h to 1100 h) for 5 wk to determine number of bites (B), head knocks (HK) and pursuits (P). Blood was collected from each animal once a wk for 5 wk, starting prior to dietary treatment and levels of Trp, 5HT, DA, NE and EP were measured using HPLC. A 2×2×2 factorial analysis was computed with repeated measures mixed models using individuals as units. Gilts showed more B (1.7±0.2 vs. 0.9±0.2, P<0.05) per interaction compared to barrows. Compared to baseline, RAC-fed gilts increased B while others decreased (P<0.05). CTL barrows showed the lowest number of HK (0.4±0.1), with others showing similar counts (0.7±0.1, treatment×gender, P<0.05). Pursuits increased greatly from baseline in RAC-fed gilts, but decreased for others (treatment ×gender, P<0.01). Overall, gilts showed more total actions per aggressive interaction than barrows (2.5±0.2 vs. 1.5±0.2, P<0.01) and RAC-fed gilts had an increase in the total number actions performed (P<0.01). RAC-fed gilts had lower 5HT compared to RAC-fed barrows (treatment×gender, P=0.08) and overall, Trp and 5HT levels increased up to d11 then plateaued (day, P<0.01). Dominant RAC pigs had highest concentrations of NE (P<0.05), and dominant barrows had higher EP levels than subordinate ones (P<0.05), but EP concentrations were similar in gilts regardless of social status. Gilts, especially RAC-fed gilts, showed more aggressive behavior which may be linked to lower 5HT availability, leading to increased production costs and impairment of welfare.

Key Words: Swine, Ractopamine, Aggression

383 Preference for foods by lambs conditioned with rumen distension and contraction. J. J. Villalba* and F. D. Provenza, Department of Wildland Resources, Utah State University, Logan.

Bloat is a major nonpathogenic cause of death and illness in livestock characterized by an accumulation of fermentation gas within the rumen which increases intraruminal pressure. We determined whether sheep

could associate ingestion of specific foods with the consequences of increased intraruminal pressure and its subsidence. In Experiment 1, 6 fistulated lambs (39 ± 2 Kg) were offered ground alfalfa, a familiar food, for 30 min after a rubber balloon was or was not inserted into the rumen of each animal. When present, the balloon was either not distended or distended with air to a volume of 1.8, 2.5 or 4.5 L. Food intake did not differ when the balloon was absent from the rumen or when it was present but not distended ($P > 0.05$). However, distension affected food intake ($P < 0.001$), which decreased linearly with an increase in distension ($r^2 = 0.7$). In Experiment 2, the 6 fistulated lambs were offered a novel food, Group 1 ($n = 3$) wheat bran and Group 2 ($n = 3$) beet pulp, after which a balloon in the rumen of each lamb was distended to a volume of 2.5 L for 30 min. The foods were then switched (Group 1: beet pulp; Group 2: wheat bran) and the balloons were deflated, relieving the intraruminal pressure. Lambs were then offered choices between the 2 novel foods and between the novel foods and alfalfa. All lambs strongly avoided the food ingested before the onset of ruminal distension, but preferred the novel food ingested when distension subsided ($P < 0.001$). A Control group of lambs that experienced the same conditioning protocol but without changes in ruminal pressure neither preferred nor avoided the novel foods ($P > 0.05$). Thus, sheep learned about the negative effects of increased intraruminal pressure and the positive effects of recovery from intraruminal pressure. These associations are likely to be critical in learning avoidances of bloat-inducing plants and preferences for plants and supplements that relieve the incidence of bloat.

Key Words: Bloat, Foraging, Sheep

384 Feeding behavior and rumen pH of lactating dairy sheep fed diets with different starch, NDF, and peNDF content. G. Molle¹, F. Boe², V. Giovanetti¹, M. Decandia¹, E. Zerbini³, and A. Cannas², ¹AGRIS Sardegna, Dipartimento Ricerca nelle Produzioni Animali, Olmedo, Italy, ²Dipartimento di Scienze Zootecniche, University of Sassari, Italy, ³Cargill Animal Nutrition, Spessa, Italy.

There is little information on the combined effects of dietary NDF, physical effective NDF (peNDF), and starch on feeding behavior and

rumen function in lactating dairy sheep. To address this gap, 40 Sarda ewes in mid-lactation were individually fed ad libitum 8 complete pelleted diets (5 ewes per diet), which differed in NDF and starch content and source. Based on their main ingredient, diets were denominated: corn meal (CM), wheat middlings (WM), corn flaked (CF), barley meal (BM), corn cobs (CC), beet pulp (BP), alfalfa (AA) and soybean hulls (SH). For each diet, peNDF was measured by dry sieving. Two hours after the morning feeding, rumen liquid was sampled with a stomach tube and its pH was measured. Sheep feeding behavior was observed for 24 h. Eating (ET), ruminating (RT), total chewing (CT = ET + RT) and idling times (IT) were measured by scan sampling each sheep every 2.5 min. Group average data were analysed using correlation and regression models.

Extreme peNDF were in diets CC and AA (25 to 27% DM) and WM and CF (6 to 9% DM), respectively. The RT was associated with peNDF intake ($r = 0.76$, $P = 0.03$), while it was not related to total NDF intake ($r = 0.54$, $P = 0.17$). In addition, the feeding behavior was strongly influenced by NDF particles larger than 2.36 mm ($r = 0.96$, $P < 0.001$, and $r = 0.93$, $P < 0.001$, for RT and CT, respectively) but not by those between 1.18 mm and 2.36 mm ($P > 0.1$ for both RT and CT), suggesting that the threshold of 1.18 mm used to define the peNDF might not be appropriate for sheep fed pelleted diets with small particle size.

Rumen pH was mostly influenced by the intake of starch ($r = -0.63$, $P = 0.09$) and NDF ($r = 0.69$, $P = 0.06$), while it was poorly associated with peNDF intake ($r = 0.53$, $P = 0.17$) and not associated at all with RT ($r = 0.13$, $P > 0.1$) or CT ($r = 0.1$, $P > 0.1$). This suggests that when sheep are fed diets characterized by small particle size, rumen pH is mainly influenced by NDF and starch intake rather than by peNDF content or RT.

Key Words: Feeding Behavior, peNDF, Rumen pH