

Holsteins were assigned to one of three dietary treatments 3 wk prior to and 9 wk following relocation. The three treatments consisted of a basal total mixed ration consisting of alfalfa and corn silage, ground corn and barley, soybean meal, and pressed brewer's grains (TMR); the TMR plus orchard grass hay as 10% of the DM offered; and the TMR plus alfalfa hay as 10% of DM offered. All cows were fed in Calan doors. Plasma cortisol concentrations, lameness scores, DMI, and milk yield (MY) were monitored. Blood samples were collected between 1400 and 1600 h on d -7, -1, 0, 1, 2, 7, 14, and 21 relative to relocation. Lameness scores, DMI, and MY data were analyzed in three periods; PD1 = pre-move, PD2 = wk 1-4 following relocation, and PD3 = wk 5-9. The effects of diet, period and their interaction were evaluated with Proc MIXED of SAS. The interaction of diet by period was significant ($P < 0.01$) for plasma cortisol and lameness score. Plasma cortisol concentrations were affected by diet on the day of relocation only. On that day, plasma cortisol was lower in cows offered the TMR than cows offered the orchard grass hay or alfalfa hay diets (6.7, 12.1, and 12.7 ng/mL). Lameness scores increased following relocation for cows on the TMR (PD1 = 1.5, PD2 = 1.6, PD3 = 2.0) and alfalfa hay (PD1 = 1.5, PD2 = 1.7, PD3 = 2.6) diets, but did not change in cows fed grass hay (PD1 = 1.5, PD2 = 1.6, PD3 = 1.8). No interaction of diet and period was observed for DMI and MY, but cows offered grass hay had lower DMI than cows offered alfalfa hay ($P < 0.03$). Offering lactating cows orchard grass hay during relocation may decrease lameness while cows are adapting to a new facility, but offering alfalfa hay did not improve production or measures of well-being.

Key Words: Relocation, Cortisol, Lactation

W5 The effect of relocation on milking parlor behavior and stress in dairy cows. C. O. Wilkes*, F. C. Gwazdauskas, M. L. McGilliard, K. J. Pence, A. M. Hurt, and O. Becvar, *Virginia Polytechnic Institute and State University, Blacksburg.*

The objective of this study was to examine how relocation affects cow behavior and measures of stress in the milking parlor. In an attempt to assess stress cows at the Virginia Tech Dairy Center were allocated to 3 groups in separate pens: 1) access to a rubber mat in the feedbunk area (MAT; $n = 18$); 2) no access to a mat in the feedbunk area (NOMAT; $n = 22$); and 3) two breeds (BREED; $n = 22$ Holsteins housed with 22 Jerseys). Parity was balanced across groups. Milking parlor behaviors observed were reaction to milk claw fitting (RMCF), latency to enter the parlor (LAT), and plasma cortisol (CORT). RMCF was a numeric scale (0 = ideal milker to 3 = steps and kicks frequently) to define behavior during udder preparation and claw fitting. LAT was the time necessary for each cow to enter the milking parlor. CORT was assessed by RIA. Data were grouped by period with d -14 and -7 as pre-move; d 0 as relocation day; d 1 and 2 as the immediate post-move; and d 5, 7, and 14 as the final period. Data were analyzed using the Mixed Model procedures of SAS. MAT had RMCF of 0.37 ± 0.09 , while NOMAT had a mean of 0.65 ± 0.08 ($P < 0.05$). Relocation caused an increase ($P < 0.05$) in RMCF among all groups, however there was a decline on d 1 and 2. There was an increase ($P < 0.05$) in LAT the day of relocation in all groups, but the NOMAT cows older than first lactation had greater LAT the day of relocation and were more hesitant to enter the parlor in subsequent periods than first parity cows ($P < 0.05$). LAT was 9.2 ± 0.5 for Holsteins vs. 6.2 ± 1.0 s for Jerseys ($P < 0.05$). Holsteins averaged 5.8 ± 0.3 vs. 4.2 ± 0.5 ng/mL CORT for Jerseys ($P < 0.05$). Treatment by period interaction indicates that MAT had a less dramatic change in RMCF on the day of relocation with respect to NOMAT. MAT adapted easier to relocation, older cows were more reluctant to enter the new facility, and Holsteins were more stressed than Jerseys during relocation.

Key Words: Relocation, Parlor Reactivity, Stress

Animal Behavior and Well-Being: Sow Housing, Management and Stress

W6 Analysis of the association between farrowing and lactation factors and sow removal. S. S. Anil^{*1}, L. Anil¹, J. Deen¹, S. K. Baidoo², and R. D. Walker², ¹University of Minnesota, Saint Paul, ²SROC, University of Minnesota, Waseca.

Farrowing performance and body condition affect sow removals in breeding herds. A study was conducted at the University of Minnesota, Southern Research and Outreach Center, Waseca, MN with 507 sows (GAP, English Belle, BW 220.69 ± 1.12 kg) of parities 1-8. The objective of the study was to assess the association of farrowing and lactation factors on the likelihood for removal of sows from the herd before next parity. The farrowing factors considered were parity, litter birth weight, mummies and stillborn. The lactation factors included lactation length, average lactation feed intake and body condition in terms of body weight and backfat thickness at day 108 of gestation. Removal from the herd was defined as cull, death or euthanasia. Data were obtained from the sow records and the PigCHAMP database of the research unit. Logistic regression analysis with removal as the binary outcome variable (full model, Proc Logistic, SAS) was performed to analyze the data. For analysis, parity was categorized into three as parities 1 and 2, 3 to 5 and ≥ 6 and mummies and stillborn were categorized as either present or absent. Average lactation feed intake, body weight and backfat at day 108 of gestation, lactation length and litter birth weight were included in the model as continuous variables. The likelihood for removal decreased ($P \leq 0.05$) with increase in backfat thickness at day 108 of gestation (Odds Ratio: 0.846, Confidential Interval: 0.783 and 0.915). As the average lactation feed intake increased, the likelihood for removal from the herd decreased (Odds Ratio: 0.543, Confidence Interval: 0.424 and 0.695, $P \leq 0.05$). Body weight at day 108 of gestation, lactation length, litter birth weight, parity and presence of mummies and stillborn did not have significant association with the likelihood for removal. The results indicated that sows with low

backfat thickness at the time of farrowing and low lactation feed intake were more likely to be removed from the herd before next farrowing.

Key Words: Lactation Feed Intake, Sow Removal

W7 Evaluation of the effect of group size and structure of gestation housing on production performance and removal of sows in pens with electronic sow feeders (ESFs). L. Anil^{*1}, S. S. Anil¹, J. Deen¹, S. K. Baidoo², and R. D. Walker², ¹University of Minnesota, Saint Paul, ²SROC, University of Minnesota, Waseca.

Group size and structure of gestation housing may affect the production performance and removal of sows. The objective of the study was to compare production performance and removal of sows housed during gestation in dynamic (D), two-time mixing (TM) and static (S) groups of different group sizes in pens with electronic sow feeder (ESF). The study was conducted at Southern Research and Outreach Center, of the University of Minnesota. A total of 400 pregnant sows (GAP, English Belle; BW 224 ± 1.87 kg; parities 0-7) were used. Sows were weaned after 18.8 ± 0.2 d lactation, every 2 weeks. Each weaned batch consisted of 20-30 sows and was allotted to pens with ESF. Four weaning batches of 20-30 sows were introduced at bi-weekly intervals to a large pen (12.75×13.5 m with 2 ESFs) to form the D group (total 98 sows). The TM treatment was formed by adding 2 batches to a pen (12.75×6.75 m with 1 ESF) at bi-weekly interval and 2 such pens were maintained (total 109 sows). A single batch of S group was housed in one half of a pen by regulating access to an ESF and 4 such groups were maintained (total 103 sows). All sows were moved to their respective housing systems prior to implantation (day 5 of gestation) and

all were exposed to aggression associated with grouping and feeder access. The data were analyzed using descriptive statistics, ANOVA and 2-sample proportion tests. The percentage of sows farrowed (82, 80 and 88 % respectively for D, TM and S groups) and removed (11.2, 7.4 and 8.7 % respectively for D, TM and S groups) were not different ($P \geq 0.05$) among the housing systems. There was no difference ($P \geq 0.05$) in farrowing performance in terms of number born alive, piglets weaned, stillborn, mummies, preweaning mortality, litter weights at birth and weaning, lactation length and wean to service interval. The grouping prior to implantation may be the reason for no difference in the reproductive performance of sows in different grouping treatments observed in this study.

Key Words: Electronic Sow Feeders, Group Structure, Farrowing Performance

W8 Evaluation of the effect of group size and structure on welfare of gestating sows in pens with electronic sow feeders (ESFs). L. Anil^{*1}, S. S. Anil¹, J. Deen¹, S. K. Baidoo², and R. D. Walker², ¹University of Minnesota, Saint Paul, ²SROC, University of Minnesota, Waseca.

The welfare of 400 pregnant sows (GAP, English Belle; BW 224 ± 1.87 kg; parities 0-7) housed in dynamic (D), 2-time mixing (TM) and static (S) groups of different group sizes in pens with ESF was evaluated to study the effect of group size and structure on welfare. The study was conducted at SROC, University of Minnesota. Four weaning batches of 20-30 sows were introduced at bi-weekly intervals to an existing group in a large pen (12.75×13.5 m, 2 ESFs) to form the D group. The TM group was formed by adding 2 batches to a pen (12.75×6.75 m, 1 ESF) at bi-weekly interval and 2 such pens were kept. A single batch of S group was housed in one half of a pen by regulating access to an ESF and 4 such groups were maintained. Behavior data and saliva samples were collected from 15 randomly identified sows from each newly added batch. Injuries of all sows were assessed. Saliva collection and injury level assessment were performed on the day before and after and 2 weeks after introduction. Behavior data were collected on the day, day after and 2 weeks after introduction. Data were analyzed using repeated measures of ANOVA and Spearman correlations. The weaning batch was considered as experimental unit. The D group had the highest ($P < 0.05$) total injury scores (TIS). The cortisol and TIS were higher ($P \leq 0.05$) at day after mixing than at 2 weeks post-mixing. The TIS was different ($P \leq 0.05$) among the treatments at 2 weeks post-mixing with the D group having higher ($P \leq 0.05$) score than the S. The number of queuing for access to ESF was higher ($P \leq 0.05$) in the TM group. The number of non-agonistic social interaction was lower ($P \leq 0.05$) in the D group ($P \leq 0.01$). The proportion of time spent queuing was less ($P \leq 0.01$) at mixing day among the treatments. Cortisol and TIS were positively correlated ($P \leq 0.05$) in D and TM groups. Total aggression was positively correlated ($P \leq 0.05$) with queue number and

duration in all groups. The higher TIS and lower number of non-agonistic social interactions indicated that the welfare of sows in the D group was compromised. Results on cortisol and TIS suggest that sow welfare is compromised by mixing, among the treatments.

Key Words: Sow Welfare, ESF

W9 Effects of a modified farrowing pen on sow maternal behavior. N. Devillers^{*1}, M.-C. Meunier-Salaün², and C. Farmer¹, ¹AAFC, Dairy and Swine R & D Centre, Lennoxville, QC, Canada, ²INRA, UMR Système d'Élevage Nutrition Animale et Humaine, Saint Gilles, France.

A modified farrowing pen (MOD) designed as a standard farrowing crate (STD) with a 1.5 x 1.6 m pen in the back, equipped with rubber floor mats and accessible to sow and piglets was used to assess if more space and comfort favor sow-piglets interactions and nursing behavior. Primiparous Yorkshire x Landrace sows were randomly allocated between STD crates ($n = 10$) or MOD pens ($n = 13$). Litter size was standardized to 10 or 11. Direct observations of two successful nursings and one inter-nursing period (INP) were done between 12:00 and 18:00 on days 5 and 17 of lactation. Duration and interruption of nursing bouts, as well as localization, posture and activity of the sow and sow-piglets interactions during INP were recorded. Data were analyzed with SAS (MIXED procedure). In MOD pens, 74% of observed nursings occurred in the back pen. The total duration of nursing bouts was not affected by the pen type (MOD: 5.1 min, STD: 4.6 min, $P = 0.1$), but the milk ejection phase was longer in MOD pens compared to STD pens (20.9 sec vs. 19.0 sec, $P < 0.05$). Sows interrupted more nursings in MOD than in STD pens (42% vs. 15%, $P < 0.05$). The duration of INP ranged from 16 to 73 min and did not differ between pen types ($P = 0.9$). During INP, sows in MOD pens spent 80% of their time in the back pen, spent more time rooting (3.3% vs. 1.1%, $P < 0.05$) and stood up and lay down more often (2.7 vs. 1.1 times/h, $P < 0.05$) than sows in STD pens. Seventy percent of sow-piglets interactions occurred during the first half of INP. Sows in MOD pens tended to initiate more interactions with their piglets (26.4% vs. 14.8%, $P = 0.08$) and showed more piglet-directed motor acts per interaction (2.1 vs. 1.6, $P < 0.05$) than sows in STD pens. In conclusion, sows housed in MOD pens were more active and expressed more piglet-directed behaviors. This suggests enhanced welfare by enabling maternal behavior expression.

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Key Words: Farrowing Pen, Maternal Behavior, Nursing Behavior

Animal Behavior and Well-Being: Swine Handling, Transportation and Stress

W10 The fatigued pig syndrome. M. Ritter^{*1}, M. Ellis¹, M. Benjamin², E. Berg³, P. DuBois⁴, J. Marchant-Forde⁵, A. Green⁶, P. Matzat⁷, P. Mormede⁸, T. Moyer⁹, K. Pfalzgraf¹⁰, M. Siemens¹¹, J. Sterle¹², T. Whiting¹³, B. Wolter¹⁴, ¹University of Illinois, Urbana, ²ELANCO Animal Health, Canada, ³University of Missouri, Columbia, ⁴Cargill, KS, ⁵USDA-ARS, IN, ⁶USDA-APHIS, CO, ⁷ELANCO Animal Health, MO, ⁸Lab Neurogenetique et Stress, France, ⁹Hatfield Quality Meats, PA, ¹⁰Tyson Fresh Meats, AR, ¹¹Smithfield Foods, Inc., VA, ¹²Texas A&M University, College Station, ¹³Agriculture & Food, Canada, ¹⁴The Maschhoffs, Carlyle, IL, ¹⁵National Pork Board, IA.

A National Pork Board sponsored workshop reviewed the literature relating to fatigued pigs, defined as a non-ambulatory, non-injured animal that, without obvious injury, trauma, or disease, refuses to walk at any stage of the marketing channel from loading at the farm to stunning at the plant. Workshop objectives were to identify the causes and economic impact of this syndrome as well as factors potentially associated with fatigued pigs. Intervention strategies were reviewed and key gaps in the scientific literature identified. Potential mecha-

nisms for the etiology of this syndrome include acute stress resulting in acidosis and chronic stress resulting in glycogen depletion and physical exhaustion. Several studies have found elevated plasma ammonia concentrations in fatigued pigs, but the importance of this is not understood. Economic impact of the syndrome is currently unknown; national statistics for its incidence are not available and losses associated with product-quality defects (i.e., pork quality, carcass trim loss, and pig/carcass disposal costs) are not known. Field studies suggest that >50% of all non-ambulatory pigs at the plant are fatigued and, thus, it is anticipated that ~0.3% of all pigs transported will develop the syndrome. Predisposing factors for this multi-factorial syndrome were characterized as pig, environment/facility, people, transport, and plant. Key gaps in the literature included but were not limited to the effects of genetics, health status, increased leanness/muscling, age/slaughter weight, production system, trailer design, transport time, and plant line speed.

Key Words: Pig, Transport Losses, Fatigue