Wednesday, July 12, 2006

POSTER PRESENTATIONS

Animal Behavior and Well-Being

W1 Analysis of the association of change in average daily gain of finisher pigs remaining after pulling out heavier pigs with the change in allometric space allowance. L. Anil*, S. S. Anil, and J. Deen, *University of Minnesota*, *St. Paul*.

The association of change in average daily gain (ΔADG) of finisher pigs remaining after the removal of heavier pigs from pens at market BW, with change in k value (Δk) and actual k experienced (k-EXP) was assessed. Barrows of 30kg (30.56±0.15) were randomly allocated to 4 floor space treatments based on 4 values of k (0.037, 0.034, 0.031 and 0.027) calculated for the final anticipated BW of 116kg and maintained up to a market weight of 116kg. The four final space allowance treatments based on k for the anticipated 116kg BW were 0.88, 0.81, 0.74 and 0.64 m^2 per pig respectively. The group composition treatments included uniform (pigs of BW above 25 and below 75 percentiles) or varying BW (pigs of BW below 25 and above 75 percentiles) and the group sizes were kept constant as 19 pigs per pen. The trial was conducted in a commercial farm in Minnesota with fully slatted floor, following a 4×2 factorial design across 32 pens. All pigs had ad libitum access to feed and water and were fed Paylean (ractopamine HCl, 9g/ton of feed) during 14th wk of the trial. The k-EXP at different time periods was calculated based on weekly BW and pen area. Pigs were individually weighed at the start, bi-weekly up to 6 wk and weekly thereafter up to 17th wk of the trial. ADG was determined from weekly BW. Heavier pigs were removed from different pens at 15th, 16th and 17th wk once the respective pen average reached 116kg. The association of ΔADG of pigs remained after removal of heavier pigs with Δk (with respect to 14th wk) and k-EXP in the pen after 14th wk was analyzed using linear regression analysis. The association of ΔADG with Δk and k-EXP in the wk after the first removal of pigs (15th wk) was not significant ($P \geq 0.05$). Regression equations for ΔADG for second (16th wk) and third removal (17th wk) of pigs were ΔADG =1.0668+ $^{-}$32.858 k-EXP+30.665 Δk (R^2=0.21, $P \leq 0.05$) and ΔADG =1.0888+ $^{-}$34.574 k-EXP+25.556 Δk (R^2=0.37, $P \leq 0.01$) respectively. It may be possible to determine benefit in terms of ADG while taking decision to pull out pigs if the k values at market weight are known.

Key Words: Daily gain, Space, Finisher pig

W2 The effects of different frequencies of weekly human interaction on handling responses in market hogs. J. A. Brown*[1], E. L. Toth[1], A. L. Stanton[1], T. M. Widowski[1], and P. Lawlis[2], [1]*University of Guelph, Guelph, Ontario, Canada*, [2]*Ontario Ministry of Agriculture and Food, Guelph, Ontario, Canada*.

The effects of different amounts of human interaction on responses to humans, handling during loading and behavior pre-slaughter were studied in 1900 market hogs from two commercial operations. Pens of 15 to 24 pigs were walked once, twice or three times per week, or not at all, during the final 12 weeks of finishing. Walking the pens involved a handler with a pig board entering and walking purposefully through the pen, spending an average of 40 (±0.39) seconds there. Responses towards humans were monitored in the home pen weekly. Handling behavior and time to load were monitored on the day of shipping and behavior in the crowd pen and chute were monitored at the packing plant. At both farms, walking the pens had a significant effect on behavior. All treatments showed a significant reduction in escape behavior over time. After eleven weeks, pigs walked twice or three times per week showed significantly less escape behavior than those walked only once per week ($P<0.05$). The percentage of animals showing escape behavior at eleven weeks were 31.25 ± 7.8, 12.5 ± 4.7 and 12.5 ± 4.7 (mean, ± SE) for pens walked once, twice and three times per week, respectively. During handling at loading no significant treatment effects were observed. The truck level that pigs were loaded on had a significant effect on loading time, with pigs loaded on the top deck requiring almost twice as long to load as those on middle or bottom decks ($P < 0.05$). At the packing plant, different treatment effects were found for each farm. Handled pigs from farm 1 showed a significant reduction in jamming at the chute entrance, while handled pigs from farm 2 took less time to move through the crowd pen. We conclude that regular human interaction during the finishing period has a significant effect on behavioral responses towards humans. Walking the pens two or three times per week during the last 12 weeks before shipping had the greatest effect on behavior on-farm in the home pen, while walking pens as little as once per week showed a positive effect on handling at the packing plant.

Key Words: Pigs, Handling, Behaviour

W3 Impact of animal management and transportation factors on transport losses in market weight pigs at the packing plant. M. J. Ritter*[1], M. Ellis[1], C. R. Bertelsen[1], R. Bowman[2], J. Brinkmann[2], J. M. DeDecker[1], O. Mendoza[1], C. M. Murphy[1], B. A. Peterson[1], A. Rojo[1], J. M. Schlipf[1], and B. F. Wolter[2], [1]*University of Illinois*, *Urbana*, [2]*The Maschhoffs, Inc.*, *Carlyle, IL*.

Two studies were carried out to evaluate the effect of animal management and transport factors on transport losses. Study 1 used 35 trailer loads of pigs in a split-split-plot design with a 2 × 3 factorial arrangement of treatments: 1) time off-feed prior to loading (0 vs. 24 h) and 2) transport floor space (0.39 vs. 0.46 vs. 0.54 m^2/pig). Study 2 used 37 loads in a split-plot design with a 2 × 3 factorial arrangement of treatments: 1) mixing during transport (unmixed vs. mixed) and 2) transport floor space (0.39 vs. 0.46 vs. 0.54 m^2/pig). Pigs from the same farm were transported in either February-March or August-September. Floor space treatments were compared in the front three compartments on each deck of the same design of straight, double-deck trailers. Pigs were loaded using standard commercial procedures and were transported ~140 km to a commercial packing plant. Data for transport losses were not normally distributed, were transformed using the Rank procedure of SAS, and were analyzed using PROC Mixed. Time off-feed and mixing during transport had no effect on transport losses. Therefore, data from studies 1 and 2 were combined to evaluate the effects of transport floor space on transport losses. The combined data showed that transporting pigs at 0.39 m^2/pig compared to 0.46 and 0.54 m^2/pig increased ($P < 0.05$) non-ambulatory pigs (0.39 vs. 0.12 vs. 0.14 ± 0.09%, respectively), but did not affect deads on arrival or non-ambulatory, injured pigs at the plant. Floor space effects on the incidence of non-ambulatory, non-injured pigs and total losses at the plant varied depending on the time of year. For loads transported in February-March, there was no effect of floor space, however, for loads in August-September, pigs with 0.39 m^2/pig had higher ($P < 0.05$) incidences of non-ambulatory, non-injured pigs (0.38 vs. 0.00 vs. 0.00 ± 0.08%, respectively) and total losses (0.72 vs. 0.16 vs. 0.00 ± 0.13%, respectively) than pigs with 0.46 and 0.54 m^2/pig. These results confirm that floor space on the trailer has a major impact on transport losses, but suggest that the effect is dependent upon transport conditions.

Key Words: Pig, Transport, Feed withdrawal

W4 Maternal stress: Behavior and endocrine response of the progeny. J. N. Landgrebe*, N. C. Burdick, and J. C. Laurenz, *Texas A&M University*, *Kingsville*.

This study examined the effects of maternal stress on offspring behavior in relationship to changes in the stress response. Pregnant sows were assigned by parity to one of two treatments and managed either per current industry standards (Control; n=2) or subjected to a daily 5 min acute restraint stress from d 85 to 110 of gestation (Stressed; n=2). After farrowing, pigs (n= 12 from control sows; MC; and n=17 from stressed sows; MS) were weighed, tattooed for identification and managed similarly throughout the study. On d 18 of age, pigs were subjected to a social confrontation test by placing 3 MC and 3 MS pigs in a 1.5 x 1.5 m open field. Each pig was numbered and the test was videotaped. The behavioral elements measured per pig included: (1) sniffing; (2) threat; (3) biting; (4) fighting; (5) chasing; (6) fleeing; and (7) withdrawal. An aggression score (AS) was calculated as the sum of elements 2 through 5. To assess pig stress response, pigs were subjected to an acute restraint test and blood samples collected at 1.5, 3 and 6 min. Plasma was analyzed for cortisol (C), epinephrine (E), norepinephrine (NE), and dopamine (D). All data was subjected to ANOVA using split-plot design. Sources of variation included treatment, time of bleed, and individual interactions. MS pigs displayed more ($P < 0.05$) sniffing than MC pigs. MS pigs had decreased ($P < 0.05$) incidents of biting and fighting, and increased ($P < 0.05$) incidents of fleeing. The AS score for MS pigs was lower ($P = 0.03$) than MC (10.9 ± 2.3 vs. 23.8 ± 6.2, respectively). The MS pigs had similar ($P > 0.05$) plasma concentrations of C, but had lower ($P < 0.05$) E, NE, D than MC pigs. For both MC and MS pigs there was a positive correlation between AS and E (r=0.76; $P < 0.01$), but no ($P > 0.05$) correlation between AS and NE and D. MC pigs showed a positive correlation between AS and C (r=0.78; $P < 0.01$). In contrast, in MS pigs there was a negative relationship between AS and C (r=-0.61; $P < 0.01$). Collectively, these data indicate that maternal stress reduces the normal aggressive behavior of pigs. In addition, the results suggest that the role of C in normal aggression in the pig is dependent upon concentrations of the E.

Key Words: Behavior, Maternal stress, Pig

W5 Analysis of the association of shoulder lesions during lactation with sow-level factors. S. S. Anil*, L. Anil, and J. Deen, *University of Minnesota*, *St. Paul*.

A study involving 162 sows was conducted to analyze the association of sow level factors with the presence or absence of shoulder lesions during lactation. The sows were housed in 4 different farms during gestation and were transported to a single facility for farrowing on 109-112d of gestation. The sow level factors considered were parity, farrowing performance (number of piglets born alive and presence or absence of stillborn and mummies), lactation length, body condition score, and lameness observed while in the farrowing crate (lame or non-lame). Body condition of all the sows was visually assessed between 110-114d of gestation on a scale of 1-5. Shoulder lesions were assessed immediately before weaning. The data were analyzed using logistic regression model. For the analysis, parity of sows was categorized into parities 1 and 2, 3 to 5 and ≥ 6 and body condition into ≤ 2 or >2. The number of piglets born alive and lactation length were included in the model as continuous variables. Since the sows were housed in 4 different farms during gestation, farm was included in the model as a random factor using Glimmix macro of SAS (v 9.1). Of the 162 sows, 54 had shoulder lesions, including 31 sows with bi-lateral lesions. Among the sows, 19 showed lameness while in the farrowing crate and 67 had body condition score ≤ 2. The average lactation length was 18 ± 0.44 days. The odds ratio (OR) indicated that the likelihood of shoulder lesions increased ($P \leq 0.05$) by 16% with one day increase in lactation length. Sows with body condition score ≤ 2 had higher ($P \leq 0.05$) likelihood of shoulder lesions than sows with score >2. Non-lame sows had 73% lower ($P \leq 0.05$) likelihood of shoulder lesions. The study indicated that lameness, poor body condition and longer lactation periods are risk factors associated with the development of shoulder lesions in sows during lactation.

Key Words: Shoulder lesions, Sow, Lameness

W6 Decreasing feed tossing behavior in dairy cows by emplacing a cable in front of manger. F. Farivar*[1] and F. Kafilzadeh[2], [1]*Gorgan University*, *Gonbad, Gorgan, Iran*, [2]*Razi University*, *Kermanshah, Kermanshah, Iran*.

This experiment was conducted to evaluate a method for decreasing feed tossing by dairy cows. Forty five lactating dairy cows were

randomly allocated to three treatments: two groups had a cable in front of their manger which was located 40 cm away from feeding fence and with either 80 or 70 cm above the standing floor of cows. The third group had no cable above their manger (control). One week after fixing the cables, feed tossing behavior of cows was directly observed during the morning feeding of a TMR ration for 10 days. Backward and forward tossing behaviors were recorded for each cows in each group. There was a highly significant difference ($P<0.01$) between groups in both backward and forward tossing behaviors. Both groups with cables above their mangers showed lower feed tossing behavior (22 and 20 vs. 52 times backward feed tossing; and 9.2 and 4.2 vs. 25.4 forward tossing for groups with 80 cm and 70 cm height above their manger and the control respectively). Height of cable (80 or 70 cm) had no significant ($P>0.05$) effect on the tossing behaviors.

Key Words: Dairy cow, Feed tossing, Behavior

W7 Behavioral patterns change when primiparous cows are mixed with multiparous cows. C. Iglesias*[1], A. Bach[2,3], M. Devant[3], X. Manteca[4], S. Calsamiglia[4], and A. Ferret[4], [1]*SEMEGA*, *Spain*, [2]*ICREA*, *Spain*, [3]*IRTA-Unitat de Remugants*, *Spain*, [4]*Universitat Autónoma de Barcelona, UAB*, *Spain*.

Forty six multiparous and 80 primiparous cows (PPC) were used over a 5-mo period to evaluate the effects of grouping strategy of PPC on behavioral patterns. On average, the number of lactating cows across the study was 100, evenly distributed according to DIM and production in 2 symmetrical pens, maintaining a ratio of cows to feeding places of 1.78. One pen was composed exclusively of PPC (PP) whereas the other (PM) included 30% PPC and 70% multiparous cows. All cows on each pen were observed twice daily (from 1100 to 1300 and from 1600 to 1730) by the same person from an observing platform every 10 d and the occurrence of drinking, fighting, licking, self grooming, ruminating, sleeping, and walking behaviors of PPC were recorded (total hours of observation was 59.5 h). A Poisson regression model including treatment, and DIM as fixed effects, day as a repeated measure, and cow as a random effect assuming an equal-correlation variance-covariance structure was used. The incidence rate ratios (IRR) were calculated to describe the probability of occurrence of a particular behavior in the PP group relative to the PM group ([incidence rate in PP] / [incidence rate in PM]). The incidences of fighting (0.95%), licking (0.95%), and self grooming (5.0%) behaviors were not different in PP than in PM. Also, proportion of observations corresponding to walking (3.7%) or sleeping (5.1%) activities were similar in both PP and PM cows. However, in the PM group, 1.8% of the total observations of PPC corresponded to drinking activities, whereas in the PP group the figure was 3.4%, which resulted in an IRR for the drinking behavior of 2.0 ± 0.56 ($P < 0.05$). Similarly, in the PM group, 43.8% of the total observations of PPC corresponded to ruminating activity, with an IRR for ruminating behavior of 1.16 ± 0.06 ($P < 0.01$). It is concluded that separating PPC from multiparous cows resulted in increased drinking and ruminating activities with no changes in self grooming or aversive behaviors.

Key Words: Cattle, Behavior, Grouping

W8 The impact of machine milking on milk production traits and blood cortisol in primiparous dairy ewes. S. P. G. Rassu[1], E. A. Cannas[2], P. Nicolussi[2], P. Bonelli[2], and G. Pulina*[1], [1]*Dipartimento di Scienze Zootecniche - University of Sassari*, *Sassari, Italy*, [2]*Istituto Zooprofilattico sperimentale per la Sardegna*, *Sassari, Italy*.

In Sardinian dairy flocks, machine milking starts at about 30 days post-partum, after lamb weaning. This is a stress factor, especially in primiparous ewes that are exposed to this practice for the first time. The objective of the trial was to evaluate the effect of milking parlour training before weaning on milk production traits. One week before weaning, six ewes (group A) and their lambs were introduced into the milking parlour and hand-milked once a day, to adapt them to the new environment and noise of the milking machine. Seven ewes (group B) were hand-milked once a day outside the milking parlour until weaning. Milk yield was recorded and milk samples were collected at each milking for the first 10 days of machine milking for fat, protein and somatic cells count (SCC) analysis. Blood samples were collected every day soon afterwards the morning machine milking and analyzed for cortisol levels. Data were analyzed using group and sampling as fixed factors and ewes within group as random factor. No differences between groups were observed in all evaluated parameters. Nevertheless, milk yield, milk fat content and yield, and SCC tended to be lower in group A than in group B. Significant interactions between group and sampling date were observed for all milk traits. Blood cortisol levels were not affected by the treatments during the first 10 DIM. The results suggest that a week of training in the machine parlour did not allow to reduce the stress caused by machine milking and weaning in primiparous ewes. Funded by the BenOLat (MiPAF) project.

Table 1. Milk production traits and blood cortisol levels (mean±se).

	Milk yield g/d	fat %	fat yield g/d	CP %	CP yield g/d	SCC *1000/ml	cortisol ng/ml
Group A	1755±175	4.4±0.2	75±8	4.7±0.2	81±8	77±1	29±2
Group B	1946±162	4.7±0.2	91±7	4.5±0.1	88±8	93±1	29±2
Significance							
Group	ns	ns	ns	ns	ns	ns	ns
Sampling	**	**	**	ns	**	**	ns
Group x Sampling	**	**	**	**	**	**	ns

CP = crude protein; SCC = somatic cells count; ns = not significant; ** significant at $P < 0.01$

Key Words: Animal welfare, Sheep management, Dairy sheep

W9 Regional differences in sweat rate response of steers to short-term heat stress. D. E. Spiers*[1], L. E. Wax[1], B. Scharf[1], and G. E. Aiken[2], [1]*Univeristy of Missouri*, *Columbia*, [2]*USDA-ARS, Forage-Animal Production Research Unit*, *Lexington, KY*.

A preliminary study was performed to determine the sweat rate response to short-term heat stress using a new portable detector. Six angus steers (319.5 avg bw) were placed in two chambers maintained at 16.5 – 18.8C air temperature (Ta) within the Brody Environmental Center at the University of Missouri. Cold chamber Ta was lowered to 8.1C and Ta within the hot chamber was increased to 32.7C over a 24h period. Measurements at selected time periods included air and rectal temperatures, along with respiration rate, as indicators of thermal strain. Skin temperature was measured at shoulder and rump locations with determination of sweat rate using a Vapometer (Delfin Technologies Ltd, Finland). Rectal temperature did not change in cold or hot

locations due to a known lag in this response, and to effectiveness of thermoeffector mechanisms. Respiration rate nearly doubled in the heat ($P < 0.05$) to maintain this core temperature. Best fit for this relationship was a fourth-order polynomial relationship (R^2 =0.87; P<0.0001). This increase occurred at a Ta above 24C. Skin temperatures at the two locations were highly correlated with each other and with Ta. In contrast, sweat rate was different at rump and shoulder sites, and affected by Ta. Sweat rate of the rump exhibited only a small increase with Ta, and showed no signs of a sharp increase. However, sweat rate at the shoulder increased more than 4-fold at Ta and shoulder temperatures above 27 and 36C, respectively. Increased sweat rate in this region is supported by an earlier report of a higher density of sweat glands in the shoulder compared to rump regions. Sweat rate was correlated with several thermal measurements to determine the most likely predictor and stimulus for this response. Fourth-order polynomial expressions for rectal, shoulder and air temperatures produced R^2 values of 0.37, 0.72, and 0.97, respectively. This suggests that thermal inputs, other than rectal or shoulder temperatures, drive the sweat response in the shoulder.

Key Words: Cattle, Heat stress, Sweat

W10 Blood indicators of stress are not affected when primiparous cows are mixed with multiparous cows. C. Iglesias*[1], A. Bach[2,3], M. Devant[3], X. Manteca[4], S. Calsamiglia[4], and A. Ferret[4], [1]*SEMEGA*, *Girona, Spain*, [2]*ICREA*, *Barcelona, Spain*, [3]*Unitat de Remugants-IRTA*, *Barcelona, Spain*, [4]*Universitat Autónoma de Barcelona (UAB)*, *Barcelona, Spain*.

A total of 142 lactating Holstein cows (52 multiparous and 90 primiparous) were used over a 10-mo period to evaluate the effects of grouping strategy of primiparous cows (PPC) on potential stress indicators in blood. On average, the number of lactating cows across the study was 100, evenly distributed according to DIM and production in 2 symmetrical pens, maintaining a ratio of cows to feeding places of 1.78. One pen was composed exclusively of PPC (PP) whereas the other included 30% PPC and 70% multiparous cows (PM). All PPC were blood and milk sampled at 3, 10, 24 DIM and monthly afterwards, to determine cortisol, serum amyloid A (SAA), haptoglobin, and NEFA in plasma, and amyloid A in milk. Milk production and DMI were monitored daily. Data of PPC were analyzed using an unbalanced (PP = 67; PM = 23) mixed-effects model with repeated measures. Milk production (25.9 vs 25.6 ± 0.8 kg/d) and DMI (18.7 vs 18.1 ± 0.9 kg/d) were similar in both PM and PP, respectively. Plasma NEFA, cortisol, and SAA concentrations were similar in PP and in PM (0.18±0.01 m*M*, 16.83±1.41 ng/ml, and 35.63±1.11 μ/ml, respectively). However, NEFA concentrations were highest (0.34±0.02 m*M*) during the first 24 DIM, and SAA during the first 95 DIM (45.15±1.22 μg/ml) than in later stages of lactation (0.13±0.02 m*M* and 27.93±1.21 μg/ml, respectively). Plasma cortisol concentrations did not change with lactation stage. Plasma haptoglobin concentrations were not affected by grouping strategy but were highest (0.31±0.13 mg/ml; $P < 0.01$) during the first 95 DIM in both PP and PM. Milk amyloid A concentration was positively correlated with SAA although the correlation was not strong ($r^2 = 0.34$, $P < 0.001$). It is concluded that either the grouping strategy had no effect on stress of PPC as production and intake were not affected, or if stress was present, the studied blood parameters were not useful indicators of it.

Key Words: Stress, Social behavior, Cattle

W11 Automatic monitoring of lying, standing and walking behavior in dairy cattle. L. Munksgaard[1], C. G. Reenen[2], and R. Boyce*[3], [1]*Danish Institute of Agricultural Sciences*, *Research Centre Foulum, Denmark*, [2]*Animal Sciences Group of Wageningen University and Research Centre*, *Lelystad, The Netherlands*, [3]*IceRobotics*, *Roslin BioCentre, Scotland*.

Management and housing can have important impact on locomotor activity and lying behavior in cattle, and this can affect the welfare of the animals. However, large scale as well as long-term studies have been limited since both direct observations and analysis of video recordings are very time consuming. The aim of the present study was therefore to validate the use of a new device (IceTag® (IceRobotics, Edinburgh, UK)) for automatic monitoring of lying, standing and walking in cows. The device is attached to the hind leg of the cow and by use of a special USB cable data can be downloaded to the IceTagAnalyser® software on a PC. There was a high correspondence between data recorded from different loggers attached to the left and right hind leg on the same cow (n=6); correlations were 0.99 for lying and standing, 0.89 for activity and 0.84 for number of steps. Lying down and getting up were recorded both by direct visual observation and by the device in two groups of six cows. Fourteen events of getting up and fifteen events of lying down were recorded by direct observation. These events were also recorded automatically. Regression analysis showed that duration of lying bouts obtained by direct observation could be reliably predicted by duration of lying bouts recorded automatically. In a third experiment 90 bouts of standing and 89 bouts of walking were recorded by direct observation of five cows which had the device attached to the hind leg. The estimated bout length from the automatically recorded data predicted the duration of bouts of walking and standing recorded by direct observation. In conclusion, the results demonstrate that the device can be used for estimating duration and frequency of lying, standing and walking in cows with high accuracy.

Key Words: Automatic monitoring, Lying, Activity

W12 The effect of stocking rate, parity, and lameness on the short-term behavior of dairy cattle. C. T. Hill*[1], R. J. Grant[1], H. M. Dann[1], C. S. Ballard[1], and R. C. Hovey[2], [1]*William H. Miner Agricultural Research Institute*, *Chazy, NY*, [2]*University of Vermont*, *Burlington*.

The objectives of the study were (1) to evaluate the effect of stocking rate (SR) on the behavior of freestall-housed dairy cattle and to identify the effect of (2) parity and (3) lameness on behavioral responses to changes in SR. Lactating Holstein cattle (n=136) were divided into four pens of 34 cows [11 primiparous (PP), 23 multiparous (MP)]. Each pen was assigned randomly to a SR (100, 113, 131, or 142%) in a 4×4 Latin Square design with 7-d periods. The SR was adjusted by altering access to stalls and headlocks. Six focal animals per pen (2 sound, PP; 2 sound, MP; and 2 lame, MP) were used to compare behavioral responses. Sound cows scored <3 and lame cows scored 3 or 4 on a 5-point gait-scoring scale. Observations were recorded at 10-min intervals over the last 48 h of each period. Data from one lame cow were excluded due to severe mastitis affecting her behavior during one period. Overall, lying time tended (P=0.14) to decrease from 51.1 to 47.4% of 24 h as SR increased from 100 to 142%. Time feeding (20.6% of 24 h) was unaffected (P=0.99) by SR, but meals per day increased (P=0.01) as SR increased. Although total time ruminating (35.0% of 24 h) was not affected (P=0.19) by SR, ruminating while standing in the alley increased (P=0.03) from 2.1 to 4.4% of 24 h at

the expense of ruminating while lying (P=0.12). Time spent standing in the alley without ruminating increased (P=0.03) from 5.6 to 8.2% of 24 h as SR increased from 100 to 142%. Parity and lameness had little effect on behavioral responses to changes in SR. However, lame cows tended (P=0.09) to spend less time ruminating than sound cows when SR increased. In summary, focal animals tended to spend less time lying, less time ruminating while lying, and more time standing in alleys as SR increased. The interaction of parity or lameness with SR had minimal effect on short-term behavior except for a tendency for lame cows to ruminate less than sound cows as SR increased.

Key Words: Stocking rate, Behavior, Lameness

W13 Age at transport effects on behavioral responses in dairy calves to novel stimuli. S. D. Eicher*[1], T. A. Johnson[1,2], and J. N. Marchant-Forde[1], [1]*USDA-ARS*, *West Lafayette, IN*, [2]*Purdue University*, *West Lafayette, IN*.

This study evaluated the effects of age at transport on behavioral response to novel stimuli within a test environment. Eighteen Holstein calves were randomly assigned to treatments according to age at d of transport; 2 to 3-d-old (young,Y), 4 to 5-d-old (moderate, M), or 6 to 8-d-old (old, O). Each calf was transported for 6 h (d 0). Then calves were placed in outdoor hutches until d 39 when they were moved to the USDA-ARS Livestock Behavior Research Unit for behavioral testing on d 43 (6 wk after transport). A 21.3 m corridor was designed with several novel objects spaced approximately 2.4 m apart; including an entry, red bucket, black mat, translucent plastic curtain, horizontal striped plank, darkened space, silver gates, reflecting metal, and open red gate to finish. Force was measured by 1=yelling; 2=moving into flight path; 3=pats; or 4=pushing to pass the obstacle. Calves went through the corridor once on d 43, then 3 times on d 44, 45, and 46. Data for the first experience with the corridor were reported previously, in which the Y calves tended to take longer to cross the first corner with a bucket than O calves and less force was needed to pass the second corner, for Y compared to M calves. All time data were analyzed using Mixed procedure and force data were analyzed using the Fisher's exact test in the Frequency procedure of SAS. Run time decreased with replication for the curtain, grate, dark and reflective metal (P<0.05). The silver gate and reflective metal were passed more quickly by the M than the Y or O calves (P<0.05). Force required to enter the corridor on d 44 was greatest for the Y calves on replicates 1 and 2 (P=0.01). Only on the 3rd run on d 46 did the Y calves require more force to pass the curtain than the M calves (P<0.05). On d 45 run 3, the O calves required more force (P=0.04) to pass the final gate than the M calves. These data show that age at transport affects behavioral responses up to 6 wk after transport.

Key Words: Calves, Behavior, Transport

W14 Effects of age and milk allowance on responses to abrupt weaning in dairy calves. K. Ito, T. J. DeVries*, M. A. G. von Keyserlingk, and D. M. Weary, *Animal Welfare Program, The University of British Columbia*, *Vancouver, Canada*.

Much recent interest has focused on alternative feeding programs for milk-fed calves, but little is known about how these calves can best be weaned. The objectives of this study were to quantify the effects of age and milk allowance on responses to abrupt weaning. Thirty-six Holstein calves were randomly assigned to either ad libitum or restricted (10% BW) access to milk and weaned at either 4 or 8 wks of age. Calves were reared in a group pen with milk provided by a computer-controlled feeder. Grain and water were provided ad libitum. Time standing and number of visits to the milk feeder were monitored from 1 wk before weaning until 3 d after weaning. Body weight was recorded automatically each time calves visited the feeder. An average of the pre-weaning values was used as a baseline in comparing responses post weaning. All calves showed strong behavioral responses to weaning, including an increase in standing time (9.5 ± 0.2 vs. 6.9 ± 0.2 h/d; P < 0.001) and a dramatic increase in feeder visits (61.7 ± 3.8 vs. 13.9 ± 3.7 visits/d; P < 0.001) during the 24 h after weaning. The restricted-fed calves tended (P < 0.1) to return to baseline values for these behaviors faster than the ad libitum-fed calves, but weaning age had little effect. Calves weaned at 8 wks of age from the restricted ration gained 0.74 ± 0.23 kg/d before weaning and actually tended to gain more (1.12 ± 0.15 kg/d; P = 0.06) during the week after weaning. However, all calves fed ad libitum and all calves weaned at 4 wks experienced a growth check at weaning. The growth rate of these calves decreased (P < 0.05), on average, from 0.82 ± 0.08 kg/d before weaning to 0.18 ± 0.09 kg/d during the week after weaning. In conclusion, all calves showed a distress response to abrupt weaning, but calves weaned early and from higher milk rations show increased behavioral responses and the greatest reductions in ADG in the days after weaning. These results illustrate the need for alternative weaning practices to accompany new milk-feeding methods.

Key Words: Milk allowance, Weaning, Dairy calves

W15 Use of recycled paper (news/office) and straw as bedding and their effects on heifer cleanliness and behavior. J. E. Wohlt*, D. B. Imwalle, and L. S. Katz, *Rutgers University*, *New Brunswick, NJ*.

Recycled paper products were compared with straw (STR) as bedding in two 4 wk trials with Holstein heifers in a loose housing system. Pens consisted of a scrape alley (3.0 x 3.6 m) and bedded pack (3.6 x 4.6 m). In Trial 1, eight pens of 5 heifers (average weight 320 kg) were bedded with STR or hammer-milled newspaper (HNP; 2.54 cm screen). In Trial 2, six pens of 38 heifers (6-7 animals/pen; average weight 211 kg) were bedded with STR, shredded newspaper (SNP), or shredded office paper (SOP). Initial bedding provided a 5.08 cm cushion for a lying heifer. Moisture content of bedded pack was recorded daily using an 81.3 cm Farmex® probe and clean bedding added if moisture exceeded 30%. Heifer cleanliness (scale 1 clean to 5 dirty) was recorded on Days 0, 7, 14, 21, and 28. Heifer behavior was recorded once daily as location (scrape alley, bedded pack) and position (lying, standing). Bedded packs were sampled on Day 28 for nutrient content. Data were analyzed using repeated measures or ANOVA using NCSS® software. Moisture content of bedded packs increased with day (P < 0.05) but did not differ with bedding type (Trial 1: 37.6%; Trial 2: 42.6 - 43.5%). Amount of bedding used per pen differed (P < 0.05) with bedding type (Trial 1: STR 164 kg, HNP 179 kg; Trial 2: STR 443 kg, SNP 464 kg, SOP 334 kg) due to density. Cleanliness scores increased (P < 0.05) with Day in Trial 1, but decreased (P < 0.05) in Trial 2. Bedding type influenced (P < 0.05) cleanliness score (Trial 1: STR 1.7, HNP 1.6; Trial 2: STR 2.8, SNP 2.3, SOP 2.5). Ammonia-N content of bedded pack differed (P < 0.05) with bedding type in Trial 2 (STR 0.098%, SOP 0.017%, SNP 1.96%). The pH content of clean bedding (STR 6.8, SNP 7.7, SOP 9.9) was a factor. Bedding type did not affect heifer behavior (P < 0.05). These experiments suggest that use of paper products compared to STR result in cleaner animals; however, amounts used and waste content can vary with bedding type or processing of paper product.

Key Words: Heifer, Bedding, Cleanliness

W16 Hair whorls locations of dairy heifers affects their growth, but not behavior. J. Broucek*[1], S. Mihina[1], M. Uhrincat[1], C. W. Arave[2], P. Kisac[1], and A. Hanus[1], [1]*Research Institute of Animal Production*, *Nitra, Slovakia*, [2]*Utah State University*, *Logan*.

We tested hypothesis that growth, time solving the maze (TSM) and number of grid crossings (GC) in open-field tests (OFT) are affected by the height location of facial whorl in heifers. 58 Holstein heifers were used. They originated from 2 sires. Differences between sire lineage's were not significant in any trait. Whorl placement was recorded by one person as each heifer entered the scale as hair whorl (HW) high (if the whorl was above the top of eyes), middle (if the whorl center was located between the top of the eyes and the bottom of the eyes) and low (if the center was located below the bottom of the eyes). Heifers were kept in hutches and fed 6 kg milk replacer (0.6 kg powder) per d until 8 wks. After weaning all heifers were kept in loose housing pens according to age and size, regardless the HW positions. Equal conditions of nutrition were ensured. Experimental conditions were as follows: The maze tests were performed in the indoor space at the age of 15 wks. Animals were deprived of concentrate prior to maze tests. A bucket with 1 kg of concentrate was placed at the exit. The heifers had to solve 2 tasks on two consecutive days. On the first day, the passage was open on the left side, and on the right side on the second day. Before the first test was one training run. Each day, the heifers were tested 4 times, TSM was measured from video tape. OFTs (one 5-min test, morning) were conducted at 16 wks and 18 months in an inside arena, visually and acoustically isolated from other animals. Number of GC were recorded. The data were analyzed using a GLM/ANOVA. We did not find any significant differences in behaviors. Heifers with a high hair whorl were the fastest during the maze tests and they had the highest GC at the both ages. Heifers with a high HW had the highest BW at days 360 ($P<0.05$) and 540 ($P<0.01$) and ADG from birth to 21 months ($P<0.001$) and from the 6th to 21st months ($P<0.01$) of age. We found that the growth was influenced in dairy cattle by height of their facial whorl, but the time of solving the maze and the locomotive activity in open-field testing was not.

Key Words: Dairy heifers, Hair whorl, Growth

W17 Effect of transport for up to 24 hours followed by twenty-four hours recovery on liveweight, physiological and hematological responses of bulls. B. Earley*, D. J. Prendiville, and E. G. O' Riordan, *Teagasc, Grange, Beef Research Centre*, *Dunsany, Co. Meath, Ireland*.

The objective of the study was to investigate the effect of road transport on liveweight, physiological and hematological responses of bulls after journeys of 0, 6, 9, 12, 18 and 24h. Eighty-four continental x bulls (mean weight (s.d.) 367 (35) kg) were randomly assigned to one of six journey (J) times of 0 (0km), 6 (280km), 9 (435km), 12 (582km), 18 (902km) and 24h (1192km) at a spatial allowance of 1.02m^2/bull. Blood samples were collected by jugular venipuncture before, immediately after and at 1, 2, 4, 6, 8, 12 and 24h. Bulls were weighed before, immediately after, and at 4, 12 and 24h. Blood samples collected into heparinized tubes were centrifuged and the plasma separated for subsequent analysis of: globulin, albumin, total protein, and creatine kinase. The hematological variables including red blood cell number (RBC), hemoglobin (Hb), hematocrit (packed cell volume (PCV)), mean cell volume (MCV), white blood cell (WBC) count, number of lymphocytes and neutrophils were determined for unclotted (K_3EDTA) whole blood. There were no differences ($P\geq0.05$) in rectal body temperature, pre- and post-transport, or liveweight among treatments on days 0 (pre-transport). Bulls traveling for 6, 9, 12, 18 and 24h lost 4.7, 4.5, 5.7, 6.6 and 7.5 percentage liveweight compared with the -24h baseline. There was no change ($P\geq0.05$) in globulin, albumin, total protein, or creatine kinase concentrations before or after transport. Neutrophil numbers (mean ± s.d) were greater ($P\leq0.01$) in all transported animals post-transport (J6,55±6.7; J9,60±10.1; J12, 48±16.8; J18,46±10.9, J24, 48±6.9) and counts returned to baseline by 24 hours for the J6 (30±15.0), J12 (34±9.3), J18 (36±12.1) and J24 (43±11.3) treatments. Control animals had greater ($P\leq0.01$) neutrophil numbers at the 6, 8, 12, and 24h sampling time periods as transported animals. Transport of bulls from 6 to 24h did not impact negatively on animal welfare. In conclusion, liveweight, physiological and hematological responses of bulls returned to pre-transport levels within 24h with animals having had access to feed and water.

Key Words: Transport, Physiology, Immune response

Animal Health III

W18 Maternal stress: Effect on the stress response and immune function of the progeny. M. Reyna*[1], S. Martinez[1], T. H. Welsh, Jr.[2], J. A. Carroll[3], and J. C. Laurenz[1], [1]*Texas A&M University*, *Kingsville*, [2]*Texas A&M University and Texas Agriculture Experiment Station*, *College Station*, [3]*USDA-ARS Livestock Issues Research Unit*, *Lubbock, TX*.

This study examined the effects of maternal stress on the stress response and immune function of the pig. Pregnant sows were assigned by parity to one of two treatments and either managed per current industry standards (Control; n=4) or subjected to a daily 5 min acute restraint stress from d 85 to 110 of gestation (Stressed; n=4). Following farrowing, pigs (n=37 from Control sows; MC; and n=31 from Stressed sows; MS) were weighed and tattooed. Pigs were subsequently reweighed at weekly intervals and average daily gain (ADG) calculated. At day 21, pigs were weaned and allowed 14 days to adapt to the new environment. Pigs were subjected to an acute restraint stress (3 min) and blood samples collected. Plasma concentrations of cortisol (C), epinephrine (E), norepinephrine (NE), and dopamine (D) were determined. To assess immune function, pigs were immunized against keyhole limpet hemocyanin (KLH) and serum samples obtained prior to immunization (d=0), and at 3, 7, 14, 21, 28, and 35 d post-immunization. Total immunoglobulin G (IgG) and KLH-specific IgG were determined. ADG during the pre-weaning period (d 1 to 21) was lower ($P < 0.05$) in MS vs. MC pigs (222 ± 8 vs. 247 ± 7 g/d, respectively). Gender affected C, with female pigs having greater ($P < 0.05$) C then male pigs (72 ± 6 vs. 50 ± 4 ng/mL) during an acute restraint stress. There was a maternal treatment by gender interaction, with male MS pigs having C concentrations lower then MC males and similar ($P > 0.05$) to female pigs. Regardless of gender, MS pigs had lower ($P < 0.05$) levels of E, NE and D. Immunization against KLH resulted in time-dependent increases ($P < 0.05$) in both total and KLH-specific IgG, with peak concentrations occurring at d 21 and 28 post-immunization, respectively. Although not affecting the temporal pattern, MS pigs had reduced ($P < 0.05$) total and KLH specific-IgG in response to immunization. These results indicate that maternal stress can dramatically impact the stress response of the progeny with an associated detrimental effect on immune function.

Key Words: Maternal stress, Immune function, Pig