and maximum of annual temperature and humidity of -3 to 42 C°, 30 to 100%, respectively. The herd size was 800 head with 300 cows milked daily and producing about 9 ton over the experiment. Two open sheds (60m x 32m) were used with 80 dairy cows in each. The average milk production of each barn was 36±1.5 Kg and average days in milk were 105±5. In one barn there were 80 free stalls and whilst the other was an open system with a concrete floor covered with wheat straw up to 10cm depth. Over 12 months, the location, posture and behavior of cows in each barn were considered at different times of day(4 AM, 9 AM, 2 PM and 8 PM). Data were analyzed using General Linear Models procedure of SAS V6.12 for ANOVA to evaluate differences among experimental groups, the design was split plot in time, means compared with Duncan test. In four seasons, the number of cows that were lying and eating in the straw bedding system was more than free stall system and the differences were significant (p≤0.05). So, data showed that cows prefer straw bedding in comparison with free stall system.

The effect of season on cow preference

	Lying in straw (%)	Lying in free stall (%	SEM
spring	35.96[a]	14.03[b]	0.013
summer	33[a]	14[b]	0.006
autumn	46.72[a]	15.88[b]	0.0001
winter	51.82[a]	35.88[b]	0.002
	Eating in straw (%)	Eating in free stall (%)	SEM
spring	31.57[a]	18.42[b]	0.011
summer	27[a]	26[b]	0.009
autumn	18.69	18.69	0.005
winter	7.4[a]	5.5[b]	0.05

Key Words: Free Stall, Straw Bedding, Dairy Cows

632 Immune function and oxidative stress vary by management and lactation stage for dairy cows in pasture-based production systems. K. Saker*[1], J. Fike[1], S. Washburn[2], and A. Meir[3], [1]*Virginia Polytechnic Institute and State University*, *Blacksburg*, [2]*North Carolina State University*, *Raleigh,*, [3]*Center for Environmental Farming Systems*, *Goldsboro, NC*.

This research focused on immune response to management and lactation stage in grazing dairy cows. Fall-calving first lactation and multiparous mixed breed dairy cattle (n=64) were maintained on pasture year-round. Pastures were a mix of cool- and warm-season perennial and annual grasses. Experimental treatments were high (3.7 cows/ha; HSR) vs. low (2.47 cow/ha; LSR) stocking rate management. A corn-cottonseed-based supplement was fed to both groups but at a greater rate for HSR cows (11 vs. 7 kg·cow d^{-1}). Stocking and supplementation rates were intentionally linked (confounding) to compare animal immune responses to differences in system management. Average milk production between the groups was similar (6100 kg/lactation), suggesting additional supplement adequately offset lower forage availability for HSR cows. Select immune function and oxidative stress measures were assessed 5 times per production year: calving (C), early lactation (EL), peak lactation/breeding (PL/B), summer heat stress (SHS), and late gestation (LG). In general, cows had lowest innate immune response during the PL/B and C periods, in that order. Phagocytic cell activity (% cells responding) of HSR cows was significantly lower than LSR cows during C (9.4 vs. 14.7%; $P < 0.01$), PL/B (9.3 vs. 18.6%; $P = 0.01$), and SHS (25.1 vs. 33.8%; $P < 0.01$) periods. Antioxidant activity in all cows closely paralleled phagocytic activity during specific times of physiological and environmental stress. Activity was lowest when oxidative stress was most pronounced. Cows at the LSR appeared to have greater protection against oxidative stress based on lower lipid hydroperoxide production (64.3 vs. 104.6 μM; $P < 0.01$) and higher antioxidant (SOD/GSH-Px) activities (36.0 vs. 15.5 and 94.4 vs. 81.2 mU/mg protein, respectively; $P < 0.05$). Somatic cell score of HSR cows were higher compared to the LSR group (3.5 vs. 2.5; $P = 0.05$). Stocking rate along with associated supplement:forage ratios in pasture-based dairy systems can influence immunological and physiological responses to management and environmental stressors.

Key Words: Antioxidant Activity, Immune Function

633 Infrared thermography as a non-invasive measure of stress in dairy cows. M. Stewart*[1], J. Webster[1], G. Verkerk[2], J. Colyn[3], and A. Schaefer[3], [1]*AgResearch*, *Hamilton, New Zealand*, [2]*Dexcel*, *Hamilton, New Zealand*, [3]*Agriculture and Agri-Food Canada*, *Lacombe, Alberta, Canada*.

Infrared thermography of the eye (ET), to detect heat produced by stress, may be a useful non-invasive way to measure the welfare impact of husbandry practices on domestic livestock. This study examined the ET of dairy cows during stimulation of the stress axis by intravenous hormonal administration or social isolation. Six cows, acclimated to handling, were each given six treatments in a random Latin-square design: 1) 5ml saline 2) ACTH (0.05 mg Synacthen) 3) bCRH (20 μg) 4) bCRH (40 μg) 5) epinephrine (1.4 μg /kg liveweight) and 6) isolation (I). Treatments were administered at time 0 and blood was sampled via jugular catheter while standing beside each cow at -30, -15, 0, 5, 10, 15, 20, 30, 40, 50, 60, 75, 90, 120, 180 and 240 min except for epinephrine which was sampled at -30, -15, -10, -5, 0, 2, 5, 10, 15, 20, 30, 45, 60, 90 and 120 min. Body temperature was recorded every 10 min and ET was recorded approximately every 2 min from 30 min pre-treatment (ThermaCam S60). Plasma samples were assayed for ACTH, cortisol and non-esterified fatty acids (NEFA). ACTH increased after bCRH, and cortisol increased after ACTH and bCRH (P<0.001). Neither cortisol nor ACTH changed after epinephrine or I. NEFA increased after epinephrine (P<0.01). ET increased prior to treatment in many cases. Compared to pre-treatment, ET was higher 30 and 60 min after saline and ACTH (P<0.001), but not after other treatments. ET tended to drop rapidly by the first sample after I (P=0.057) and then increase again (by 30 min, P<0.001). Body temperature was not affected by any treatment. Increases in cortisol, ACTH and NEFA confirmed stress axis activation. Pre-treatment increases in ET, possibly due to prior activity or handling stress, confounded post-treatment effects. The changes in ET found after I are novel, suggestive of an acute sympathetic response and may reflect psychological stress which was unique to social isolation.

Key Words: Infrared Thermography, Stress, Welfare

Animal Behavior and Well-being: Cattle, Pain Stress and Welfare

634 Does ketoprofen alleviate acute pain during dehorning? S. Millman*, T. Duffield, K. Lissemore, S. James, and L. Misch, *University of Guelph*, *Guelph, ON, Canada*.

Research shows that dehorning is painful to calves and that local anaesthetic, such as a lidocaine block, alleviates acute pain responses. Currently, the vast majority of dairy producers in North America dehorn their own calves, and rarely use lidocaine for this procedure. Effective in reducing post-surgical pain from dehorning, we examined if ketoprofen, an over-the-counter non-steroidal anti-inflammatory drug, is effective in alleviating pain when calves are dehorned at very young ages. Dairy calves (n=27) were dehorned when less than one month of age. All calves received corneal (IC) and intramuscular (IM) injections immediately prior to the dehorning procedure, with calves randomized among three treatments: L (lidocaine IC, saline IM), K (saline IM, ketoprofen IM) or C (saline IC, saline IM). Persons dehorning and collecting data were blind to the treatments. Behaviour data was collected during dehorning. Physiologic data was collected immediately prior to and following dehorning. Analysis of variance was used to analyse heart rate, respiratory rate, stamping and

avoidance. Contrasts between treatments were constructed using simple t-tests. All other observations were collapsed into dichotomous variables and analyzed using Fishers exact test. Both K and C calves performed more foot stamping (P=0.001) and avoidance (P=0.0004) than L calves. Tail hanging, a relaxed posture, was more frequently observed in L than K or C calves (P=0.005). Episodes of falling, kicking, rearing and vocalization were analysed collectively, and were performed significantly more often by K and C calves (0/9, 7/9, 5/9 respectively). Similarly, K and C calves displayed significantly greater changes in heart rate (P=0.001) and respiratory rate (P=0.001) than L calves. There were no significant difference between K and C calves for any of the variables measured. In conclusion, behavioural and physiological responses indicate that ketoprofen is not an acceptable alternative to local anaesthetic when managing pain associated with dehorning, even when conducted at young ages.

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Key Words: Dehorning, Animal Welfare, Pain Management

635 Effect of neck injections and use of a blind on behavior and flight speed in cattle. R. Müller*[1], M. A. G. von Keyserlingk[1], and K. S. Schwartzkopf-Genswein[2], [1]*Animal Welfare Program, University of British Columbia*, *Vancouver, BC, Canada*, [2]*Agriculture and Agri-Food Canada*, *Lethbridge, AB, Canada*.

The use of the neck region as injection site in cattle is becoming routine. Use of a blind may reduce aversive behavior caused by the presence of the person administering the injection. To evaluate whether cattle react to the proximity of the stockperson or to the subcutaneous injection (5 ml 0.9 % NaCl solution), 120, 10 mo old, Angus steers weighing 298 ± 28 kg (mean ± SD) were assigned to one of four treatment groups using a crossover design (neck/sham injection × blind/no blind) replicated over 2 d (3 d apart). Cattle were restrained for a total of 60 s in a squeeze chute with treatment being administered 20 s after entry. Squeeze activity (SA) was rated (scale: 5 levels from calm (1) to highly agitated (5)) for three 20 s intervals (initial 20 s baseline, middle 20 s including treatment, and final 20 s post treatment). Flight speed (m/s) was used as a measure of aversion to treatments and was taken upon release from the chute. No treatment or day effect on flight speed (2.67 vs. 2.58 m/s, ns, ANOVA) was observed; however, correlation between days ($r = 0.74$, $P \leq 0.001$) was significant. Animals receiving an injection were more agitated during the middle interval compared to animals receiving a sham injection (SA d 1, d 2: 1.90 vs. 1.58, 1.86 vs. 1.63; $P \leq 0.05$, $P \leq 0.1$; respectively). Although use of a blind had no effect on SA within d 1, animals exposed to the blind on d 1 were more agitated on d 2 (SA: 1.87 vs. 1.53; $P \leq 0.01$). Moreover, steers exposed to the blind on d 2 had higher reactivity scores during the baseline (SA: 1.87 vs. 1.53; $P \leq 0.01$) and post treatment intervals (SA: 2.17 vs. 1.67; $P \leq 0.001$) compared to animals without a blind. Flight speed may not be a useful measure of aversion when treatment differences are small, but appears to be repeatable. The results suggest that use of a blind does not reduce aversive responses by cattle to human presence or injection but appears to increase reactivity over time.

Key Words: Cattle Behavior, Injection Site, Flight Speed

636 A comparison of cattle temperament scores by breed type using different types of temperament scoring. J. Baszczak*, T. Grandin, S. Gruber, T. Engles, and J. Tatum, *Colorado State University*, *Fort Collins*.

The objective was to study beef cattle temperament during handling through a squeeze chute using several different numerical scoring systems. Four hundred and twenty 6 to 9 month old steers were grouped into 42 pens by breed type: Brahman crossbreds (n = 140), British (n = 140), and Continental crossbreds (n = 140). Temperament was evaluated on all cattle twice, approximately 28 days apart during standard weighing and processing. A four-point scoring system was used to assess the force required to induce the animal to enter the squeeze chute: none, tap on rear, one electric prod and multiple electric prods. A three-point scale of walk, trot, or canter was used for entering and exiting speed into and out of squeeze chute. Temperament within the squeeze chute was assessed with a four-point scale. Vocalization and defecation were measured by the number of occurrences while being held in the squeeze chute. Brahmans crossbreds ($x = 2.06$) needed the least amount of force to enter the squeeze chute compared to British ($x = 2.35$) or Continental crossbreds ($x = 2.83$) at $P = 0.001$. Entry speed scores were not significant at $P = 0.23$. Squeeze chute temperament scores were also not significant among the breed types at $P = 0.79$. Vocalization and defecation were not significant ($P = 0.38$ and 0.07). Exit speed scores were found to be significant at $P = 0.005$. Upon exiting the squeeze chute, Brahman crossbreds ($x = 2.06$) would trot, and Continentals crossbreds ($x = 1.87$) were more likely walk to trot, and British steers ($x = 1.50$) would walk. Cattle forced entry and exit speed scores are probably a more sensitive way for determining differences in temperament by breed type. The data was analyzed using a repeated measures model by pen in SAS 9.1.

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Key Words: Cattle, Temperament, Breed Type