

ADSA-SAD Undergraduate Competition: Undergraduate Original Research

243 The effects of metaphylaxis antibiotics on health and development of neonatal bull calves. K. G. DeHaan*, G. A. Holub, and M. A. Tomaszewski, *Texas A&M University, College Station.*

A study evaluating the effects of metaphylaxis antibiotics and milk replacer additives on the health and development of Holstein bull calves ($n = 52$; mean body weight = 42.28 kg + 3 kg; starting age < 3 d) was conducted. The calves were placed into a completely random 3×4 factorial design with each group receiving either tilmicosin phosphate (TIL), ceftiofur crystalline free acid (CEF), or saline solution (CON) injected subcutaneously into the neck area. For the duration of the study, the calves also received a commercial milk replacer powder (22% crude protein / 20% crude fat) fed at 1.1% BW. Within metaphylaxis treatment, calves were randomly assigned to receive either; 1) 4 g/d for 7 d and then 2 g/d for 14 d of an egg-based probiotic (PR); 2) 2 g/d of 96% betaine (BE); 3) both PR and BE (BP); or 4) no additives. The calves were housed in individual fiberglass hutches with commercial calf starter and water provided ad libitum. The body weight of each calf was recorded twice weekly in addition to daily recordings of fecal scores (1 = firm to 4 = watery) for 54 d. Medical treatments provided to each calf for scours, respiratory distress, or febrile events were recorded daily. The cumulative response of these incidences were analyzed and used as an index of morbidity. None of the additive effects were significant for any of the measured variables. The use of metaphylaxis did not significantly affect the average daily gain ($P > 0.60$) as the average daily gain was ~0.45 kg. However, when examining fecal scores, CEF and TIL significantly reduced the average fecal score over the control (1.85 vs. 1.97 vs. 2.20 respectively) ($P < 0.01$). The incidences of fever nor respiratory issues ($P > 0.20$) were influenced dramatically by metaphylaxis. Overall, the average daily treatment for fever was only 0.66 events and 0.39 events for respiratory distress. Metaphylaxis did not influence the occurrence of scours (fecal score > 2) ($P > 0.87$). Other than fecal score, these results indicate the use of metaphylaxis did not enhance productivity or reduce morbidity of Holstein neonatal bull calves.

Key Words: calf, metaphylaxis

244 Effects of Purina Cornerstone 20 AMPLI-CALF DX30 on calf growth. A. A. Blasi*¹, C. C. Stanley², C. R. Krehbiel¹, D. A. Jones², and W. Hurst¹, ¹Oklahoma State University, Stillwater, ²Land O'Lakes Purina Mills LLC.

Proper calf nutrition is key life-long productivity of the cow. Investments in a heifer during the first 12 weeks of life can affect her productive potential in adulthood. Proper milk replacer and calf starter that meets all of a calf's needs is essential for full growth potential. The objective of this study was to compare commercially available Purina Cornerstone 20 AMPLI-CALF DX30 to a mill prepared calf starter (contained 16.3 mg/kg Bovatec 68). Each had a similar composition on a DM basis with AMPLI-CALF containing 21.89% CP and the mill calf starter containing 21.23% CP. AMPLI-CALF was fed without oat hay until 12 wks of age with oat hay presented starting at 6 wks of age to the milled starter group. Twenty Holstein heifer calves born at the OSU dairy were placed at random in one of 2 feed treatment groups. Calves were housed individually in fiberglass hutches with wire panel runs and given free choice water. All calves received 3.79 L of premium colostrum within 24 h of birth. Calves were fed twice daily with Land O'Lakes 28:20 Cow's Match milk replacer. All calves were weaned at 9 wks old. Orts were recorded every day at 1600 and appropriate feed amounts were

adjusted and fed ad libitum to allow for excess feed. Water was offered ad libitum. To determine calf growth, measurements of weight, heart girth, pelvic width, pelvic height and wither height were taken on 1, 28, 56 and 84 d. Measurements were taken in the afternoon before new feed was presented. There was no difference ($P > 0.10$) in ADG from d 1–28, 28–56 or 1–84. However, from d 56–84 ADG was greater ($P = 0.05$) for calves fed AMPLI-CALF (1.30 kg/d) compared with control calves (1.10 kg/d). There were no differences ($P > 0.10$) in body weight, heart girth, pelvic width, pelvic and wither heights, as-fed feed intake or gain efficiency on d 1–28, 28–56, 56–84 or 1–84. Although overall growth was not affected, AMPLI-CALF increased post-weaning ADG of heifer calves compared with the milled calf starter.

Key Words: calf nutrition, heifer growth, performance

245 Use of omega-3 fatty acid rich algae and their oil as a feed supplement for dairy cattle. D. M. Shepherd*¹, J. A. Stamey¹, B. A. Corl¹, M. J. de Veth², and D. R. Winston¹, ¹Virginia Polytechnic Institute and State University, Blacksburg, ²Balchem Corp., New Hampton, NY.

Studies have shown that ω -3 fatty acids can improve reproductive performance in dairy cattle. Microscopic algae are a source of ω -3 fatty acids that could be used as a supplement for dairy rations. Availability of ω -3 fatty acids from the diet is limited due to their biohydrogenation in the rumen. A potential solution is to encapsulate the algal biomass in a lipid coating, theoretically allowing ω -3 fatty acids, specifically docosahexaenoic acid (DHA) found in algae, to remain inert in the rumen for absorption and utilization post-ruminally. To examine the supply of DHA for incorporation into milk fat by lipid encapsulated algal supplements, 4 late-lactation Holstein cows were assigned to a 4×4 Latin Square design. Their rations were supplemented with treatments: 1X rumen-protected algal biomass, 1X rumen protected algal oil, or 0.5X rumen-protected algal biomass. Supplements were lipid encapsulated (Balchem Corp., New Hampton, NY). The control treatment was unsupplemented. The 1X supplements supplied 29 g of DHA/d and the 0.5X supplement supplied half this amount. Data were compared using orthogonal contrasts. Supplementation did not affect feed intake, milk yield, or milk composition. Algal biomass supplements increased DHA content of milk fat (0.47 vs. 0.10 g/d; $P < 0.05$). Algal biomass was more effective at transferring DHA to milk fat than algal oil (0.55 vs. 0.30 g/d; $P < 0.05$). Supplements increased the milk fat content of trans-18:1 fatty acids. The effect on trans-18:1 fatty acids suggests that some of the supplemented fatty acids may have influenced the rumen biohydrogenation microflora. The transfer efficiency of dietary DHA to milk fat across treatments ranged from 0.5% to 3%. In conclusion, there was a significant increase in the amount of DHA present in milk fat.

Key Words: omega-3 fatty acid, algal biomass, milk fat

246 Effect of rumen sampling on time budget of lactating Holstein dairy cows. J. Deming*, P. D. Krawczel, and S. E. Boucher, *W.H. Miner Agricultural Research Institute, Chazy, NY.*

There is increasing evidence that a relationship exists between a dairy cow's ability to maintain her time budget and her productivity. This suggests that sampling regimens that alter behavior could potentially mask treatment effects in nutrition trials. The objective of this experiment was to determine differences in the feeding, ruminating, and lying behaviors

of ruminally cannulated lactating Holstein dairy cows housed in tie-stalls during the adjustment and sampling periods of a dairy nutrition experiment. We hypothesized that sampling would decrease time spent feeding, ruminating, and lying. Thirteen cows were assigned to the concurrently conducted nutrition trial, and all cows were subject to the same sampling schedule. Time spent eating, ruminating, drinking, lying, standing, or in the milking parlor was quantified by direct observation. Behavior was recorded at 5-min intervals for 24 h during both the adjustment and sampling periods. Data were analyzed as a completely randomized design using the Mixed procedure of SAS. Due to differences in time outside of the pen during sampling period (63.0 ± 0.9 min/d) and adjustment period (80.3 ± 0.9 min/d; $P < 0.001$), feeding, ruminating, and lying behaviors were evaluated as percentage of time within the tie-stall. Feeding ($18.7 \pm 1.2\%$) and ruminating ($40.3 \pm 1.3\%$) were not affected by sampling ($P > 0.10$). Lying decreased from $55.0 \pm 3.2\%$ during the adjustment period to $49.3 \pm 3.2\%$ during the sampling period ($P = 0.003$). Ruminating while lying was also reduced by sampling (from 28.3 ± 2.9 to $24.7 \pm 2.9\%$; $P = 0.03$). The results of this study suggest that sampling can impact some aspects of a dairy cow's time budget. The number of times cows are disturbed for the collection of samples should be considered when designing sampling regimens.

Key Words: dairy cow, behavior, sampling

247 Effect of coliform mastitis on osteopontin expression in mammary tissues of Holstein dairy cows. K. M. Jackson^{*1}, J. C. Gandy², L. M. Sordillo², and E. L. Karcher¹, ¹*Department of Animal Science, Michigan State University, East Lansing*, ²*Department of Large Animal Clinical Sciences, Michigan State University, East Lansing*.

Mastitis caused by gram-negative bacteria is often characterized by uncontrollable inflammation. Osteopontin (Opn) is a proinflammatory factor that plays a role in initiating the innate immune response by promoting cellular adhesion and eliciting proinflammatory cytokines. The objective of this study was to evaluate Opn gene expression in the mammary tissue of Holstein cows naturally infected with coliform mastitis compared with healthy controls. Parenchymal tissue was collected from 3 lactating cows killed for reasons relating to natural coliform infection and 3 lactating cows killed for non-infectious reasons. All animals were from a commercial herd. Real-time PCR was performed to evaluate the expression of the following cytokine genes in parenchymal tissue: Opn, tumor necrosis factor (TNF)- α and interleukin (IL)-1. Additional samples were collected from the external pudendal artery and analyzed for Opn gene expression. Osteopontin and IL-1 expression did not differ between the natural coliform infected parenchymal tissues and that of the control tissues. There was a trend for greater TNF- α expression in infected tissues compared with control tissues (20.5 ± 16.6 vs. 2.2 ± 1.9 ; $P < 0.07$). Variability within infected and control parenchymal tissue was high which may be a result of the collection periods and the heterogeneous population of cells. The severity and duration of coliform infection was not controlled in this study and expression of proinflammatory genes will be affected by these 2 factors. There was a 4.2-fold increase in Opn expression between the infected and control external pudendal artery samples (4.3 ± 0.5 vs. 1.0 ± 0.3 ; $P < 0.001$). Unlike the parenchymal tissue, the vasculature represents a more homogeneous population of cells. The variability between these samples was diminished compared with the parenchymal tissues. In conclusion, this is the first study to evaluate the presence of Opn in parenchymal tissue and external pudendal arterial samples. Further controlled studies are needed to reduce the variability observed between the infection groups.

Key Words: osteopontin, mastitis, mammary tissue

248 Evaluation of dairy cattle lying behavior in commercial freestall barns. C. Gravatte^{*}, C. Coombs, and J. Bewley, *University of Kentucky, Lexington*.

Animal activity monitoring sensors have been developed to measure lying behavior and have been validated using direct visual observations. These sensors may prove useful for assessment of facility functionality and animal well-being. However, to properly evaluate results, within and across herd variations must be understood. The objective of this research was to describe physiological factors impacting automatically recorded lying times across multiple commercial dairy farms using freestall barns. The lying times of 247 Holstein cows were measured using an animal activity monitor in 12 commercial dairy herds in Kentucky. Herds were categorized by production level (high, medium, and low) using rolling herd average milk. Within herds, project cows were distributed equally among lactation stage (60 to 400 DIM, mid and late lactation) and production level (high, medium, and low) categories. Cows that exhibited clinical lameness were excluded. For cows exhibiting estrus, the day of and the day before breeding were removed. When hours lying or number of steps taken within an individual day differed from an individual cow's weekly average by 2 or more standard deviations, these observations were removed. An IceTag animal activity monitoring sensor (IceRobotics Ltd., Edinburgh, Scotland, UK), which measures posture (lying versus standing) and number of steps, was attached to the hind leg of each cow above the fetlock for 14 d. The MIXED procedure of SAS was used to develop models to describe hours lying. Mean lying time ($n = 3298$) was 11.19 ± 2.70 h/d while mean locomotion score was 1.37 ± 0.56 . Cows that were in mid lactation (11.04 ± 0.39 h/d) had significantly lower lying times than cows in late lactation (12.42 ± 0.39 h/d, $P < 0.0001$). Lying time decreased with increasing milk yield ($P = 0.03$). Though the difference only approaches significance ($P = 0.11$), cows with a locomotion score of 3 spent more time lying (12.31 ± 0.71 h/d) than cows with a locomotion score of 1 or 2 (11.16 ± 0.14 h/d). Consideration of lactation stage, milk yield, and locomotion score is necessary for interpretation of results obtained from automatic activity monitoring sensors.

Key Words: lying behavior, activity monitor, precision dairy farming

249 Associations of DNA marker profiles for dry matter intake and efficiency with DNA marker profiles for fat-corrected milk yield and body weight. D. E. Brown^{*1}, C. D. Dechow¹, J. M. Daubert¹, W. Liu¹, and S. Bauck², ¹*Pennsylvania State University, University Park*, ²*IGENITY Livestock Production Unit, Duluth, GA*.

The objective of this study was to estimate the associations of DNA marker profiles for dry matter intake (DMI) and dry matter efficiency (DME) with DNA marker profiles for fat-corrected milk (FCM) and body weight (BW). DMI and BW were recorded within 7 d of monthly DHI milk testing on 11 Pennsylvania tie-stall dairy farms. Farms were visited once per month over a 6-mo period to measure feed intake on all cows, and blood was collected for DNA extraction. Genotypes were obtained at 86 loci that had a major allele frequency of < 95 for 796 cows. There were 35,390 test day FCM, 3,999 test-day DMI, and 2,195 test-day BW records available for analysis. Test-day records were used to derive 305 d total FCM (3,558 records), average BW (1,095 records), 305 d DMI (994 records) and 305 d DME (993 records) for analysis. Two 3 trait models (FCM, BW and either DMI or DME) were used to conduct genetic evaluations that included marker genotypes as fixed effects and a random polygenic animal effect in ASREML. Correlations for DNA marker effects were positive between DMI and FCM (0.29), DMI and BW (0.63), and DME and FCM (0.80). Correlations were negative between DMI and DME (-0.33) and DME and

BW (-0.15). Correlations of the polygenic effects were also strongly positive between DMI and FCM, DMI and BW, and DME and FCM and negative polygenic correlation was found between DME and BW. This study also showed genetic variation for feed intake and for feed efficiency. These findings indicate that it may be possible to use DNA markers to select for higher DME.

Key Words: dry matter efficiency, fat-corrected milk, DNA marker profiles

250 Evaluating the effectiveness of “cow-side” tests to identify animals with a dominant follicle at the time of insemination in a TAI protocol. T. L. Crouch* and J. L. Fain, *Clemson University, Clemson, SC.*

This study investigated changes in metabolic functions and their tendency to correlate with an adequate preovulatory follicular size (>15 mm) and secondary signs of estrus to better determine whether insemination should be performed in a TAI protocol. A total of 26 non-pregnant lactating Holstein and Jersey dairy cattle (n = 21; n = 5, respectively) of unknown estrous cycle status were synchronized (PGF_{2α}, d-18; GnRH, d-16; GnRH, d-10; PGF_{2α}, d-3, GnRH, d-1) and were inseminated 12 h after the final GnRH injection, d0. Temperature, urine pH and milk weights were collected at 12 h intervals beginning 48 h before TAI with the final collection occurring at insemination. The size of the largest follicle for each animal was determined by transrectal ultrasonography 12 h before TAI. On d 0, milk samples were collected and progesterone concentrations analyzed using a rapid milk P4 test. The results were qualitatively recorded on a scale from 1 (P4 = 0–1 ng/mL) to 3 (P4 = 5 ng/mL). Secondary signs of estrus were recorded 12 h before and at TAI with scoring based on the following observations: 1 = behavioral change, 2 = mucosal discharge, and 3 = mucosal discharge and mounting or standing activity. No strong correlations (> ±0.4) were realized between any “cow side” sampling method and the incidence of a dominant follicle or increased estrus expression. No differences (P > 0.05) in parameters were found regardless of the presence of a dominant follicle at TAI. When reproductively inefficient cows, as indicated by > 250 DIM and > 3 previous services, were excluded from the results (n = 7), a moderate positive correlation of 0.57 was identified with urine pH increasing in the 24 h before TAI in animals with larger follicles 12 h before TAI. Animals with an identifiable dominant follicle also had a greater increase in urine pH 24 h before TAI when compared with animals with the largest follicle being <15 mm in diameter (0.32 and 0.02, respectively; P < 0.05). Anomalies within the data are being overcome with additional sampling and correlation with blood serum P4 concentrations as well as pregnancy rate data.

Key Words: cow side

251 Effects of temperature on X chromosome carrying compared to Y chromosome carrying bovine sperm cells: preliminary results. L. A. Krueger*¹, J. L. Herring¹, and R. Wilborn², ¹*Alabama A&M University, Normal*, ²*Auburn University, Auburn, AL.*

Climatic conditions and slight differences in a female’s internal environment can influence the gender of her offspring (Cameron et al., 2008; Bonier et al., 2007). An observation by Roche, et al. (2006) revealed that air temperature raised by 1°C at the time of breeding increased the likelihood of the conception of a male calf by 1%. This observation suggests that X and Y chromosome carrying sperm cells are affected differently by raised environmental temperature. The purpose of this experiment was to compare the effects of female body temperature against X chromosome and Y chromosome carrying sperm. Eighteen gender sorted bovine semen straws of Genex Bull AN01043 were sub-

jected to time temperature treatments. Nine straws were sorted for the X chromosome (group A), and nine sorted for the Y chromosome (group B). Experimental Groups A and B each consisted of three subgroups (1, 2, and 3) of three semen straws each, so each subgroup contained three semen straws. The straws were incubated in randomly assigned water baths after thawing simultaneously for 40 seconds at 34°C according to the procedure recommended by Genex. The control (subgroups A1 and B1), was incubated at 37.94°C representing the normal internal body temperature of a cow. Subgroups A2 and B2 were incubated at 38.89°C and subgroups A3 and B3 at 39.72°C to represent the internal body temperature of a cow under increasing heat stress (McGhee et al., 2008). One straw was drawn from each subgroup at six hours, representing bovine sperm cell capacitation, at nine hours, and at twelve hours for examination of motility using Sperm Vision (minitube, Mt. Horeb, WI). Data were to be analyzed with an unpaired t-test at P < 0.05.

The test results at six hours of incubation revealed 10% motility for all subgroups, with all motile sperm cells labeled nonprogressives. Due to the nature of the data, time temperature treatments were stopped for all samples. This study is being revised to examine time temperature differences on fresh bovine unsexed semen. This revision will aid in the determination of adjustments necessary for continuation and retrieval of this experiment.

Key Words: temperature, sperm, bovine

252 Corn grain and liquid feed as non-fiber carbohydrate sources in diets for lactating dairy cows: digestibility trial. E. M. Eilenfeld*, M. L. Eastridge, and J. L. Firkins, *The Ohio State University, Columbus.*

We hypothesized that sugars in liquid feeds would maintain or improve measures of ruminal fermentation and diet digestibility to a greater degree when corn grain is processed to have a lower rumen degradable starch concentration. Five rumen cannulated cows were used in a 5 × 5 Latin square design and fed a control diet with steam-flaked corn (SFC) or 4 diets with dry corn that was finely or coarsely ground (FGC or CGC at mean particle sizes of 0.8 or 1.9 mm, respectively) factorialized without or 3.5% liquid supplement (LF; Quality Liquid Feeds, Dodgeville, WI) replacing corn grain. All diets contained a constant 24% corn silage and 16% alfalfa hay and 6% grass hay that were adjusted to maintain 36% NDF and 20.3% forage NDF. Diets were formulated to contain 36% non-fiber carbohydrates. Each period consisted of 2 wk, cows were fed and milked twice daily, and chromic oxide was dosed via the rumen as a digestibility marker. Contrasts were SFC vs. dry corn (SFC vs. the 4 ground corn diets) and the main effects and interaction of particle size and LF. The SFC decreased (P < 0.05) ruminal acetate and increased (P < 0.05) propionate concentrations. Finer particle size reduced (P < 0.05) ruminal pH (5.99 vs. 6.16), reduced (P < 0.10) ruminal concentration of acetate, and increased (P < 0.05) propionate concentration. Liquid feed reduced (P < 0.10) acetate, and there was an interaction for butyrate (LF increased with FGC but no effect with CGC). Finer particle size (P < 0.10) and SFC (P < 0.05) reduced ruminal NH₃ concentration. There were no treatment effects on digestibilities of DM (65.9%), OM (67.7%), or NDF (54.9%). The DMI was similar (24.6 kg/d), but SFC increased (P < 0.10) milk yield (38.0 vs. 35.9 kg/d). Milk fat (3.51%) was similar, but there was an interaction for milk protein - LF reduced (P < 0.10) milk protein with CGC but not with FGC. Milk urea N was lower (P < 0.05) with finer particle size (11.8 vs. 13.0 mg/dl). The SFC and finer particle size appeared to be more rapidly fermented in the rumen, without adversely affecting intake or apparent diet digestibility. Liquid feed appeared to be more beneficial with FGC than CGC.

Key Words: particle size