Graduate Student Competition:
ADSA Southern Section Graduate Student Competition

274 Supplementing a pasteurized milk balancer product to two feeding levels of pasteurized whole milk fed to Holstein calves. K. Glosson*[1], B. Hopkins[1], S. Davidson[1], G. Smith[1], T. Earleywine[2], and C. Ma[1], *[1]North Carolina State University, Raleigh, [2]Land O'Lakes Animal Milk Products, St. Paul, MN.*

Using 80 Holstein heifer calves, this study investigated the effects of supplementing 2 levels of pasteurized whole milk with or without a pasteurized all-milk balancer product (Land O'Lakes Pasteurized Milk Balancer), on the growth of dairy calves. Two locations were used in this trial, NCSU Lake Wheeler Dairy (Raleigh, NC) and NCDA Piedmont Research Station (Salisbury, NC), with 40 calves fed according to the protocol at each site. All calves were removed from their dams after birth (d 0), fed 3.8L pasteurized colostrum, and received their respective treatment from d 1 until weaning at d 56. All calves were fed pasteurized whole milk from d 1 through d 56. There were 4 dietary treatments (n = 20 calves per treatment). Calves on treatment 1 and 2 were fed 3.8 L milk divided into 2 equal feedings from d 1 through d 56. Calves on treatment 3 and 4 were fed 3.8 L milk divided into 2 equal feedings from d 1 through d 14, 5.7L milk divided into 2 equal feedings from d 15 through d 42, and 2.85L milk fed once daily from d 43 through d 56. Treatments 2 and 4 included pasteurized all-milk balancer fed at a rate of 0.23kg per 3.8L of pasteurized whole milk. Calves were weighed and measured for wither height (WH), hip height (HH), and hip width (HW) every 7 d from birth until weaning at d 56. Average daily gain (ADG) and feed efficiency (FE) were calculated from d 0 through d 56. Feed efficiency is the ratio of ADG to dry matter intake (DMI), which included the total of milk dry matter (DM), milk balancer DM, and calf starter DM consumed. Calves fed treatment 4 had greater body weight (BW) and ADG through 56 d of age.

Table 1. BW, HH, HW, WH, ADG and FE as affected by treatment for 80 Holstein heifer calves from birth through weaning at 56 d

	Treatment					
Item[1]	1	2	3	4	SEM	$P \leq$
BW, kg	51.5[a]	54.0[ab]	52.9[ab]	58.8[c]	1.1	0.05
HH, cm	84.1	84.2	84.1	85.1	1.3	0.6
HW, cm	18.4	18.4	18.4	19.0	0.6	0.3
WH, cm	79.8	80.0	80.0	81.0	1.2	0.4
ADG, kg	0.64[a]	0.69[ab]	0.72[b]	0.84[c]	0.02	0.01
FE, kg/kg	0.62[a]	0.63[a]	0.70[b]	0.68[b]	0.02	0.03

[a-c]Means differ ($P < 0.05$).
[1]Average weight and frame measurements were calculated from birth until weaning.

Key Words: calf, growth, pasteurization

275 Methane production in ruminal continuous cultures fed bermudagrass harvested at varying stages of maturity. K. M. Young*[1], N. S. Hill[2], A. Thompson[2], D. W. Hancock[2], J. G. Andrae[1], W. C. Stringer[1], and T. C. Jenkins[1], *[1]Clemson University, Clemson, SC, [2]University of Georgia, Athens.*

Management intensive grazing systems on dairy farms in the Southeast are evaluated for efficient milk production as well as environmental impact. The objective of this study was to examine the relationship between forage maturity and rumen methane production. Tifton 85 bermudagrass was harvested at 5 maturity dates (14 d, 21 d, 28 d, 35 d and 42 d) from plots at the University of Georgia in the fall 2011, freeze-dried and ground (2-mm sieve). Thirty grams of harvested forage was fed daily to separate dual-flow continuous fermenters equipped with a gas sensor system to measure methane concentrations in headspace for 3 7 d periods. Average forage NDF and CP (%DM) ranged from 52.0 to 63.1, and 15.3 to 21.2 respectively. Methane readings were taken at each feeding (0800 and 1600 h) on d 3 and 4, and every hour between feedings on d 5 to 7. Methane data were analyzed by the Fit Model procedure in JMP (SAS Institute) with period and treatment × period interaction as random effects and treatment contrasts comparing 28 d vs. 42 d, and 42 d vs. all other maturities. VFA were determined by GC and the resulting data were analyzed by the glimmix procedure in SAS for variation due to maturity date, time after feeding, and their interaction. Feeding bermudagrass at 42 d decreased ($P < 0.05$) overall average methane production (13.5 mmol/d), compared with the average (19.8 mmol/d) of all other treatments. Average maximum (19.6 mmol/d) and minimum (6.4 mmol/d) methane production for 42 d tended to be lower ($P < 0.10$) than average maximum and minimum production (26.9 mmol/d, 10.9 mmol/d, respectively) of all other treatments. Feeding bermudagrass at 42 d also decreased ($P < 0.05$) overall average methane production compared with 28 d (21.7 mmol/d) and tended to decrease ($P < 0.10$) average maximum methane production compared with 28 d (30.0 mmol/d). Methane per g of DM or g of NDF fed had similar differences between maturities. Acetate/propionate was not affected by maturity (ranged from 4.4 to 4.9). The data suggest that forage maturity has no effect on rumen methane production unless cattle are grazed on bermudagrass of 42 d relative to forages aged 14 d-35 d.

Key Words: continuous culture, methane

276 Effects of feeding calcareous marine algae to Holstein cows beginning prepartum on postpartum performance and serum metabolites. Z. Wu* and J. K. Bernard, *University of Georgia, Tifton.*

Thirty-six multiparous Holstein cows and 12 springing heifers were used in a 9-wk randomized design trial to determine the effect of feeding calcareous marine algae (Acid Buf, Celtic Sea, Ireland) from 3 wk prepartum through 6 wk postpartum on DMI, milk yield and composition, blood and urine metabolites. Within parity, animals were assigned randomly to 4 treatments with a 2 × 2 factorial arrangement beginning 3 wk prepartum through 6 wk postpartum. Prepartum diets were balanced for a −10 DCAD with calcareous marine algae (CMA) or without (CON). Postpartum diets were formulated with either supplemental sodium bicarbonate (NBC) or CMA with a DCAD of 35 and 17, respectively. All diets were formulated to meet NRC requirements for late gestation and early lactation, respectively. No differences ($P > 0.10$) were observed in prepartum DMI which averaged 11.9 and 12.3 kg/d for CON and CMA, respectively. Postpartum DMI, milk yield, percentage of milk fat, protein, lactose, and SNF were not different ($P > 0.10$) among treatments and averaged 18.0, 37.7, 4.03, 2.71, 4.75, and 8.37; 19.8, 38.4, 4.06, 2.84, 4.74, and 8.38; 19.4, 37.5, 4.01, 2.70, 4.75, and 8.41; and 20.0 kg/d, 38.1 kg/d, 4.21%, 2.80%, 4.72%, and 8.37% for CON-NBC, CMA-NBC, CON-CMA, and CMA-CMA, respectively. No differences were observed among

treatments in serum metabolite concentrations prepartum, but serum Na concentrations were greater ($P < 0.05$) for cows fed NBC postpartum compared with CMA. Urinary concentrations of Na exhibited an interaction among treatments postpartum ($P = 0.0201$) and were highest for CON-NBC, intermediate for CMA-NBC, and lowest for CON-CMA and CMA-CMA; 128.62, 100.97, 56.88 and 37.97 mmol/L, respectively. Urinary K concentrations were higher ($P < 0.05$) for cows fed CMA postpartum compared with NBC; 157.78 and 116.76 mmol/L, respectively. Results of this trial indicate that cows feeding CMA prepartum did not affect prepartum DMI or serum metabolites. Performance and serum metabolite concentrations of cows fed CMA postpartum were comparable with that of cows fed NBC.

Key Words: DCAD, milk yield, milk composition

277 Changes in choline esters in blood and milk during early to mid lactation in dairy cows. V. M. Artegoitia*[1], J. M. Middleton[2], F. Harte[1], S. R. Campagna[2], and M. J. de Veth[3,4], *[1]Food Science and Technology, University of Tennessee, Knoxville, [2]Chemistry Department, University of Tennessee, Knoxville, [3]Animal Science, University of Tennessee, Knoxville, [4]Balchem Corporation, New Hampton, NY.*

Choline is an essential nutrient for humans and production animals. The ruminant is a unique animal model as almost all dietary choline is degraded in the rumen and the requirement for choline is not established for dairy cows. Therefore, understanding what choline forms are secreted by the mammary gland may provide an understanding of the lactation requirement for choline in the dairy cow. The objective of this study was to characterize the changes in choline and choline esters in blood and milk occurring in early and mid-lactation. Twelve Holstein cows were selected at calving and managed under the same diet, without choline supplementation. Throughout the study milk and blood samples were collected 3 times during early (wk 1, 2 and 3) and mid lactation (wk 7, 10 and 13). Free choline (Cho) and choline esters, glycerophosphocholine (GPC), lysophosphocholine (LPC), phosphatidylcholine (PtC), phosphocholine (PC) and sphingomyelin (SM), were analyzed using liquid chromatography-tandem mass spectrometry and quantified by using stable isotope-labeled internal standards. Differences reported are all $P \leq 0.01$. Total choline (Cho and all esters) concentration in plasma increased by 5-fold from wk 1 to wk 13 of lactation. The major choline forms in plasma were PtC (79%) and SM (14%) and both remained relatively constant through lactation. The concentration of all esters decreased in milk, except PtC (unchanged) and free choline (increased). The main choline forms in milk were PC (46%), PtC (27%) and Cho (11%). Total choline content in milk was negatively correlated with plasma total choline concentration ($r = -0.62$), whereas the free choline content in milk was positively correlated with total choline concentration in plasma ($r = 0.78$). The total daily milk output of choline (accounting only for choline moiety in esters) was highest in early lactation (averaged 2.7 g/d) and decreased during mid-lactation (wk 13 = 1.5 g/d; SE = 0.2). In summary, the 2-fold higher level of choline output by the mammary gland, combined with lower plasma levels, during early lactation suggest that there is a greater requirement for choline during this period.

Key Words: choline, requirement, LC-MS/MS

278 Characterization of lying time, milk yield, and rumination time with different freestall bases. B. A. Wadsworth*, A. E. Sterrett, C. L. Wood, K. J. McQuerry, J. D. Clark, D. L. Ray, and J. M. Bewley, *University of Kentucky, Lexington.*

Freestall bases may affect dairy cow productivity, longevity, and well-being. The objective of this study, conducted from January 18, 2012, to January 18, 2013, at the University of Kentucky Coldstream Dairy, was to compare daily lying time (LT), milk yield (MY), and rumination time (RUMT), for cows housed in 2 freestall barns. Barn "W" includes 50 Dual Chamber Cow Waterbeds (Advanced Comfort Technology, Reedsburg, WI) (DCCW) and barn "R" includes 50 rubber-filled mattresses (MAT). Both barns were renovated in November 2011 to the correct industry standard stall size for the largest Holsteins in the herd. Stall lengths were 1.8 m. Neck rail heights were 1.2 m, and mean stall widths were 1.2 m. All variables were classified for 96 cows (Holsteins (n = 70), Jerseys (n = 10), and crossbreds (n = 16)). IceRobotics (Edinburgh, Scotland) IceQube sensors, which contain a 3-axis accelerometer, recorded daily LT. MilkLine milking systems (Italy) recorded daily MY. The HR Tag (SCR Engineers, Ltd., Israel) recorded daily RUMT. The GLM procedure in SAS (Cary, NC) was used to evaluate factors influencing LT, MY, and RUMT. All main effects were kept in each model regardless of significance level. Stepwise backward elimination was used to remove non-significant interactions ($P \geq 0.05$). Daily LT was significantly ($P < 0.01$) higher for DCCW (10.79 h/d ± 0.20) than for MAT (10.06 h/d ± 0.22). MY was not significantly ($P = 0.78$) different between DCCW from MAT. Daily RUMT was significantly ($P < 0.01$) higher for MAT (382.10 min/d ± 7.18) than for DCCW (365.54 min/d ± 6.49). In this study, LT was higher for cows housed in freestalls with DCCW as a freestall base. Lying time can be an indicator of a comfortable and desirable resting area. Comfortable lying areas may improve cow leg and hock conditions. Dual Chamber Cow Waterbeds may provide a more resilient resting surface for dairy cows than rubber-filled mattresses. A resilient surface may benefit cow LT, overall productivity, and animal well-being.

Key Words: lying time, waterbeds, freestalls

279 Direct fed-microbial supplementation and milk replacer effects on performance of Holstein calves. A. J. Geiger*[1], S. H. Ward[1], C. C. Williams[2], B. J. Rude[1], C. J. Cabrera[1], K. N. Kaletsch[1], and B. E. Voelz[1], *[1]Mississippi State University, Mississippi State, [2]Louisiana State University, Baton Rouge.*

Forty-four Holstein calves were fed a direct-fed microbial (DFM) and increased CP in the milk replacer (MR) to evaluate performance and mitigation of heat stress. Treatments were: 1) control (CON; 22% CP, 20% fat), 2) MR+ (27% CP, 10% fat), 3) DFM (CON + DFM), and 4) DFMMR+ (MR+ with DFM). DMI, rectal temperatures, respiration scores, rates, and fecal scores were collected daily. Body weight (BW), hip and wither height, heart girth, blood and rumen fluid samples were collected weekly. Effects of treatment, sex, week, THI, and their interactions were analyzed using the MIXED procedure of SAS (Cary, NC). Contrast statements tested effects of milk replacer (CON and DFM vs. MR+ and DFMMR+); of DFM (CON and MR+ vs. DFM and DFMMR+), and CON vs. all other treatments. Birth weight was used as a covariate for BW. Significance was declared at $P < 0.05$. Calves only experienced heat stress (THI >72) on 8 d of the trial. CON calves tended to consume grain earlier compared with all other treatments (6.38 vs. 7.92 d, respectively; $P < 0.07$). Calves fed the MR+ had greater weaning BW (60.1 vs. 49.8 kg, respectively), hip height (87.7 vs. 84.2 cm, respectively), wither height (84.2 vs. 81.1 cm, respectively), and heart girth (91.2 vs. 85.7 cm, respectively; $P < 0.01$) compared with calves fed CON. Calves fed DFM, compared with the other treatments, had the greatest feed efficiency (4.13 vs. 2.07, respectively; $P < 0.01$). Fecal scores were greatest in calves fed

DFM, but rectal temperatures were lower ($P < 0.01$). Blood mineral concentrations, glucose, and hematocrit were not different. Serum protein was greater in calves fed CON compared with others (6.48 vs. 6.13 g/100 mL, respectively; $P < 0.01$). HCO3 and pCO2 were lower in calves fed CON and both were greater in calves fed MR+ compared with MR. DFM supplementation did not affect blood metabolites. Butyrate was lower in calves fed MR+ compared with MR (2.41 vs. 3.77, respectively; $P < 0.01$), but DFM did not have an effect. Isovalerate was greater in calves fed MR+ compared with MR and lower in calves fed DFM ($P < 0.01$). Rumen pH and other VFA were not different.

Key Words: milk replacer, calf, direct-fed microbial