
RUMINANT NUTRITION III

0613 Performance of and digestion in calves fed conventional, moderate, and aggressive milk replacer programs.

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Calves fed large amounts of milk replacer (MR) gain more BW pre-weaning than calves fed less MR; however, post-weaning growth may be reduced. Limited research suggests that impaired nutrient digestion may depress growth post-weaning. We compared growth and post-weaning digestion in 3-d old male Holstein calves fed one of three MR programs. Programs were Conventional (C, 0.45 kg/d of powder containing 21% CP, 21% fat (DM basis), fed for 42 d), Moderate (M, 0.68 kg/d of powder containing 27% CP, 17% fat (DM basis), fed for 42 d), and Aggressive (A, up to 0.91 kg/d of powder containing 27% CP, 17% fat, fed for 49 d). All calves were fed a 20% CP (DM basis) textured starter and water ad libitum for 56 d. The trial used 96 calves (initial BW = 41.4 ± 1.86 kg) received 5 wk apart in two replicates of 48 calves. During d 51 to 55, fecal samples were collected from five calves per treatment randomly selected from calves in the first replicate. Selected nutrients and acid insoluble ash (used as an internal marker) were analyzed in starter and feces to estimate nutrient digestibility. Data were analyzed as a randomized complete block design with replicate as block. Repeated measures analysis was performed on overall (0 to 56 d) data. Means were separated with a protected LSD test. Pen was the experimental unit. Calves fed C had lower ($P < 0.05$) average daily BW gain (0.35, 0.51, and 0.55 kg/day, respectively, for C, M, and A; SEM = 0.018), gain/feed (0.35, 0.49, and 0.48; SEM = 0.016), and change in hip width (3.3, 4.1, and 4.1 cm; SEM = 0.20) compared to other calves. Calves fed A had greater ($P < 0.05$) change in body condition score and lower ($P < 0.05$) starter intake compared to other calves. Digestibility of OM was 79, 78, and 68% and NDF digestibility was 54, 51, and 26% for calves fed C, M, and A, respectively, and were lower ($P < 0.05$) in calves fed A. Results are similar to previous published results in calves and suggest that depressed post-weaning digestion may be related to reduced starter intake and impaired rumen development.

Key Words: calves, milk replacer, digestion

0614 Performance of and digestion in calves fed two levels of milk replacer and functional ingredients.

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We compared growth and post-weaning digestion using 48 male Holstein calves (initial BW = 42.6 ± 1.50 kg; initial age = 2 to 3 d) fed to 56 d. Calves were fed diets in a 2 × 2 factorial arrangement of feeding rate (Low [L], 0.68 kg/d of milk replacer (MR) powder and High [H], up to 1.36 kg/d of MR powder) and inclusion of a functional ingredient (without [NT-] or with [NT+] NeoTec5 g, Provimi North America, Brookville, OH). The MR contained 27% CP and 17% fat (DM basis) and was fed to weaning at 49 d. The NT+ treatment was administered in MR before weaning and in calf starter (CS) from weaning to d 56. All calves were fed NT- CS before weaning. The CS were textured (pellets, oats, corn) and contained 20% CP (DM basis). Starter and water were available for ad libitum consumption throughout the study. During d 51 to 55, fecal samples were collected from five calves per treatment selected at random. Selected nutrients and acid insoluble ash (as an internal marker) were analyzed in CS and feces to estimate digestibility. Data were analyzed as a completely randomized design with a factorial arrangement of MR rate (L/H) and NeoTec5 g (NT+/NT-) using a repeated measures ANOVA. Pen was the experimental unit. There were no interactions of main effects. Average daily BW gain (ADG), change in body condition score (BCS), and average fecal score from d 0 to 56 were greater ($P < 0.05$) in calves fed H vs. L. Calf ADG, hip height change, and BCS change were greater ($P < 0.05$) in calves fed NT+ vs. NT-. Intake of CS during the digestion period tended ($P < 0.10$) to be lower in calves fed H vs. L. Digestibility of DM, OM, NDF, and ADF was reduced by 7, 7, 65, and 58%, respectively, in calves fed H compared to L ($P < 0.05$). Feeding NT+ increased digestibility of DM, OM, NDF, and ADF by 4, 4, 65, and 74%, respectively ($P < 0.05$) compared to NT-. Feeding high rates of MR reduced ADG by 12% during the last 2 wk of the trial (0.58 vs. 0.65 kg/d for H and L, respectively), which was likely due to reduced intake and digestion of CS as calves transitioned from MR to CS. Feeding NeoTec5 g improved ADG, hip width change, and digestion of nutrients.

Key Words: calves, milk replacer, digestion

0615 The effect of solid feed diet on the oral and cross-sucking behavior of pre-weaned dairy calves.

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In the dairy industry calves are most frequently artificially reared in groups, which create a greater opportunity for solid feed consumption and cross-sucking behavior. This study aimed to compare the effect of differing solid feed diets on the pre- and post-weaning feed intake, growth rate and oral behav-

ior of calves reared artificially in groups. This experiment was a randomized block design with the treatments diets allocated at random, in blocks. The research was completed at Massey University's dairy calf unit No. 4 and involved 108 Friesian and Jersey x Friesian dairy calves that were allocated to one of three treatment diets: lower forage (LF) alfalfa total mixed ration (TMR); a higher forage alfalfa (HF) TMR; and perennial ryegrass hay along with a pelleted starter (HPS). Calves were reared in 36 groups of three calves per group and monitored until 12 wk of age. The data was transformed and analyzed using PROC MIXED GLM in SAS using diet as a fixed effect and calf as a random effect in the model. Data was presented as means with standard errors for each observation according to diet treatment. Calves fed HPS had the greatest dry matter intake [LF: 0.80 (0.012), HF: 0.95 (0.012), HPS: 1.70 (0.011) kg/DM/d], live weight at 40 d of age [LF: 60.3 (1.41), HF: 63.8 (1.41), HPS: 67.1 (1.38) kg] compared with TMRs. These calves also spent the most time eating [LF: 129.1 (0.14), HF: 163.7 (0.14), HPS: 154.1 (0.14) mins/d], and spent the least amount of time engaged in non-nutritive pen sucking [LF: 13.4 (0.16), HF: 11.2 (0.17), HPS: 10.3 (0.16) mins/d]. It was concluded that, while cross-sucking was not entirely eliminated, providing perennial ryegrass hay along with a pelleted starter resulted in the least non-nutritive sucking behavior, along with the greatest feed intake and growth rates compared with low and high forage alfalfa based total mixed rations.

Key Words: calves, growth, feed intake, behaviour, sucking

0616 Development of a modified accelerated milk replacer feeding program through 8 wk of age.

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Our previous studies have demonstrated that a modified accelerated milk replacer (MR) having a 24:20 crude protein (CP):fat concentration fed at higher feeding rates (FR) resulted in improved growth performance and gain/feed, but not linearly. The current study was to evaluate pre- (d 1 to 42) and post-weaning (d 43 to 56) calf performance when modified accelerated MR was fed at higher FR compared to a MR having similar or higher CP and lower fat concentrations. One-hundred thirty (1 to 6 d old) fed Holstein heifer calves (40.1 ± 0.76 kg) were blocked by birth date and randomly assigned to one of five treatments. Treatments of MR fed at 14.7% solids were: 1) Control (C): all milk 24:20 MR fed at 0.26 kg at 2x/d from d 1 to 35; 2) C+: C MR fed at 0.32 kg 2x/d from d 1 to 35; 3) LF: CP and low fat (24:16) MR fed at 0.32 kg 2x/d from d 1 to 35; 4) LF+: LF MR fed at 0.32 kg 2x/d from d 1 to 7 and at 0.39 kg from d 8 to 35; and 5) HP+: High CP:LF MR (26:16) fed at the

rates of LF+. All MR were fed 1x/d from d 36 to weaning at d 42 with water and 18% CP texturized calf starter (CS) offered free choice from d 1 through 56. Calves fed C+ had greater ($P < 0.05$) ADG (0.71, 0.75, 0.70, 0.72, and 0.72 kg/d for C, C+, LF, LF+, and HP+, respectively) from d 1 to 56 compared to calves fed LF, with other treatments being intermediate. Calves fed C+, LF, and HP+ were similar, but taller at the hips ($P < 0.05$) than calves fed C and LF+ (98.1, 99.6, 99.8, 98.5, and 99.8 cm). However, calves fed C+ had greater hip widths on d 56 (22.3, 22.6, 21.7, 21.8, and 22.3 cm) and on d 84 (26.2, 26.5, 26.0, 26.2, 26.4 cm) than calves fed LF with other treatments similar. This study demonstrates that feeding a modified accelerated MR (24:20) at a moderate FR improves ADG and frame measurements compared to calves fed MR having similar or different CP and fat concentrations. The development of a modified accelerated feeding program optimized the protein energy ratio for the potential of producing a dairy heifer with a frame that is taller and wider without having a weaning slump.

Key Words: milk replacer, protein concentration, fat concentration.

0617 Amino acid supplementation of calf milk replacers containing bovine plasma protein.

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Plasma protein (PP) is an effective alternative protein source for young calves, but utilization at higher amounts may be limited by Ile and Thr content. We determined the effects of PP and supplemental AA in milk replacers (MR) on calf growth and health. Male Holstein calves ($n = 104$) were blocked by BW and randomly assigned to 1 of 5 MR formulated to contain 22% CP, 20% fat, and 2.0% Lys. Treatments (trt) were: all milk protein (A); 5% PP plus Met to equal trt A (B); 5% PP plus Met, Ile, and Thr to equal A (C); 10% PP plus Met to equal A (D); or 10% PP plus Met, Ile, and Thr to equal A (E). Treatments (12.5% solids) were fed twice daily at 10% of BW for d 1 to 2, 12% of BW for d 3 to 7, and 14% of BW for d 8 to 35, adjusted weekly. No starter was fed. Calves were housed in individual hutches bedded with straw and offered water ad libitum. Health data were recorded daily and growth measured weekly. Serum obtained on d 28 before and 4 h after feeding was analyzed for total protein (TP), urea nitrogen, albumin, and globulin. Data were analyzed using the MIXED and GLIMMIX procedures of SAS. Initial BW (41.9 ± 4.38 kg) and serum TP (5.7 ± 0.09 g/dL) were similar among groups. Intakes of DM, CP, ME, and Lys did not differ ($P > 0.35$) among trts. Average daily gain tended ($P = 0.08$) to be decreased by 10% PP (D), but not when AA were supplemented (E). Gain:DMI ($P = 0.10$) and gain:Lys intake ($P = 0.08$) tended to be lower for trt D. The Logistic model revealed that during the first 21 d, scours occurrence

was higher in trt A than trt D and E (odds ratio [OR] = 1.35, $P = 0.07$ and 1.61, $P = 0.01$, respectively), and trt C tended to be higher than trt E (OR = 1.41, $P = 0.08$). The chance of antibiotic treatment was greater in trt A than trt B, C, and E (OR = 3.55, $P < 0.0001$; 3.39, $P = 0.0002$; 2.48, $P = 0.001$) and lower in trt B and C than trt D (OR = 0.31, $P = 0.0003$; 0.32, $P = 0.0006$). Serum albumin was highest ($P = 0.02$) for trt B, and urea nitrogen tended ($P = 0.10$) to be higher for trt A; TP and globulin did not differ ($P > 0.11$). Inclusion of PP in MR improved health of young calves; when AA were balanced, growth and efficiency were similar to all milk protein.

Key Words: amino acid, plasma protein, milk replacer

0618 The use of highly digestible corn grain in calf starters when calves are fed an accelerated milk replacer. D. Casper^{*1}, S. Srivastava², M.Kkirk³, S. Harris⁴, K. Koone⁴ and B. M. Strayer¹, ¹South Dakota State University, Brookings, ²South Dakota University, Hyderabad, India, ³Masters Choice, Anna, IL, ⁴Masters Choice, Anna, IL.

New corn hybrids have been developed by Masters Choice (MC) seeds that vary in energy density and starch digestibility. These MC hybrids have lower starch densities due to an altered starch structure, which allows for greater ruminal and intestinal starch digestion. Altered starch structure of these new hybrids results in reduced feed manufacturing (i.e., grinding). Thirty (1- to 3-d old) Holstein heifer calves (40.6 ± 1.72 kg) were randomly assigned to one of two calf starters to evaluate growth performance of Holstein heifer calves through 8 wk of age. Treatments were: 1) Control (C) starter: containing 40% (DM basis) conventional ground shelled corn and 2) MC starter: containing (40% DM basis) MC corn. Experimental calf starters were formulated to contain 24% CP (DM basis) and were fed for ad libitum consumption as a pellet starting on d 1. The study was conducted from April 25 through August 1, 2013. Body weights and body measurements were collected weekly. All calves were fed a 28% (CP):18% fat accelerated milk replacer 2x/d at the rate of 0.68 kg/d up to 10 d, 1.02 kg/d from 11 to 35 d, and fed 1x/d at 0.51 kg/d from 35 to 42 d. Data were analyzed as a completely random design using the PROC MIXED of SAS Version 9.3. Initial body weights (40.6 and 40.7 kg for C and MC, respectively) were similar ($P > 0.10$), while final body weights (64.5 and 66.7 kg) were numerically greater for calves fed the MC starter. Body weight gains (23.9 and 26.0 kg) and average daily gains (0.68 and 0.74 kg/d) were similar but numerically greater for calves fed MC starter. No significant differences were detected ($P > 0.10$) in frame parameters as measured by change in body length (12.3 and 11.4 cm), heart girth (8.7 and 9.3 cm), hip height (6.8 and 6.6 cm), and wither height (13.1 and 12.3 cm). While no significance improvements in growth rates were detected in this study, which was conducted during the early

summer, but the MC starter resulted in a numerical increase in body weight gains and average daily gains.

Key Words: corn hybrids, calf starter, starch

0619 Intensive milk feeding in calves affects growth performance, metabolic and endocrine traits, but not rumen development. H. M. Hammon^{*1},

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Restricted milk feeding during the pre-weaning period is supposed to stimulate solid feed intake, but growth performance is insufficient in calves. The objective of the present study was to compare feed intake, growth performance, metabolic traits, and rumen development during the pre-weaning period in calves with different milk feeding levels. The hypothesis was tested that intensive milk feeding supports metabolic changes related to enhanced growth but does not impair solid feed intake and rumen development. Four d after birth, 28 Holstein × Charolais calves (male and female) were fed either 6 L milk replacer (MR; 125 g powder/L)/d for 8 wk (RES) or unlimited amounts of MR up to d 35 of life (AL) that was stepped down to 6 L/d afterward. Concentrates and hay were available ad libitum for both groups. Blood samples were taken weekly for determination of plasma concentrations of glucose, triglycerides, NEFA, BHBA, urea, insulin, IGF-I, and IGF binding proteins (IGFBP). Calves were slaughtered at $d 60 \pm 2$ and rumen tissue samples were taken for measurements of papilla size. Data were analyzed by the MIXED Model of SAS with feeding, sex, time, and feeding × time interaction as fixed effects. MR intake increased ($P < 0.001$) in AL to 14.5 ± 0.4 L/d in wk 5 of life, but did not change in RES calves. Concentrate intake increased ($P < 0.001$) in both groups from wk 4 on, but did not differ between groups. Body weight and ADG were greater ($P < 0.001$) in AL than in RES calves. Plasma concentrations of triglycerides, glucose, insulin, and IGF-I were higher ($P < 0.05$) and concentrations of NEFA, urea, and IGFBP-2 and -4 were lower ($P < 0.05$) up to d 35 of life in AL than in RES calves. Plasma concentrations of BHBA tended to be higher ($P < 0.1$; mainly from d 21 to d 35 of life). Rumen empty weight and papillae length were not different, but papillae densities in atrium and ventral sac were greater ($P < 0.05$) in RES than in AL. Intensive milk feeding resulted in enhanced body growth and changes in metabolic and endocrine traits supporting anabolic metabolism in AL calves. Intensive milk feeding did not impair concentrate intake and slightly affected rumen papillae growth.

Key Words: calf, milk feeding, rumen development

0620 Fish oil supplementation on growth and health of pre-weaning dairy calves.

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The objective of this study was to study the effect of fish oil (energy source) for preweaning calves. Preweaning calves were more sensitive to environment and stress to sickness. Thirty-six male dairy calves fed with 0% (group 1), 2.5% (group 2), and 5% (group 3) of fish oil in milk replacer. All calves were assigned with randomized complete block design. The calves were placed into individual pen after birth randomly. Calves were fed with colostrum after birth until 3 d of age. Calves were fed calf starter and milk replacer from d 4 to d 42 of age. All calves fed with calf starter and water in different bucket set in the front of pen. Calves were fed 5 kg/h/d milk replacer 2x/day. All calves were weaned on d 42. Body weights were measured after birth and d 1, d 21, and d 42. Feed and milk replacer intake and fecal scores were measured daily after feeding in the morning. Blood samples were collected on d 1, d 21, and d 42 after morning feeding for 2 h for chemical analysis. Growth, health and neutrophils and lymphocytes (stress indices) were evaluated for 42 d. Average daily gain (131.6, 141.5, and 118.4 g/d for group 1, 2, and 3, respectively), feed intake, fecal score, and body cleanliness score of calves did not differ ($P > 0.05$) among treatments but feed intake was affected by week ($P < 0.0001$). Calf health was also affected by week ($P < 0.001$). Immunoglobulin G was higher on d 1 (40.1 mg/ml, $P < 0.05$). The ratio of neutrophils and lymphocytes (1.13, 0.46, and 0.26 for d 1, d 21, and d 42, respectively), glucose concentration (163.7, 115.1, and 104.1 mg/dl for d 1, d 21, and d 42, respectively) decreased when calf was older ($P < 0.001$). Growth and health performance of calves fed with three levels of fish oil did not differ ($P > 0.05$). At 3 wk of age, immunoglobulin G of calves was increased as calf fed 2.5% fish oil supplemented in milk replacer.

Key Words: fish oil, dairy calf, health

0621 The effects of corn silage inclusion in pre-weaned calf diets.

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The objective was to evaluate the effects of corn silage inclusion in starter feed provided to calves after birth through weaning. Thirty-six heifer calves and nine bull calves were reared at the U.S. Dairy Forage Research farm, where they were individually housed in hutches. All treatments were fed pasteurized milk with either all calf starter (C), 60% calf starter and 40% corn silage (CC), or all corn silage (CS). Feed intake and health scores were recorded daily. Every other week, calves were sampled for weight, withers and hip height, heart girth, serum protein, hematocrit, blood urea nitrogen, glucose,

and β -hydroxybutyrate. Nine bull calves were sacrificed 1 wk post-weaning at 8 wk of age. Rumen and intestinal tissue were collected and preserved with formalin for later analysis. One intestinal tissue sample was taken at consistent lengths from the duodenum, jejunum, ileum, and colon; from each tissue sample, three blocks were cut and 24 tissue slides were stained from each block for measurement. Three rumen samples were taken from four areas within the rumen and 12 random papillae per sample were measured for length and width. Daily and biweekly measurements were analyzed using a repeated measures analysis of the PROC MIXED and intestinal and ruminal measurements were analyzed using the General Linear Model procedure of SAS 8.3 (2010). Initial growth measurements were used as covariates for growth analysis and significance was found at $P < 0.05$. Feed intake was not different between treatments; however, there was a treatment by week interaction ($P < 0.0001$). Least squares means of rumen papillae lengths were different (9.3, 7.5, and 3.9 ± 0.3 mm for treatments C, CC, and CS, respectively; $P < 0.05$). Jejunal villi lengths tended to be different (97.65, 105.61, and 89.57 ± 5.8 μ m for treatments C, CC, and CS, respectively; $P = 0.12$), and crypt depths were different (46.10, 48.58, and 38.69 ± 2.8 μ m for treatments C, CC, and CS, respectively; $P = 0.03$). Treatments did not differ for weight ($P < 0.15$), heart girth ($P < 0.4$), hip height ($P < 0.7$), withers height ($P < 0.15$), serum protein ($P < 0.8$), and hematocrit values ($P < 0.6$). This data indicates the inclusion of corn silage to starter feed does not affect growth and overall feed intake but may affect weekly feed consumption. Solely feeding corn silage as starter feed stunted the growth of the rumen papillae and reduced crypt depths indicating reduced absorption and efficiency. Future milk production will be monitored.

Key Words: calves, corn silage, calf starter feed

0622 Growth performance and health of dairy calves fed with *Schizochytrium* sp.

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Thirty-six dairy calves were studied on *Schizochytrium* sp. supplementation affecting on growth performance and health. Repeated measurement in completely randomized design was assigned. Treatment had three groups (12 calves per group). Group 1 was control (fresh milk added with lactobacillus). Group 2 was control plus 3 g/h/d of *Schizochytrium* sp. supplementation. Group 3 was control plus 6 g/h/d of *Schizochytrium* sp. supplementation. After birth, calf was placed in individual pen. Each calf fed colostrum immediately until 3 d of age. On d 4, all calves were fed ad libitum of calf starter and water separated bucket in the front of individual pen. Calves were also fed fresh milk 5 kg/h/d, 2 times a day from d 4 to 42 of age. Feed intake, fecal fluidity score and calves cleanliness score were recorded daily. Initial body weight, d 7, d 21, and final body weight were measured. On d 1, d 21, and d 42 fresh

blood analyzed for neutrophil:lymphocyte ratio (N:L ratio; stress indicator), serum immunoglobulin G (IgG), serum glucose, serum urea-nitrogen (SUN) were collected. Feed intake (778.8, 763.3, and 758.3 g for group 1, 2, and 3, respectively) and average daily gain (ADG 552.5, 552.1, and 557.1 g/d for group 1, 2, and 3, respectively) did not differ ($P > 0.05$). However, feed conversion ratio (FCR; 1.40 for group 3) had lower than others (1.49 and 1.83 for group 1 and 2; $P = 0.060$). Serum IgG (37.7, 38.6, and 37.6 mg/ml for group 1, 2, and 3, respectively), serum glucose (159.1, 171.9, and 179.4 mg/dl for group 1, 2, and 3, respectively) and SUN (9.6, 10.17, and 9.6 mg/dl for group 1, 2, and 3, respectively) did not differ ($P > 0.05$). The percentage of white blood cells count and N:L ratio (0.2, 0.17, and 0.16 for group 1, 2, and 3, respectively) also did not differ ($P > 0.05$). However, on d 1, serum IgG and serum glucose were the highest in three groups. Overall blood N:L ratio decreased when calf was older ($P < 0.05$).

Key Words: *Schizochytrium* sp., dairy calf, health

0623 Growth performance, health, and immunocompetence of preweaning dairy calves fed with stevioside. R. Panivivat^{*1}, C. Boonkaewwan¹, and S. Sriwichai², ¹*Kasetsart University, Bangkok, Thailand*, ²*Dairy Promotion and Organization of Thailand, Saraburi*.

The objective of this study was to study the effect of stevioside (medical herbs) supplementation on growth and health of preweaning calves. The preweaning calves were more sensitive to sickness because of lower immunoglobulin and more stress after birth. Thirty-six dairy calves fed with 0, 150, and 300 mg/kg of stevioside supplemented in calf starter. All calves were assigned with randomized complete block design. The calves were placed into individual pen after birth randomly. Calves were fed colostrum after birth until 3 d of age. Calves were fed calf starter and milk from d 4 to d 42 of age. Calves were fed 5 kg/h/d milk, 2x/d. All calves were fed with calf starter and water in different bucket set in the front of pen. Growth, health, and stress indices were evaluated for 42 d. Average daily gain (367.8, 348.5, and 315.5 g/d for group 1, 2, and 3, respectively), feed intake, fecal score, and body cleanliness score of calves did not differ ($P > 0.05$) among treatments, but feed intake was affected by week ($P < 0.05$). Calf health was also affected by week ($P < 0.05$). Immunoglobulin G was greater ($P < 0.05$) when calf was older. The ratio of neutrophils and lymphocytes (stress indices), serum glucose, and butyrate concentration decreased ($P < 0.05$), while immunoglobulin G increased ($P < 0.05$) when calf was older. The concentration of α -1 acid glycoprotein (AGP) and TNF- α did not differ ($P > 0.05$) among treatments. Growth and health performance of calves fed with three levels of stevioside did not differ ($P > 0.05$). At 3 wk of age, immunoglobulin G of calves increased ($P < 0.05$) as 150 mg/kg stevioside was supplemented in calf starter.

Key Words: stevioside, dairy calf, health

0624 An evaluation of a calf-side betahydroxybutyrate test in dairy calves fed a high plane of nutrition and weaned at six versus 8 wk of age.

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Recent research suggests that circulating betahydroxybutyrate (BHBA) levels may be a meaningful indicator of grain intake and rumen development in pre-ruminant calves. As such, BHBA levels may be a surrogate measure of rumen function to assure minimal weaning stress during the transition from liquid to solid feed. The Precision Xtra test for BHBA in whole blood has been validated in lactating dairy cows. The objective of this study was to validate the Precision Xtra test against a gold standard laboratory method in calves at weaning, and to determine preliminary associations between circulating BHBA levels and amount of solid feed intake in dairy calves fed higher planes of nutrition and weaned at 6 vs. 8 wk of age. A total of 20 Holstein female calves were randomly assigned at birth to be weaned at 6 wk ($n = 10$) or 8 wk ($n = 10$). Milk replacer (mixed at 150 g/L) was offered at 1.2 kg/calf/d in two meals until a 1-wk step down, where meals were reduced by 50% 1 wk before weaning. Measurements included daily starter, chopped straw, and water intake, as well as weekly blood BHBA, until 70 d of life. Whole blood BHBA was determined by the Precision Xtra test at calf-side. In addition, serum was separated from a clotted sample, frozen, and stored until laboratory analysis was performed. Data were plotted, and Spearman correlation coefficients between the Precision Xtra and laboratory BHBA levels were determined. Using an arbitrary level of BHBA to indicate meaningful rumen function, the sensitivity and specificity of the Precision Xtra test were calculated. Finally, the correlation between BHBA levels and solid feed intake was determined. The correlation coefficient between Precision Xtra and laboratory BHBA was high ($r = 0.95$; $P < 0.05$). Using a cut-off level of ≥ 250 $\mu\text{mol/L}$ BHBA on the laboratory test, the sensitivity and specificity of the Precision Xtra test were 91% and 93%, respectively. These test characteristics were even higher, when the assessment was restricted to calves weaned at 8 wk (100% and 94%, respectively). The correlation between BHBA results and solid feed intake was also high ($r = 0.90$; $P < 0.05$). These results indicate that the Precision Xtra whole blood BHBA test conducted at calf-side is a highly accurate test and shows some promise for use in the decision-making process of determining appropriate weaning age.

Key Words: calves, weaning, betahydroxybutyrate