W44 Effects of breed and health incidences on total milk consumption and predicted body weight of Holstein and Angus × Holstein F1 calves during the preweaning period. T. S. Steckler* and J. P. Boerman, Department of Animal Sciences, Purdue University, West Lafayette, IN.

The objective of this study was to compare the impact of milk consumption, health incidences, and growth between Holstein and Angus × Holstein F1 calves fed through automated calf feeders. Daily milk consumption, serum total protein (STP), pneumonia and scour incidences, birth weights and weaning weights were recorded on a commercial dairy farm from October 1, 2017 to January 30, 2019. Calves (n = 4,185; Holstein n = 2,912, Angus × Holstein F1 n = 1,273) were fed pasteurized waste milk with a 30% protein, 5% fat milk enhancer added at 20 g/L of milk through a Förster-Technik automated calf feeding system (pens = 16; feeders per pen = 2) for an average of 68 d. STP was taken between 1 and 7 d after birth (6.8 ± 0.69 g/dL, mean ± SD). Daily BW was estimated for individual animals using Legendre polynomials to best model growth data. The effects of feeder, days on feeder, incidences of pneumonia and scours, STP, breed and sex were evaluated using a multiple regression model to predict body weight and total milk consumption. When predicting total milk consumption, 4 variables were highly significant: feeder, pneumonia incidences, STP, and total milk consumption. When predicting body weight at 60 d, predicted BW at 60 d: feeder, pneumonia incidences, STP, and total milk consumption.

W45 Effects of porcine plasma or combined sodium butyrate and Bacillus subtilis on growth and health of dairy calves. D. Wood*1, R. Blome1, A. Keunen2, D. Renaud1, J. Campbell2, and J. Crenshaw4, 1Animix LLC, Juneau, WI, 2Mapleview Agri Ltd., Painswick, ON, Canada, 3Population Medicine, University of Guelph, Guelph, ON, Canada, 4APC Inc., Ankeny, IA.

The objective of this study was to evaluate the health and performance effects of incorporating 2 common feed additives, Bacillus subtilis (1.3 million cfu/g) and 70% sodium butyrate at 2kg/MT (FA), or spray dried porcine plasma (SDPP) at 5% of the milk replacer formula (MR). Holstein male calves (n = 158) were randomly assigned to receive one of 3 formulations containing SDPP, FA, or a control group with no feed additives or non-milk proteins. Calves were housed individually until weaning at d 49, then commingled into consecutive groups of 5 until d 78. MR was formulated with 26% crude protein (CP) and 17% fat and fed at 0.7 kg powder / d in 2 feedings for 5 weeks followed by 0.45 kg of MR powder / d over a 2-week weaning period. Calf starter (18% CP) was fed for 21 d followed by a mixed corn and supplement (18.1% CP) ration for the remainder of the study. For the first 28 d following arrival, calves were scored for fecal consistency on a scale of 0 to 3 with 0 being normal manure and 3 meaning watery feces. Calves were observed daily for symptoms of respiratory disease. Body weights were recorded at arrival, 49, and 78. A Cox proportion hazard model was built to evaluate the impact of treatment groups on the risk of morbidity, and mortality over the growing period, whereas a mixed linear regression model was built to evaluate the effect on average daily gain. To evaluate the effect of treatment group on fecal score, a generalized linear model with a logit link and binomial family was used. There was no difference between the groups with respect to body weight (P = 0.56), or level of serum total protein (P = 0.48) measured at arrival. Calves in the FA group had an increased risk of mortality (P = 0.02) when compared with the control group. SDPP fed calves had a reduction in the number of days with a fecal score of 3 (P = 0.03). There were no significant differences between groups with respect to treatment for diarrhea, respiratory disease, or average daily gain. This study suggests that feeding plasma in milk replacer may help reduce the severity of diarrhea, whereas, adding the FA could result in a higher risk of mortality.

Key Words: calf, health, growth


This study evaluated the effects of 2 milk replacer (MR) feeding rates and addition of functional fatty acids (FA) to calf feeds on total track digestion (TTD). Male Jersey calves (n = 48; initially 30 ± 2.4 kg BW; 3 to 7 d of age) were randomly assigned to 4 treatments in a 2 x 2 factorial arrangement of MR feeding rate (454 g for 42 d, then 227 g for 7 d [Low]; or 454 g for 3 d, 568 g for 4 d, 681 for 35 d and 341 for 7 d [High]) and supplementation with (FA+) or without (FA-) a FA blend (NeoTec5g, Provimi) added to MR and CS. Milk replacer (24% CP, 21% fat DM) was reconstituted to 14% solids and fed in 2 equal feedings for 42 d and a.m. only for 7 d. Textured calf starter (CS; 20% CP, 39% starch DM) and water were offered for ad libitum consumption. From d 57–112, CS was mixed with 5% chopped grass hay. Up to d 56, calves were housed individually and from d 57–112 in groups (n = 4/pen). Total tract digestion was measured from 5 calves/treatment at wk 3 and 7, and from all pens at 9, 11, and 15 wk using acid insoluble ash as a digestion marker. Data were analyzed as a completely randomized design with repeated measures when appropriate, with calf as the experimental unit d 1–56 and pen thereafter. No differences were detected in CS intake or performance. No TTD differences were detected at wk 3. Shortly after weaning (7 wk) TTD of DM, OM, starch, NDF, and ADF were greater (P < 0.05) for calves fed Low; and TTD of DM, OM, NDF, ADF and fat were greater (P < 0.05) for calves fed FA+. Average TTD for DM, OM, starch, NDF, ADF and fat at 7 wk were 79, 80, 97, 40, 28 and 75%, respectively. Combined group pen TTD (wk 9, 11 and 15) of DM, OM, NDF and ADF were greater (P < 0.05) for calves fed Low; and DM, OM, sugar, NDF, ADF, CP and fat were greater (P < 0.05) for calves fed FA+. Average TTD for wk 9, 11 and 15 of DM, OM, sugar, NDF, ADF, CP and fat were 78, 80, 95, 47, 39, 78, 67%, respectively. In this study, feeding Jersey calves more MR had a negative impact on
post-weaning digestion of feeds, whereas supplementing the diets with functional FA improved digestion.

**Key Words:** feeding rate, digestibility, Jersey calf

W47 Different milk replacer induces changes in growth performance and rumen bacterial diversity of dairy bull calves. Y. Zhang1, D. Jin1, J. Cheng2, N. Zhang1, Y. Zhang1, and J. Wang*, 1State Key Laboratory of Animal Nutrition, Institute of Animal Sciences, Chinese Academy of Agricultural Sciences, Beijing, China, 2Institute of Animal Husbandry and Veterinary Science, Shanxi Academy of Agricultural Science, Taiyuan, China.

The diets of calves are predominantly milk, and the beginning of solid feed intake triggers a critical process of the activity of the rumen microbiota and ruminal fermentation. However, little in know about the rumen bacterial diversity changes in dairy bull calves induced by milk replacer and other starters such as solid pellets or hay. The effects of replacing part milk replacer with pellet diet and Chinese wildrye in the diet on growth performance and rumen bacterial composition of dairy bull calves were analyzed. Thirty-two newborn Holstein bull calves with initial weight of (42 ± 5) kg were randomly allocated to 4 dietary treatments: Group MFC were fed milk replacer, pellet diet and Chinese wildrye, group MFR were fed milk replacer and Chinese wildrye, group MCO were fed milk replacer and pellet diet, group MIL were fed milk replacer only. One week for pretrial and 7 weeks for experiment. At the end of the experiment, 3 calves from each treatment were slaughtered. The outcome suggests that feeding calves milk replacer with 3% wheat protein results in reduced ADG in the post-weaning period, with no effects on diarrhea, respiratory disease, or mortality. No difference was found in gain from arrival to d 49, however, from d 49 to d 78, calves in the WHT gained 0.08 kg/d less compared with the MLK (P < 0.004) when using a random effect controlling for the group the calf was contained within. The outcome suggests that feeding calves milk replacer with 3% wheat protein results in reduced ADG in the post-weaning period, with no effects on diarrhea, respiratory disease, or mortality.

**Key Words:** milk replacer, dairy calf, protein

W48 Effects of feeding Holstein calves 3% wheat protein in milk replacer. A. Keunen*1 and D. Renaud1, 1Mapleview Agri Ltd., Palmerston, ON, Canada, 2Population Medicine, University of Guelph, Guelph, ON, Canada.

Following birth and colostrum feeding, many calves are fed a commercial milk replacer (MR). MR including non-milk proteins such as wheat, can be perceived as a cost-effective way of raising calves. The objective of this 78d study was to evaluate the health and performance of Holstein male calves fed one of 2 MR treatments differing in CP source. Milk proteins supplied 100% of the CP in MLK. Hydrolyzed wheat supplied 3% of the CP in WHT, with the remainder from milk proteins. Both MR contained 25% CP (as-fed) and 19% animal fat (as-fed). Calves (n = 240), were sourced from dairy farms or auction at approximately 7 d of age. Calves were randomized upon arrival based on BW, source, and serum total protein and fed individually until weaning at d 49, then co-mingled into consecutive groups of 5 until d 78. Both groups were offered: 0.52kg MR for wk 1 and 2; 0.65kg MR for wk 3; 0.90kg MR for wk 4 and 5, followed by a 2 wk weaning period of 0.45kg of MR powder at 13% solids, daily. Calf starter (21% CP, as-fed) was fed until d 28, followed by a corn and supplement ration (18.1% CP, as-fed) until d 78. Milk intake was not different (P = 0.76), however, grain consumption was higher in the preweaning period in the MLK (P = 0.02) but not in the post weaning period (P = 0.67). Fecal scores were recorded for the first 28 d and calves were observed for respiratory disease daily for 78 d. Body weight was recorded at arrival, on d 49, and d 78. Cox proportional hazard models were built to evaluate impact of treatment on mortality and morbidity, whereas, a mixed linear regression model evaluated the effect of treatment on ADG. No differences were observed between treatment groups with respect to diarrhea, respiratory disease, or mortality. No difference was found in gain from arrival to d 49, however, from d 49 to d 78, calves in the WHT gained 0.08 kg/d less compared with the MLK (P < 0.004) when using a random effect controlling for the group the calf was contained within. The outcome suggests that feeding calves milk replacer with 3% wheat protein results in reduced ADG in the post-weaning period, with no effects on diarrhea, respiratory disease, or mortality.

**Key Words:** diet composition, rumen, bacteria diversity


The objective of this study was to evaluate the effect of tributyrin (TB) supplementation in milk replacer (MR) on growth performance and plasma glucagon-like peptide-2 (GLP-2) concentration in preweaning dairy calves. Twenty Holstein heifer calves were supplemented with 0.3% palm oil (Control; n = 10) or TB (TB; n = 10) on dry matter basis. The MR supplemented with palm oil or TB, and containing 28.0% CP and 15.0% fat was offered at 578 g/d (dry matter basis) from 7 to 13 d of age, 770 g/d from 14 to 20 d of age, 1,156 g/d from 21 to 41 d of age, 770 g/d from 42 to 48 d of age, and 578 g/d from 49 to 55 d of age, then weaned on 56 d of age. All calves were fed calf starter ad libitum and chopped hay limited 200 g/d (as fed basis). Body weight were measured weekly from 7 to 56 d of age. Blood samples were collected weekly from 7 to 56 d of age and assayed for plasma GLP-2 and metabolite concentrations. A mixed model was used to determine the effects of treatment and day as repeated measures, and their interaction. Average daily gain did not differ between control (0.78 ± 0.03 kg/d; LSM ± SE) and TB (0.72 ± 0.03 kg/d). Dry matter intake (DMI) of MR and hay did not differ between the 2 treatments. However, interaction effects between treatment and day about DMI of calf starter, total DMI and intake of metabolizable energy (ME) were observed (P < 0.05), and these were lower for TB calves at 46, 47, from 50 to 55 d of age compared with control calves. Plasma GLP-2 concentration was higher for TB calves (0.59 ± 0.05 ng/mL) compared with control (0.41 ± 0.05 ng/mL) calves (P < 0.05). Blood glucose and serum β-hydroxybutyric acid concentrations did not differ between the 2 treatments. In conclusion, MR supplemented with TB increased plasma GLP-2 concentration. Despite the decreased ME intake in preweaning dairy calves fed TB, no
difference in growth performance was observed which may be related to GLP-2 action on gut development and nutrient absorption.

Key Words: calf, tributyrin, glucagon-like peptide-2

W50 Use of body measurements to estimate live weight of Holstein dairy calves in the pre-weaning period. M. Hasnaoui*1, D. Santschi2, S. Plante1, E. Vasseur3, A. Bregard1, S. Binggeli1, and É. Charbonneau1, 1Université Laval, Québec, QC, Canada, 2Valacta, Ste-Anne-de-Bellevue, QC, Canada, 3McGill University, Ste-Anne-de-Bellevue, QC, Canada.

The evaluation of body weight (BW) is one of the most effective ways to assess proper growth of calves and ultimately management. Although a scale is the best way to achieve this measure, most small dairy herds still rely on heart girth (HG) measurements with a tape to estimate calves BW. The equations linking HG measurements with BW were developed using animals of several weights, but rarely pre-weaning calves. The aim of this study was to validate the use of HG measurement for dairy calves in the pre-weaning period to estimate their BW and verify if other body measurements would also be effective to predict pre-weaning BW of calves. A database was built by weighting on a scale and measuring different parameter related to body size (HG circumference, withers height, hip height, and at the hip width) of 329 Holstein dairy heifers of 2 dairy farms in Quebec, Canada. The measures were taken 3 times per week during the first 3 weeks of life and every 2 weeks until the week following weaning at 76 d of age. Preliminary analyses with Pearson correlations were performed to assess the relationship between body weight and independent variables. Simple regressions were then performed using the MIXED procedure of SAS to predict body weight with calf as a random effect. Five-fold cross-validation was used for each independent variable to evaluate the equations. The prediction equation for BW resulting in the highest \( r \) (0.99) and the lowest RMSPE (6.87) was using HG. The prediction equation with HG was BW (kg) = 119.04 − 3.3089 × HG (cm) + 0.02959 × HG^2. Further analyses showed no mean bias (0.11 kg; \( P = 0.51 \)) or linear bias (−0.002 kg, \( P = 0.47 \)) for the proposed equation. In contrast, the most commonly used equation (Heinrichs et al., 1992; J. Dairy Sci. 75:3576–3581) exhibited a mean bias of 0.63 kg (\( P < 0.001 \)) and a linear bias of −0.045 (\( P < 0.001 \)). Predictions were also possible with the other parameters measured (hip width: \( r = 0.97 \), RMSPE = 9.92; withers height: \( r = 0.97 \), RMSPE = 10.82; hip height: \( r = 0.96 \), RMSPE = 11.38). The results of this study confirm the possibility to use HG or other body parameters to predict pre-weaning BW of calves.

Key Words: body weight, dairy calf, heart girth