
We evaluated the effects of fatty acid (FA) supplements with different ratios of palmitic (C16:0) and oleic acid (C18:1) in low and high fat basal diets on production responses of dairy cows. Thirty-six multiparous Holstein cows (50.2 ± 5.8 kg milk/d; 160 ± 36 d DIM) were used in a split-plot Latin square design. Cows were blocked by milk yield and allocated to a main plot receiving either a low fat (LF) basal diet (n = 18) containing cottonseed meal and cottonseed hulls or a high fat (HF) basal diet (n = 18) containing whole cottonseed. Diets were balanced for similar NDF (30.0% DM), starch (28.5% DM), and CP (17.5% DM). Within each plot a 3x3 Latin square arrangement of treatments was used with 3 21 d periods. Treatments were: 1) control (CON; no FA supplementation), 2) FA supplement containing 80% C16:0 + 10% C18:1 (PA), and 3) FA supplement containing 60% C16:0 + 30% C18:1 (PAOA). FA supplements were fed at 1.5% DM and replaced soyhulls in CON. The statistical model included the random effect of cow within basal diet, and the fixed effect of treatment, diet, period, and their interactions. Treatment by basal diet interactions were observed with FA treatments increasing lactose yield (P = 0.01) and tending to increase milk yield (P = 0.14) in LF but not in HF. Basal diet had no effect on DMI (P = 0.66) or milk yield (P = 0.62). Compared with LF, HF increased 3.5% FCM (46.7 ± 20.2 kg/d; P = 0.04) and milk fat yield (1.65 vs. 1.83 kg/d; P = 0.02) and tended to increase ECM (47.1 ± 50.0 kg/d; P = 0.07). Results for FA treatments are presented in the following order: CON, PA, and PAOA. PAOA decreased DMI (33.0 ± 33.1, 32.0 kg/d; P < 0.01), FA treatments increased 3.5% FCM (47.4 ± 48.9, 49.0 kg/d; P < 0.01), ECM (47.8, 49.0, 48.9 kg/d; P < 0.01), and milk fat yield (1.69, 1.76, 1.76 kg/d; P < 0.01) compared with CON but there was no difference between FA treatments. In conclusion, a high fat basal diet had positive production responses while the addition of fat supplements increased milk fat yield, 3.5% FCM, and ECM regardless of basal diet.

Key Words: fat supplementation, basal diet, milk fat


Sweet potato (Ipomoea batatas) is a high source of starch feed (75.7%). This crop usually generate up to 30% of discards that are not marketing, becoming a potential ingredient as a coproduct to be added in a rumenated ration. Therefore, the objective of this study was to evaluate sweet potato flour addition on concentrate, partially replacing corn, on milk yield and metabolism of dairy cows. Twenty lactating multiparous Holstein cows 45 ± 15 DIM were randomly enrolled into 2 groups: cows receiving a standard diet with corn as an energy source (n = 20) and cows receiving a concentrate with 40% of sweet potato flour replacing corn (n = 20). Milk production was obtained daily by the sum of the morning and afternoon milkings throughout the experiment. Serum and plasma samples were collected every 3 d from all animals after morning milking through a coccygeal vein puncture, and analyzed for glucose, nonesterified fatty acid (NEFA), gamma-glutamyl transferase (GGT), aspartate aminotransferase (AST), total protein (TP), albumin and urea concentrations. The experiment lasted 70 d, divided into 2 periods of 35 d each, 14 d for adaptation to diet and 21 d for collection, adopting the crossover design (2 treatment groups and 2 periods) and data were analyzed using NCSS software. There was no effect (P > 0.05) of carry-over on the treatments in any variables. The average daily milk production was similar (P = 0.62) between groups, 38.95 and 38.67 kg/day, respectively for control and sweet potato groups. Metabolic evaluations were all within the physiologic ranges and they were similar (P > 0.05) between groups glucose (P = 0.11); NEFA (P = 0.58); GGT (P = 0.19); AST (P = 0.48); TP (P = 0.21); albumin (P = 0.14). The concentration of urea was greater (P = 0.001) in the sweet potato flour group, 38.63 mg/dL, as compared with 34.96 mg/dL to the control. In conclusion, corn substitution by sweet potato flour at 40% in lactating cow diets, did not affect milk yield and metabolism. Therefore, sweet potato flour can be a potential ingredient to be used for lactating diets of dairy cows.

Key Words: milk production, ruminal nutrition, starch


This study investigated the effect of high-amylase corn silage on lactation performance, enteric methane (CH4) emission, and rumen fermentation of lactating dairy cows. Following a 2-wk covariate period, 48 cows averaging (±SD): 121 ± 30 d in milk (DIM), 43 ± 9 kg/d milk yield (MY), and 620 ± 61 kg BW were blocked based on DIM, MY, and enteric CH4 emission and randomly assigned to 1 of 2 treatments in an 8-wk randomized complete block design experiment: (1) control corn silage from an isolean parent corn without α-amylase trait (CON) and (2) corn silage containing a bacterial transgene expressing high levels of α-amylase in the endosperm of the grain (EFC; EnogenFeed, Syngenta Seeds LLC, Downers Grove, IL). Silages were included at 40% of the total mixed ration dry matter (DM) EFC and CON silage were 43.3 and 41.8% DM and had (% DM): neutral-detergent fiber (NDF), 36.7 vs. 37.5 and starch, 36.1 vs. 33.1, respectively. The overall diets contained (% DM basis): crude protein, 16.5 vs. 16.7; NDF, 33.6 vs. 33.9; and starch, 25.2 vs. 24.0 for EFC and CON, respectively. Enteric CH4 emission was measured using the GreenFeed system (C-Lock Inc., Rapid City, SD). Rumens samples were collected using the ororuminal sampling technique on experimental wk 6. Data were analyzed using PROC MIXED of SAS with block and block × treatment as random effects. DMI (25.3 kg/d; SEM = 0.34, P = 0.55) was similar between treatments. Compared with CON, MY (38.8 vs. 40.8 kg/d; SEM = 0.50), feed efficiency (1.53 vs. 1.63 kg/kg; SEM = 0.027), ECM feed efficiency (1.51 vs 1.57 kg/kg; SEM = 0.022), milk true protein (1.20 vs 1.25 kg/d; SEM = 0.033), and lactose yields (1.89 vs 2.00 kg/d; SEM = 0.016) were increased (P < 0.05) by EFC. Daily CH4 emission (416 g/d; SEM = 8.2) was not affected (P = 0.32) by treatment, but CH4 emission intensity was decreased (P = 0.007; 11.1 vs 10.3 g/kg milk; SEM = 0.22%) by EFC. Molar proportion of butyrate was higher (P = 0.04) in CON vs. EFC (14.6 vs. 11.3 mol %; SEM = 0.16). EFC inclusion at 40% of dietary DM increased milk yield and feed efficiency and decreased CH4 emission intensity in dairy cows.

Key Words: dairy cow, corn silage, enteric methane

178 Milk production and feed intake responses to increasing levels of palmitic acid supplementation in early lactation Holstein cows. P. D. French*1 and M. J. Martin2, 1PHD R&D LLC, Fort Atkinson, WI, 2University of Wisconsin, Madison, WI.

Several published studies show that mid-lactation Holstein cows of varying production levels respond to increasing levels of palmitic acid (PA) supplementation. We evaluated the dose-dependent response of a PA supplement in early lactation Holstein cows fed a basal diet containing 2.6% total fatty acids (FA) and 0.5% PA. Twelve multiparous, Holstein cows (53 ± 15 DIM) with a preliminary milk yield of 62 ± 8 kg/d were fed a

We evaluated the effect of a live yeast supplement and changes in ruminal fermentability of dietary starch on feed intake and the yields of milk and milk components of mid- to late-lactation dairy cows (158 ± 76 DIM). Thirty-two multiparous Holstein cows (45.5 ± 5.1 kg/d) were used in a crossover design with two 28-periods. A fermentable starch challenge (FSC) on the last 7 d of each period was utilized as a split-plot design experiment and assigned to either a control diet containing no supplemental fat (CON) or a diet supplemented with calcium salts (CS) of palmitic (C16:0) and oleic (C18:1) acids (FAT) either from calving to 24 DIM (fresh period, FR) or from 25 to 67 DIM (peak period, PK). Fresh diets contained (% DM) 17% CP, 23% forage NDF, and 25% starch. Peak diets contained (% DM) 17% CP, 19% forage NDF, and 28% starch. The CON contained 60% C16:0 and 30% C18:1 (total fatty acid basis) and was added at 1.90% of diet DM replacing soyhulls in CON diets. The statistical model included the random effect of block and cow within block and treatment, and the fixed effect of treatment, time, and their interactions. Results are presented in the sequence CON vs. FAT. During FR there was no effect of treatment on DMI (21.2 vs. 21.5 kg/d, P = 0.25), milk yield (40.6 vs. 39.1 kg/d, P = 0.30), or BW change (−2.59 vs. −2.20 kg/d, P = 0.35). Compared with CON, FAT increased milk fat content (4.62 vs. 4.95%, P = 0.02) and yield (1.80 vs. 1.96 kg/d, P = 0.02) and ECM (45.6 vs. 48.4 kg/d, P = 0.05). During PK there was no effect of treatment on DMI (28.1 vs. 28.3 kg/d, P = 0.73), or BW change (0.39 vs. 0.30 kg/d, P = 0.38). Compared with CON, FAT increased milk yield (51.5 vs. 54.0 kg/d, P = 0.05), milk fat content (3.52% vs. 3.63, P = 0.05) and yield (1.82 vs. 2.02 kg/d, P < 0.01) and ECM (51.5 vs. 55.2 kg/d, P < 0.01). A treatment by time interaction was observed for DMI during PK (P = 0.05) because intake was higher for FAT compared with CON after wk 5 of calving. We observed that cows that received FAT compared with CON during FR increased milk yield by 2.7 kg/d (P = 0.04) and ECM by 2.9 kg/d (P = 0.03) during PK indicating a positive carryover effect of CS supplementation early postpartum. Our results demonstrate that feeding a CS supplement containing 60% C16:0 and 30% C18:1 during early lactation increases milk fat yield and ECM without changes in DMI or BW during the fresh and peak periods.

Key Words: live yeast, starch, milk fat

PA supplement (88.0% C16:0, 3.6% C18:0, 5.1% C18:1) at 0, 0.5, 1.0, or 1.5% of ration DM in a replicated 4 × 4 Latin square design. Periods were 14 d with the final 5 d used for data collection except for milk composition and yield which was determined on the last 2 d of each period. Cows were milked 3x/d and fed a TMR once daily that contained 54% forage (35% corn silage and 19% alfalfa silage), 15.8% CP, 27.7% NDF, and 28.4% starch. Data were analyzed using the mixed model procedure of SAS and linear (L), quadratic (Q), and cubic (C) contrasts were used to evaluate PA dose-response. Results are presented in the following order: 0, 0.5, 1.0, or 1.5% PA. PA intake was 151, 297, 436, and 573 g/d. PA dose increased milk yield (60.1, 59.9, 61.4, and 61.6 kg/d; L, P < 0.01) and ECM (59.8, 58.9, 61.8, and 60.9 kg/d; L, C, P < 0.01). PA dose affected DMI (30.1, 31.6, 31.6, and 31.5 kg/d; Q, P < 0.05) and ECM feed efficiency (1.94, 1.88, 1.97, and 1.95; C, P < 0.01). Milk fat concentration (3.52, 3.44, 3.59, 3.53%; C, P < 0.05), milk FA acid concentration (3.33, 3.26, 3.40, and 3.34; C, P < 0.05) and milk fat yield (2.16, 2.10, 2.26, 2.20 kg/d; C, P < 0.01) were affected by PA dose. PA did not alter milk protein concentration (2.90%) but did affect yield (1.78, 1.77, 1.84, and 1.79 kg/d; C, P < 0.01; L, P < 0.08). Preformed FA (>C18) increased with PA dose (L, P < 0.05), whereas mixed FA (C16:0) responded cubically (P < 0.05), and de novo (>C16) were not affected by PA dose. In conclusion, high-producing Holstein cows responded most efficiently to 1.0% PA supplementation.

Key Words: fat supplementation, feed efficiency, milk fat

Effects of timing of a calcium salt supplement containing palmitic and oleic acids on production responses of early lactation dairy cows. A. Pineda1, J. de Souza2, J. Newbold1, R. M. Kirkland1, and A. L. Lock1, 1Michigan State University, East Lansing, MI, 2Perdue AgriBusiness, Salisbury, MD, 3Scotland’s Rural College, Durnfries, UK, 4Volac Wilmar Feed Ingredients, Royston, UK.

Fifty-six multiparous cows were used in a randomized complete block design experiment and assigned to either a control diet containing no supplemental fat (CON) or a diet supplemented with calcium salts (CS) of palmitic (C16:0) and oleic (C18:1) acids (FAT) either from calving to 24 DIM (fresh period, FR) or from 25 to 67 DIM (peak period, PK). Fresh diets contained (% DM) 17% CP, 23% forage NDF, and 25% starch. Peak diets contained (% DM) 17% CP, 19% forage NDF, and 28% starch. The CS contained 60% C16:0 and 30% C18:1 (total fatty acid basis) and was added at 1.90% of diet DM replacing soyhulls in CON diets. The statistical model included the random effect of block and cow within block and treatment, and the fixed effect of treatment, time, and their interactions. Results are presented in the sequence CON vs. FAT. During FR there was no effect of treatment on DMI (21.2 vs. 21.5 kg/d, P = 0.25), milk yield (40.6 vs. 39.1 kg/d, P = 0.30), or BW change (−2.59 vs. −2.20 kg/d, P = 0.35). Compared with CON, FAT increased milk fat content (4.62 vs. 4.95%, P = 0.02) and yield (1.80 vs. 1.96 kg/d, P = 0.02) and ECM (45.6 vs. 48.4 kg/d, P = 0.05). During PK there was no effect of treatment on DMI (28.1 vs. 28.3 kg/d, P = 0.73), or BW change (0.39 vs. 0.30 kg/d, P = 0.38). Compared with CON, FAT increased milk yield (51.5 vs. 54.0 kg/d, P = 0.05), milk fat content (3.52% vs. 3.63, P = 0.05) and yield (1.82 vs. 2.02 kg/d, P < 0.01) and ECM (51.5 vs. 55.2 kg/d, P < 0.01). A treatment by time interaction was observed for DMI during PK (P = 0.05) because intake was higher for FAT compared with CON after wk 5 of calving. We observed that cows that received FAT compared with CON during FR increased milk yield by 2.7 kg/d (P = 0.04) and ECM by 2.9 kg/d (P = 0.03) during PK indicating a positive carryover effect of CS supplementation early postpartum. Our results demonstrate that feeding a CS supplement containing 60% C16:0 and 30% C18:1 during early lactation increases milk fat yield and ECM without changes in DMI or BW during the fresh and peak periods.

Key Words: palmitic acid, oleic acid, postpartum