time did not differ between treatments (201.0 min/d), but heifers did spend more time at the bunk in the 2 h following feed delivery on the TD ration (50.1 vs. 32.0 min/d; SE=1.3, *P*<0.001). Fecal scores were lower for heifers on the TD ration (2.7 vs. 3.4; SE=0.1; *P*=0.003). Lower fecal scores may reflect altered rumen fermentation on the TD ration from lower effective fiber intake, as result of greater sorting against long particles, and consumption of a large portion of concentrate following feed delivery.

Key Words: heifers, sorting, feeding behavior

W241 Wheat grain eases metabolic transitions in periparturient heifers. F. Ehsanbakhsh, H. Amanlou, D. Zahmatkesh, and A. Nikkhah*, *Zanjan University*, *Zanjan, Iran*.

Wheat grain possesses reasonably synchronous starch and protein fermentation rates, low cation-anion difference, and high palatability. Such prepartal diet properties can reduce the risk of postpartum hepatic lipidosis, hypocalcemia, and subacute rumen acidosis. We determined the effects of feeding WG to prepartum heifers on periparturient metabolic, health, and productive criteria. Fifteen Holstein heifers at 31 ± 6 days prepartum were blocked based on expected calving date and assigned to three treatments. The treatments were totally mixed rations containing either 1) a conventional blend of barley grain and wheat bran (BGW), 2) 10% wheat grain (WG10), or 3) 18% WG (WG18) (DM basis). Prepartum diets contained no anionic salts. Cows were monitored until 21-day postpartum and fed a same early lactation diet. The prepartal WG tended to linearly increase DMI (10.1, 10.6, 10.7 kg/d, P=0.09), reduced urine pH at 7-day prepartum (7.0, 6.7, 6.6; P<0.001), and elevated (P<0.05) blood calcium and glucose at 7-day prepartum (40 vs. 52, 53 mg/dl; 7.5 vs. 8.6 and 9.1 mg/dl) and at 3-day postpartum (30 vs. 39 and 40 mg/dl; 7.5 vs. 8.0 and 8.8 mg/dl). Milk fat (0.98 vs. 1.03 and 1.14 kg/d, P<0.01) and protein (0.89 vs. 1.02 and 1.02, P<0.05) yields increased during 21-day postpartum in heifers receiving prepartal WG10 and WG18 instead of BGW. The prepartal apparent dry matter (59.9 vs. 54.3%, P=0.09) and crude protein (67.7 vs. 60.3%, P=0.05) total tract digestibilities were greater for WG10 than for BGW. Blood albumin, globulins, total proteins and urea were similar among groups. Feeding WG did not affect body condition score, calving difficulty, calf weight and health, placenta weight, and the time interval between calving and placenta expulsion. In conclusion, prepartal WG provision concurrently improved energy and calcium states in transition heifers without compromising parturition status and calf health. These data support our previous findings in mature cows and suggest that novel feeding strategies using most suitable ingredients ease the periparturient metabolic transition even without anionic salts in the diet.

Key Words: wheat, preparturient, heifer

Ruminant Nutrition: Fat Supplementation

W242 Effect of dietary lipids on selected strains of ruminal bacteria. R. B. Potu*[1], A. A. AbuGhazaleh[1], K. L. Jones[1], R. L. Atkinson[1], D. Hastings[1], J. D. Haddock[1], and S. Ibrahim[2], [1]*Southern Illinois University*, *Carbondale*, [2]*North Carolina A&T University*, *Greensboro*.

Previous studies have shown that fish oil (FO) promotes vaccenic acid (VA) accumulation in the rumen by inhibiting the last step of biohydrogenation. The objective of this study was to compare the effects of different lipid sources on DNA concentration of bacteria involved in biohydrogenation. Four continuous culture fermenters were used in a 4 x 4 Latin square design with four periods of 10 d each. Treatment diets (50% alfalfa pellets, 50% concentrate) were fed (45 g/d DM basis) in three equal portions during the day. The diets were 1) control (CON), 2) control + saturated fat (rumofat; SAT), 3) control + soybean oil (SBO), and 4) control + fish oil (FO). Lipid supplements were added at 3% of diet DM. Samples collected at 3 h post feeding on d 10 were used for fatty acids and quantitative PCR analysis. The concentrations (g/100g fatty acids) of VA were similar between the SBO (10.50) and FO (12.72); both were higher (P < 0.10) than the levels for CON (6.71) and SAT (3.64). Concentrations of C18:0 were lowest (P < 0.10) for FO (4.82) compared with the other treatment diets (SAT- 45.46, SBO- 21.14, and CON- 14.61). The concentration of conjugated linoleic acid (cis-9, trans-11 CLA) was highest (P < 0.10) with SBO (0.41) in comparison with the other treatment diets (SAT- 0.04, FO- 0.10, and CON- 0.11). DNA concentrations for total bacteria, *Anaerovibrio lipolytica*, and *Succinivibrio dextrinosolven*s were similar (P > 0.10) for all diets. The concentrations of *Butyrivibrio fibrisolvens* (0.06196 ng/45ng total DNA) and *Ruminococcus albus* (0.00196 ng/45ng total DNA) were lowest (P < 0.10) with FO but were similar among the other treatment diets (SAT- 0.1042; 0.005416, SBO- 0.1212; 0.00571, and CON- 0.1263; 0.00517). In conclusion, SBO and rumofat had no effects on bacterial DNA concentrations tested in this study and FO effects on biohydrogenation may be due in part to its effect on *Butyrivibrio fibrisolvens* and *Ruminococcus albus*.

Key Words: fish oil, trans FA, bacteria

W243 Effects of docosahexaenoic acid and linoleic acid on rumen trans-vacceinc acid and microbe populations. D. Li, J. Q. Wang*, D. P. Bu, K. L. Liu, and P. Yu, *State Key Laboratory of Animal Nutrition, Institute of Animal Science, Chinese Academy of Agricultural Sciences*, *Beijing, China*.

The objective of this study was to determine the influence of dietary refined docosahexaenoic acid and free linoleic acid supplementation on the population of *Anaerovibrio lipolytica, Fibrobacter succinogenes, Ruminococcus flavefaciens, Megasphaera elsdenii* strain YJ-4, *Butyrivibrio fibrisolvens* A38, *Butyrivibrio hungatei* JK684, and *Butyrivibrio hungatei* Su6 in ruminal fluid and the concentration of trans vaccenic acid (TVA) in rumen from lactating cows fed high forage diets (forage to concentrate ratio 60:40). Four lactating cows with ruminal, duodenal and ileal cannulas were randomly assigned into a 4 × 4 Latin square with 21-d periods. These diets included basal diet (control), basal diet with 2.73% refined free linoleic acid (RFLA), 2.73% refined free linoleic acid plus 0.50% refined docosahexaenoic acid (RFLDA), or 0.50% refined docosahexaenoic acid (RFDA) on a DM basis. Rumen samples were obtained via the fistula at 0, 4, 6, 8, 10 and 12 h after morning feeding on the 15th d of each period, respectively. TVA was measured with gas chromatography. DNA was extracted and shift in the microbial populations were monitored by real-time PCR using specific primers. The data were statistically analyzed using the PROC MIXED models of SAS (SAS Institute, 2002). The TVA contents in RFLA, RFLDA and RFDA treatments increased by 3.5-, 5.4- and 1.0-fold compared

with the control. *A. lipolytica, F. succinogenes, B. hungatei* JK684 and *B. hungatei* Su6 decreased ($P<0.05$) with DHA and LA addition, while *M. elsdenii* YJ-4 and *B. fibrisolvens* A38 increased ($P<0.05$). DHA and LA addition did not change *R. flavefaciens* population. The study indicated that PUFA addition or a combination of refined linoleic acid and DHA led changes to ruminal bacteria populations. TVA accumulation in rumen was partly due to DHA and LA inhibition on *A. lipolytica*, *F. succinogene* and *B. hungatei*, and increase of *B. fibrisolvens* A38 and *M. elsdenii* to some extent.

Key Words: docosahexaenoic acid, linoleic acid, trans vaccenic acid

W244 Effect of coconut oil on fermentation, digestion, and N flow in rumen-simulating fermenters. G. A. Harrison*, M. D. Meyer, and K. A. Dawson, *Alltech Biotechnology, Nicholasville, KY*.

The feeding of coconut oil has reduced methane emissions but effects of this oil on ruminal N metabolism deserve further attention. Effects of coconut oil (CO) were investigated in single-flow rumen-simulating fermenter cultures. Cultures were fed diets formulated in CPM (version 3.08) with four levels of CO (0, 1.67, 3.34, and 5.0% DM). Twelve cultures were used in a completely randomized design with 4 dietary treatments and 3 replications per treatment. Cultures were fed 12.5 g as fed of experimental diets twice daily for 6 days. Fermentation samples were collected from all cultures prior to morning feeding during the last 3 days of experiment. Composite effluent samples from each fermenter were used for DM and NDF disappearance and volatile fatty acid (VFA) analyses. Methane concentration was estimated from VFA concentrations based on a theoretical fermentation balance (Wolin. 1960. J. Dairy Sci. 43:1452). Nitrogen flow measures were estimated by using purine to N ratios for effluent and bacteria. Data were analyzed for effects of treatment using GLM procedure of SAS and linear effects were determined by orthogonal contrasts. Increasing levels of CO resulted in a linear increase in culture pH ($P<0.01$), molar proportions of acetate ($P<0.0001$), and butyrate ($P<0.05$), while decreasing propionate ($P<0.0001$), isoacids ($P<0.05$), and total VFA ($P<0.01$). Methane concentration (mmoles/L) and production (mmoles/d) decreased with more CO in culture diets ($P<0.0001$). Culture ammonia concentration was higher in 1.67 and 3.34% oil cultures than in cultures fed control or 5% oil diets ($P<0.001$). Digestion of true DM and NDF decreased as oil level increased (linear effect; $P<0.01$). N flow measures were also affected by oil with linear decreases in protein degraded ($P<0.05$) and bacterial N yield ($P<0.0001$) as CO increased. Coconut oil at 1.67 to 5% of dietary DM shifted ruminal fermentation in a manner that resulted in lower methane concentration and production but negatively affected digestion and N flow.

Key Words: coconut oil, methane, ruminal metabolism

W245 Effects of different rates of continuous abomasal or pulse ruminal infusions of either free or protected nicotinic acid on plasma NEFA concentrations. J. Pescara*, J. Pires, and R. Grummer, *University of Wisconsin, Madison*.

Five non-lactating feed-restricted Holstein cows were used in a 5x5 Latin square to test the effects of different rates of nicotinic acid (NA) infusion on plasma NEFA concentration. From d 1 to 5 of each period, cows were fed at 30% of energy requirements to increase plasma NEFA concentration; 9 d were allowed between periods. Treatments were continuous abomasal infusion of free NA beginning at feed restriction and continuing for 108 h at a rate of 0, 0.5, 1 or 3 mg/h per kg BW or protected NA (as Niashure; Balchem Corp.; New Hampton, NY) administered into the rumen every 6 h a rate of 0.5 mg/h per kg BW starting at 48 h before feed restriction and continuing through feed restriction. Blood samples were collected every 6 h starting immediately prior to feeding and lasting for 108 h. After termination of NA infusions, blood samples were collected hourly for 12 h. During period 1 and 4, the cow receiving 3 mg NA/h per kg BW had to be euthanized after 72 h of continuous infusion. Evidence suggested that death was due to NA toxicity. Plasma NEFA concentrations started at approximately 70 μEq/L prior to feed restriction, and at 108 h of continuous infusion were 509, 587, 442, 850 and 108 μEq/L for cows that received 0, 0.5 (Niashure), 0.5 (Free), 1 or 3 mg NA/h per kg BW, respectively. Cows receiving 3 mg NA/h per kg BW had lower plasma NEFA than all other cows ($P < 0.05$). Greater plasma NEFA concentration was observed for cows receiving 1 than cows receiving 0.5 mg (Niashure) NA/h per kg BW ($P < 0.05$). After termination of infusion, an increase in plasma NEFA concentration was observed for cows receiving 1 or 3 mg NA/h per kg BW compared to cows receiving the other treatments ($P < 0.01$); plasma NEFA concentration peaked at approximately 1900 μEq/L or 1360 μEq/L at 4 or 5 h after termination of infusions, respectively. It is unlikely there is a dose of NA that can suppress plasma NEFA and avoid a dramatic increase in NEFA following termination of treatment.

Key Words: nicotinic acid, NEFA, dairy cow

W246 Effects of infusing volatile fatty acids intraruminally on rumen and milk odd and branched-chain fatty acids. E. A. French* and L. E. Armentano, *University of Wisconsin, Madison*.

Our objective was to determine if the presence of VFA precursors increased odd and branched-chain fatty acids (OBCFA) in either rumen microbes or milk. Four midlactation cows were assigned to a 4×4 Latin square design with 2 d periods. Infusion treatments were acetate (A), propionate (P), 3-methylbutyrate (3B), and 2-methylbutyrate (2B). Infusions began 5.5 h before feeding (time=0 h) at 17.4 mmol of VFA/min for 18 h. Infusions were well above any attainable physiological level for 3B and 2B. Fatty acid analysis was performed on solid (S) and liquid (L) phase rumen samples collected at 18 h, and daily milk fat composites (M) from d 1 and 2 of each period. Intakes were determined at 23 h. VFA, blood NEFA, and blood glucose were measured at 18 h. Pre-planned, single df contrasts were made for 3B v. 2B, P v. 2B, and A v. P for intakes and blood measurements. Surprisingly, the greatest differences in OBCFA were the increases in L *iso* C15:0 and C17:0 for 2B. Infusing 3B increased *iso* C15:0 in both S and M. Propionate increased M C15:0 and C17:0. Both gluconeogenic compounds, P and 2B, had similar and greater M C15:0 compared to A and 3B. Intakes were 23, 23, 16, and 18 kg DM for A, P, 3B, and 2B ($P \neq 2B$, $P < 0.05$). Rumen L concentrations of the infused VFA were 115.2, 49.6, 62.6, and 62.0 m*M* for A, P, 3B, and 2B. Both 3B and 2B had similar decreases in energy intake and balance; however, 2B maintained blood NEFA (121, 102, 172, and 78 mmol/L for A, P, 3B, and 2B; $3B \neq 2B$, $P < 0.10$) and glucose (56.3, 64.3, 31.9, and 59.1 mg/dL for A, P, 3B and 2B; A, P, $2B \neq 3B$, $P < 0.05$). Rumen and milk OBCFA responses were minimal considering the large amounts of VFA infused.

Tablt 1. Treatment effects on rumen and milk OBCFA (g/100 g total fatty acids)

Site	Treatment	*i* C15:0	*ai* C15:0	C15:0	*i* C17:0	*ai* C17:0	C17:0
L	2B	1.47	.29	.30	.06	.08	1.18
	3B	.27	.10	.27	.01	.06	.76
	A	.29	.16	.32	.02	.05	.66
	P	.23	.09	.32	.02	.05	.49
S	2B	.20^{b}	.49	.49	.17	.17	.55^{ab}
	3B	.34^{a}	.41	.53	.16	.13	.57^{a}
	A	.25^{ab}	.41	.50	.14	.12	.47^{b}
	P	.22^{b}	.43	.58	.15	.13	.52^{ab}
M	2B	.14^{b}	.34	.94^{ab}	.15	.30	.53^{ab}
	3B	.16^{a}	.32	.78^{b}	.15	.29	.51^{ab}
	A	.14^{b}	.32	.80^{b}	.13	.28	.48^{b}
	P	.15^{ab}	.33	1.06^{a}	.14	.28	.55^{a}

$^{a-b}$Means within a column and sampling site not sharing a common superscript differ (P<.05)

Key Words: odd and branched-chain fatty acids, rumen fermentation

W247 Effects of *trans*-monounsaturated and omega-6 fatty acids on performance of periparturient Holstein cows. C. Caldari-Torres*, M. C. Perdomo, C. A. Risco, C. R. Staples, and L. Badinga, *University of Florida*, *Gainesville*.

Fat supplementation has become a common practice in the dairy industry due to the inability of high-producing dairy cows to maintain a positive energy balance during the transition to lactation. The objective of this study was to examine the effects of *trans*-monounsaturated fatty acid (*t*FA) and omega-6 fatty acids (n-6 FA) on performance of periparturient Holstein cows (n = 28). Treatments were the following: 1) Rumen-bypass fat (RBF, 91.4% saturated fat, 1.8% of DM), 2) Ca salts of *t*FA (57.5% *trans* isomers of C18:1, 1.5% of DM), and 3) Ca salts of fatty acids made from safflower oil (n-6, 63% C18:2, 1.5% of DM). Dietary treatments were initiated approximately 28 d before calculated calving dates and continued through d 50 postpartum. Dry matter intake (DMI, as a % of BW) decreased (P < 0.001) from 1.77 ± 0.1% at wk 3 prepartum to 0.87 ± 0.1% on day of calving and then increased to 3.10 ± 0.1% at wk 7 postpartum. Cows fed an RBF-enriched diet had greater (P = 0.03) DMI (2.35 ± 0.09%) than those fed the *t*FA (1.99 ± 0.10%)-supplemented diet. The average BW decreased (P < 0.001) from 750 ± 14 kg at wk 3 prepartum to 628 ± 14 kg at wk 5 postpartum and did not differ among dietary treatments. Although overall milk production did not differ among dietary treatments, cows fed the n-6 FA-enriched diet produced less (P = 0.04) fat-corrected milk (FCM; 29.3 ± 2.1 kg/d) than those receiving the RBF (36.5 ± 1.8 kg/d) or *t*FA (34.4 ± 1.5 kg/d) supplements. Milk fat percentage decreased (P < 0.001) from 4.8 ± 0.2% at wk 1 to 2.6 ± 0.2% at wk 7 of lactation. Cows fed n-6 FA-enriched diet had lower (P = 0.002) milk fat content (2.8 ± 0.2%) than those receiving isolipid RBF (3.6 ± 0.2%) or *t*FA (3.8 ± 0.2%)-supplemented diets. Results indicate that peripartum *t*FA supplementation may increase feed efficiency for milk production. Whether or not the decrease in milk fat content in cows fed n-6 FA-supplemented diet reflects an increase in endogenous CLA production warrants further investigation.

Key Words: fat, performance, dairy cow

W248 Effects of *trans*-monounsaturated and omega-6 fatty acids on uterine health and reproductive efficiency of transition Holstein cows. C. Caldari-Torres*, M. C. Perdomo, C. R. Staples, C. A. Risco, and L. Badinga, *University of Florida*, *Gainesville*.

Modern dairy cows experience varying degrees of immunological dysfunction from approximately 3 wk before calving to 3 wk after calving, which may have practical implications for health and reproductive management. The objective of this study was to determine the effects of *trans*-monounsaturated (*t*FA) and omega-6 fatty acids (n-6 FA) on uterine health and reproductive efficiency of early postpartum Holstein cows (n = 28). Treatments consisted of 1) Rumen-Bypass Fat (RBF, 91.4% saturated fat, 1.5% of DM), 2) Ca salts of *t*FA (57.5% trans C18:1, 1.8% of DM), and 3) Ca salts of fatty acids made from safflower oil (n-6, 63% C18:2, 1.8% of DM). Dietary treatments were initiated approximately 28 d before expected calving dates and continued through d 50 postpartum. Cows fed the n-6 FA-supplemented diet tended (P = 0.07) to have higher rectal temperatures at d 12 postpartum (39.1°C) than those fed isocaloric RBF (38.8°C) or *t*FA (38.9°C)-supplemented diets. Incidences of postpartum metritis (Metricheck score = 3 in the first 21 DIM) were 90, 60 and 62%, respectively, for cows fed RBF-, *t*FA- and n-6FA-supplemented diets. Corresponding values for subclinical endometritis (uterine cytology with ≥ 10% neutrophils at 40 DIM) were 30, 0, and 0%. By 50 DIM, accumulated progesterone concentration was higher (P < 0.05) in cows supplemented with n-6 FA than those receiving isolipid *t*FA or RBF-supplemented diets. First-service conception rates were 30, 50, and 71%, respectively, for the RBF, *t*FA and n-6 FA groups. Corresponding values for days open were 130, 113 and 101 d. Results provide preliminary trends that peripartum fat supplementation may improve uterine health and reproductive responses in postpartum dairy cows. Studies with larger numbers of animals are needed to fully document the beneficial effect of fat supplementation on postpartum health and reproductive efficiency in cattle.

Key Words: fat, reproduction, dairy cow

W249 The long-term effect of supplementation with fish oil or microalgae on the performance of grazing dairy cows. P. Vahmani*[1], E. Gnemmi[2], K. Glover[2], and A. Fredeen[2], [1]*Dalhousie University*, *Halifax, NS, Canada*, [2]*Nova Scotia Agricultural College*, *Truro, NS, Canada*.

The effect of long-term supplementation with rumen protected fish oil (PFO) or rumen protected microalgae (PMA) on milk yield and composition of dairy cows grazing a mixed sward was evaluated. Twenty four pre-partal Holstein cows were blocked by parity and predicted calving date and assigned randomly within block to receive one of three treatments: 1) control (no supplement), 2) PFO (300 g/d) or 3) PMA (300 g/d) for 120 days beginning 30 days before calving. Cows were housed in tie stalls and fed TMR plus one of the treatments twice daily from the start of study until 30±5 days after calving, then they grazed pasture under rotational management for the rest of study. Grazing cows were fed a concentrate according to milk yield plus one of the treatments after morning and afternoon milkings. The basal diets were formulated to be isocaloric, isonitrogenous and isolipidic and to meet nutritional requirements. Pasture dry matter intake was estimated by the net energy balance method. Cows were milked twice daily and milk samples were taken at 7, 30, 60 and 90 DIM for compositional analysis. Analysis of variance was conducted using a completely randomized block design with repeated measures. No significant treatment effects (P>0.05) were observed except in milk fat yield, which was significantly lower (P= 0.04) when cows were fed PFO and tended to be lower (P= 0.07) when

cows were fed PMA compared with control. However milk fat yield was similar (P = 0.65) among the cows fed PMA or PFO. This study suggests that PFO and PMA may reduce milk fat yield due to nonsignificant reductions in both milk yield and fat percentage and this effect may be slightly less with PMA.

Table 1. Effect of PFO or PMA on the performance of grazing dairy cows

	Control	PFO	PMA	SEM
DMI, kg/d	24.41	21.57	23.51	1.67
Milk, kg/d	36.42	33.57	34.26	1.82
Milk fat, %	4.67	4.11	4.13	0.24
Milk fat, kg/d	1.70[a]	1.35[b]	1.41[ab]	0.10
Milk protein, %	2.98	2.99	3.01	0.06
Milk protein, kg/d	1.09	1.00	1.02	0.06
Milk lactose, %	4.46	4.57	4.55	0.04
Milk lactose, kg/d	1.63	1.54	1.56	0.09

[ab] Least square means within a row not sharing a common superscript differ (p<0.05).

Key Words: grazing, fish oil, microalgae

W250 Effect of feeding rapeseeds on lactation performance in dairy cows and oxidative stability of milk and butter. O. Y. Tsisaryk*, *Lviv National University of Veterinary Medicine and Biotechnologies, Lviv, Ukraine*.

Twelve multiparous Ukrainian Red Milk cows were divided into 2 groups (on 6 heads) – C (no rapeseeds) and R (2.6% fat from rapeseeds). Diets were composed of 45% (dry basis) concentrate mix, 22% corn silage, 15% hay and 18% haylage. Ground full-fat rapeseeds replaced a part of concentrate mix in the canola diets. Diets were isonitrogenic. Ether extract and NEL increased from 3.4% and 1.42 Mcal/kg for the control diet, to 5.8% and 1.47 Mcal/kg for the fat supplemented diet, respectively. Groups were fed identical diets (control) for 3 weeks preparatory period of (PP) and C and R diets for 6 weeks of trial period (TP). Compared to the control cows, the treated cows had similar dry matter intake and milk production. Feeding canola seeds increased fat content and yield, contents and yield of fat were 3.91% and 798 g/day (C) and 3.22% and 651 g/day (R) in PP and 4.09% and 774 g/day (C) and 3.78% and 708 g/day (R) in TP respectively. Addition of supplemental fat did not affect milk protein and lactose percentage or milk component yields. After 3 weeks of feeding rapeseeds experimental cows had higher total plasma lipids (3.33 vs. 1.7 g/L, p <0.05), NEFA (123.0 vs. 112.0 μmol/L, p < 0.05), but no differences in plasma TAG, total cholesterol, HDL- and LDL-cholesterol. After 6 weeks of trial period, the difference in plasma lipid metabolites was not significant between groups. R cows had higher activity of plasma and erythrocyte GSH-Px (p < 0.05) and lower plasma concentration of hydroperoxides and MDA (p < 0.01) during all trial period. The sensibility to oxidation of milk and butter was analyzed. Pasteurized milk with the addition of copper (0.1 mg/kg) from R cows had lower content of TBA-activity products (p < 0.05) after 6 days storage at 4°C. Rapeseeds diet butter exhibited no changes in oxidative stability during 35 days storage under 4°C, but at +102°C it had lower peroxide value and TBA-test after 48 hours. Penetrometer readings indicated that R butter was softer at 4°C. Feeding dairy cows full-fat ground canola seeds had positive effect on milk fat yield and had not harmfull effect on the oxidative sensibility on milk and butter.

Key Words: cows, rapeseeds, milk

W251 Performance and metabolic measures of lactating dairy cows fed diets supplemented with either mostly saturated or more unsaturated fatty acids. J. K. Bernard*[1] and A. F. Kertz[2], [1]*The University of Georgia, Tifton*, [2]*ANDHIL LLC, St. Louis, MO*.

A 10-wk lactation trial was conducted during the late summer and early fall of 2006 using 45 late lactation cows (199.7 ± 66.3 DIM and 32.0 ± 5.2 kg milk/d) to determine the effect of feeding supplemental mostly (85%) saturated (SAT) or more (50%) unsaturated (UNS) fatty acids on performance and metabolic concentrations. Cows were fed a control diet during the first 2 wk of the trial without any supplemental fat. At the end of wk 2, cows were blocked by parity and randomly assigned to one of 3 treatments. Treatments included no supplemental fat (control), or the equivalent of 1 kg/d of mostly saturated or more unsaturated fatty acids. DMI, milk yield, milk fat percentage and milk protein percentage were similar among treatments and averaged 23.8 kg/d, 32.5 kg/d, 3.47%, and 3.23%, respectively. The BW and BCS was similar for all treatments throughout the trial. Concentrations of total cholesterol ($P < 0.01$), HDL ($P < 0.01$), and LDL ($P = 0.02$) were higher for cows fed diets supplemented with UNS compared with either control or SAT. Triglyceride and BUN concentrations were similar among treatments. Concentrations of NEFA were higher ($P = 0.02$) for UNS whereas insulin concentrations were higher ($P = 0.05$) for SAT than either control or UNS. Internal body temperature of cows was measured every 5 min using a vaginal probe. There were no differences among treatments but there was an interaction of treatment and time of day ($P = 0.06$) during wk 4 related to higher body temperatures for cows fed UNS at 0500 through 0530 compared with control and SAT and again at 0930 through 1030 compared with SAT. Respiration rates were similar among treatments during week 4, but were higher ($P = 0.06$) for cows fed UNS during week 8 than control or SAT. These results indicate that supplemental SAT or UNS did not alter intake or performance of late lactation cows that have been through heat stress; however, feeding UNS did increase cholesterol and NEFA concentrations along with lowered insulin and tended to keep body temperature higher than either control or SAT-supplemented diets.

Key Words: supplemental fat, blood metabolites, heat stress

W252 Effects of duodenal infusion of linolenic acid on nutrient digestion, milk production, and milk composition in dairy cows. . Khas-Erdene[1], D. P. Bu[1], J. Q. Wang*[1], Q. S. Liu[1], L. Wang[1], H. Y. Wei[1], L. Y. Zhou[1], and J. K. Drackley[2], [1]*State Key Laboratory of Animal Nutrition, Institute of Animal Science, Chinese Academy of Agricultural Sciences, Beijing, P. R. China*, [2]*Department of Animal Sciences, University of Illinois, Urbana*.

Our objective was to determine the effects of duodenal infusion of a high C18:3 free fatty acid mixture on nutrient digestion, milk production, and milk composition. Four multiparous Chinese Holstein cows (BW = 556 ± 19 kg, DIM = 93 ± 9 d) fitted with duodenal cannulas were administered 2 treatments in a crossover design. Treatments were homogenized aqueous mixtures of α-linolenic acid (LNA; 82.4% *cis*-9, *cis*-12, *cis*-15 18:3; 14.7% *cis*-9, *cis*-12 18:2; 2.8% *cis*-9 18:1) or control containing only the emulsifying ingredients. The control infusate consisted of 15 g/d of xanthan gum, 5 g/d sodium alginate, and 25 g/d of Tween 80 in 10 L of water. Each period lasted 5 wk, during period 1, 2 cows received each amount (0, 40, 80, 120, and 160 g/d) of LNA for 1 wk each, and the other 2 cows received only the carrier infusate. In period 2, the procdures were repeated so that the other 2 cows received the LNA infusate, and the cows that previously received LNA received the control infusate. Measurements were made during the last 3 d of

each infusion amount. Data were analyzed statistically by using PROC MIXED of SAS. Dry matter intake (17.3 kg/d) and total tract apparent digestibilities of DM (63.1%), OM (66.1%), CP (66.9%), and ADF (53.3%) were not affected by LNA infusions. Milk production tended (P = 0.08) to decrease as LNA infusion increased (18.5, 17.2 16.9, 15.9, and 16.3 kg/d for 0, 40, 80, 120, and 160 g/d of LNA, respectively) but production of 4% FCM (17.3 kg/d) was not changed. Milk fat content increased linearly with LNA infusion (4.01, 4.12, 3.96, 4.32, 4.41%). Milk protein content (3.31%) was not changed by LNA infusion, whereas milk lactose content (4.67, 4.60, 4.68, 4.59, 4.57%) and milk lactose yield (0.85, 0.79, 0.79, 0.73, 0.74 kg/d) were lower for LNA vs. control and decreased quadratically as LNA infusion increased. Increasing the amount of LNA supplied to the small intestine of dairy cows had no effect on DMI and nutrient digestibility, but increased milk fat percentage. Infusion of LNA did not affect milk protein or fat yield, but decreased milk lactose content and yield.

Key Words: linolenic acid, nutrient digestion, milk composition

W253 Effects of feeding different rumen-protected fat supplements on the fatty acid composition of milk. A. R. Sewell*, M. L. Eastridge, P. N. Gott, B. Mathew, and D. L. Palmquist, *The Ohio State University, Columbus*.

Specialty fat supplements to target specific functions in dairy cattle, including fatty acid (FA) composition of milk, continues to be of interest. Five lactating Holstein cows (153 ± 74 DIM; 690 kg BW), used in a 5 x 5 Latin square design, were fed: 1) Control with no supplemental fat; 2) 2.5% Veggielac (VEG; Double Pass LLC, Tualatin, OR; canola as a source of 18:1, 35.0% FA); 3) 2.5% Prequel (PRQ; Virtus Nutrition, Corcoran, CA; calcium salt of soybean fatty acids as source of 18:2, 90.2% FA); 4) 2.5% Omegain (OMG; Double Pass LLC, Tualatin, OR; linseed as a source of 18:3, 36.1% FA); and 5) 5.0% OMG. Diets contained 34.8% corn silage, 15.8% alfalfa hay, and 49.4% concentrate. All diets were formulated to contain similar concentrations of CP, nonfiber carbohydrates, and NDF. Cows were milked twice daily, and diets were mixed once daily and fed twice daily for ad libitum intake. Each of the 5 periods were for 2 wk. Dry matter intake and milk yield were recorded daily. Two milk samples were taken for 4 consecutive milkings during wk 2 of each period, one set with preservative for analysis of fat, protein, and urea nitrogen and the other set without a preservative for FA analysis were composited by cow based on milk yield. Due to illnesses unrelated to dietary treatments, 2 cows within different periods were removed from the data anlaysis. Performance and milk composition were similar among treatments: DMI, 24.0 kg/d; milk, 34.4 kg/d; milk fat, 2.89%; milk protein, 3.06%; and MUN, 15.6 mg/dl. Feeding supplemental fat reduced ($P < 0.05$) unsaturated FA in milk, and PRQ resulted in the highest level of unsaturated FA in milk ($P < 0.05$). The PRQ resulted in the highest level of 18:1 *t*-11 (5.73 versus 2.31% of FA). Both the VEG and OMG tended ($P < 0.10$) to increase total 18:1*c* in milk, and compared to PRQ, they increased 18:0 ($P < 0.01$). The PRQ increased ($P < 0.01$) 18:2 *c*-9 *t*-11 (1.53 versus 0.65%) and total 18:2 (7.19 versus 5.30% of FA). The OMG resulted in the highest level of 18:3 n-3 ($P < 0.05$), and the level increased ($P < 0.01$) with level of OMG fed. Feeding these fat supplements altered some of the targeted FA in milk.

Key Words: canola oil, soybean oil, linseed oil

W254 Fatty acids profile of milk fat from cows with different forage and lipids levels in the diet. M. A. Oliveira[1], M. M. Ladeira[2], I. G. Pereira[3], B. N. Faria[1], and R. B. Reis*[1], [1]*Veterinary School, Federal University of Minas Gerais, Brazil*, [2]*Animal Science Department, Federal University of Lavras, Brazil*, [3]*Animal Science Department, Federal University of Jequitinhonha and Mucury Valley, Brazil*.

The objective of this study was to evaluate the effects of forage to concentrate ratio (60:40 or 40:60) and lipids levels (2.8 or 5.5% of dry matter) in the diet on milk yield and fatty acids profile in the milk fat of dairy cows. Eight Holstein cows ranging from 58 to 67 days in milk, averaging 28 ± 4 kg milk/day were distributed in a Latin Square design 4x4, in a 2x2 factorial arrangement. Forage and lipid sources were corn silage and whole extruded soybeans, respectively. The treatments were high forage and low lipids (HFLL), high forage and high lipids (HFHL), low forage and low lipids (LFLL) and low forage and high lipids (LFHL). Main effects of forage, lipid and their interaction were tested by analysis of variance using Proc Mixed (SAS, 1999). The increase of lipids levels in a high and a low forage diets decreased short chain fatty acids concentrations ($C_{4:0}$ to $C_{12:0}$) ($P<0.05$). Conjugated linoleic acid (CLA) content (*Cis*-9 *trans*-11 $C_{18:2}$) increased from 3.72 to 4.85 mg/g milk fat (30.5%, $P<0.01$), when lipid levels were increased in high forage diets. Similarly, the inclusion of lipids in low forage diets increased the CLA in 28%, from 4.60 to 5.89 mg/g milk fat ($P<0.01$). The increasing in dietary lipid levels resulted in higher *Trans*-11 $C_{18:1}$ fatty acid concentration ($P=0.01$). Fatty acid *Trans*-10 $C_{18:1}$ tended to increase with the increasing dietary lipid levels, indicating increased contribution of intermediate fatty acids from rumen biohydrogenation to the mammary glands. The CLA *Trans*-10 *cis* 12 increased for diets with high lipid levels regardless of forage to concentrate ratio. Increasing lipid and decreasing forage levels in the diet increased CLA content of milk fat.

Key Words: conjugated linoleic acid, extruded soybean

W255 Milk fatty acid composition of dairy cows fed whole flaxseed or/and Ca-salts of flaxseed oil. C. Côrtes*[1], D. C. da Silva[1,2], R. Kazama[1,2], N. Gagnon[1], C. Benchaar[1], G. T. d. Santos[2,3], L. M. Zeoula[2,3], and H. V. Petit[1], [1]*Agriculture and Agri-Food Canada, Sherbrooke, QC, Canada*, [2]*Universidade Estadual de Maringa, Parana, Brazil*, [3]*CNPq, Brazil*.

The objective of this study was to examine the effects of dietary whole flaxseed and Ca-salts of flaxseed oil on milk fatty acid (FA) composition. Four primiparous Holstein cows (BW = 602 kg; DIM = 64 d) fitted with ruminal cannulae were used in a 4 x 4 Latin square. Each experimental period consisted of 21 d of adaptation and 7 d of data collection. Cows were milked and fed twice a day. Four total mixed rations were formulated: no flaxseed product (CO), 5% (DM basis) whole flaxseed (WF), 2% Ca-salts of flaxseed oil (CF), and a mixture of 2.5% whole flaxseed and 1% Ca-salts of flaxseed oil (MF). Results were analyzed using the GLM procedure of SAS. Tukey-Kramer multiple-comparison test was applied to separate means. Significance was declared at $P < 0.05$. Feeding flax products led to the lowest 16:0 concentration (% of total FA). Cows fed CF had higher concentrations of *trans*9-18:1, *trans*11-18:1 and *cis*6-18:1 than those fed CO and WF. Feeding flax products increased *cis*9-18:1 concentration. Concentration of *cistrans*11-18:2 was higher for CF than for WF and concentration of *cis*9,12,15-18:3 was higher for CF and MF than for CO. In general, feeding CF resulted in the highest concentrations of *cis*9,*trans*11-18:2, *cis*9,12,15-18:3, and long-chain FA in milk fat and n-3 FA concentration tended to increase. Supplementation with flaxseed products, mainly Ca-salts, decreased the n-6 to n-3 ratio in milk fat, which may improve the nutritive value of milk fat.

Table 1. Fatty acids concentrations (% of total FA)

	CO	WF	CF	MF	SE	P-value
16:0	32.1[a]	29.0[b]	26.4[b]	27.4[b]	0.43	0.01
*trans*9-18:1	0.28[b]	0.33[b]	0.41[a]	0.37[a]	0.01	0.01
*trans*11-18:1	0.91[b]	0.94[b]	1.65[a]	1.26[ab]	0.08	0.02
*cis*6-18:1	0.73[d]	1.08[c]	1.98[a]	1.44[b]	0.04	0.001
*cis*9-18:1	14.8[b]	16.7[a]	17.6[a]	16.7[a]	0.14	0.003
*cis*9,*trans*11-18:2	0.43[ab]	0.42[b]	0.67[a]	0.53[ab]	0.04	0.05
*cis*9,12,15-18:3	0.59[b]	0.84[ab]	1.03[a]	0.95[a]	0.05	0.02
Long-chain FA	31.9[c]	36.5[b]	41.1[a]	38.4[b]	0.37	0.002
n-3	0.88	1.16	1.39	1.32	0.08	0.07
n-6:n-3	3.48[a]	2.61[b]	2.19[b]	2.27[b]	0.10	0.01

Key Words: dairy cows, flaxseed, milk fatty acids

W256 The effect of nonstructural carbohydrate and addition of full fat roasted canola seed on milk fatty acid composition in lactating cows. M. Sari, A. A. Naserian*, and R. Valizadeh, *Ferdowsi Universuty of Mashhad, Mashhad, Iran*.

The objective of this study was to examine the effects of modifying the dietary profile of neutral detergent-soluble carbohydrate (NDSC), addition of full fat roasted canola seed (RCS) as a source of polyunsaturated fatty acid, and possible interactions on milk fatty acid composition in lactating cows. Twelve lactating Holstein cows (BW=596±29 kg, DIM=85±14) were used in a 4×4 Latin squares design. Treatments were in a 2×2 factorial arrangement, and periods were 21 d. The first 15 d were used for diet adaptation. The cows were fed individually four experimental diets as TMR ad libitum. The diets, which contain 15% barley (S), 10% dry citrus pulp (NDSF), with or without addition of 6% ground RCS, were formulated to meet NRC (2001) recommendations. Diets contained 17.5% CP, constant forage to concentrate ratio (45:55). Cows were milked three times a day and samples were collected at each milking over the last three d of each treatment period. Pooled milk samples were analyzed for milk fatty acid composition. Data were analyzed using the GLM procedure of SAS (2001). The inclusion of RCS reduced proportion of short- and medium chain fatty acids in milk fat (C10:0-C17:0, (P<0.01)). Partial replacement of barley with citrus pulp significantly increased C10:0 and decreased C14:1 cis-9, C15:0, and C17:0 (P<0.05). Interaction (P<0.05) between NDSC profile and RCS were detected for trans-11 C18:1, with increase in trans-11 C18:1 for cows consumed NDSF+RCS (P<0.05). The CLA content increased by 30.1% in milk fat of cows fed the S+RCS diet and by 33.3% in milk fat of cows fed the NDSF+RCS diet (P<0.05). Milk fat contents of cis-9, cis-12 C18:2, C18:3 n3, and C20:0 were increased by RCS addition (P<0.01), but were not affected by NDSC profile. Results of this study showed that there were only minor differences in fatty acid composition of milk fat related to NDSC profile. Adding RCS to dairy cow diets can improve the nutritive value of milk fat.

Key Words: milk fatty acids, nonstructural carbohydrates, roasted canola seed

W257 Effect of coconut oil and lauric acid on ruminal protozoa and milk production and composition in dairy cows. A. Faciola*[1] and G. Broderick[2], [1]*University of Wisconsin, Madison*, [2]*U. S. Dairy Forage Research Center, Madison, WI.*

Ruminal protozoa (RP) are major contributors to bacterial protein turnover in the rumen; therefore, reducing RP may improve N utilization. In our previous studies, lauric acid (LA), a 12 carbon saturated fatty acid, found in fats such as coconut oil (CO), sharply decreased RP. However, despite reducing RP, LA has also consistently reduced DMI and milk yield. In this trial, we tested CO as a practical defaunating agent and assessed the effects of partial defaunation on N utilization, fermentation patterns, nutrient digestibility, milk production and composition. Thirty Holstein cows (6 fitted with ruminal cannulae) were blocked by DIM into 10 blocks of three cows and randomly assigned within blocks to 3 dietary treatments in a 3 X 3 replicated Latin square with 21 days of adaptation and 7 days of sampling. The basal diet contained (DM basis) 50% alfalfa silage, 10% corn silage, 17% high-moisture corn, 5% soybean meal, 10% dry molasses, 4% ground corn, vitamin and mineral premix, 16% CP and 29% NDF. Diets A and C provided the same amount of fat: A) 3% Megalac and C) 3% CO. Diets B and C provided the same amount of LA (287g/d). Data were analyzed using proc mixed in SAS. Results are reported in the table. DMI was similar among treatments; however, both CO and LA were effective in reducing RP. LA reduced yields of milk, 3.5% FCM, and milk components and CO reduced MUN.

Table 1.

Item	Megalac	LA	CO	SEM	P>F
DMI, kg/d	22.5	22.2	22.9	0.6	0.18
Milk yield, kg/d	35.6[a]	34.1[b]	35.9[a]	1.7	<0.01
Fat, %	4.19	3.95	4.05	0.14	0.21
Fat yield, kg/d	1.49[a]	1.32[b]	1.42[a]	0.06	<0.01
Protein, %	2.98	3.03	3.01	0.07	0.32
Protein yield, kg/d	1.06[a]	1.00[b]	1.04[ab]	0.03	0.03
Lactose, %	4.93[a]	4.82[b]	4.77b	0.05	<0.01
Lactose yield, kg/d	1.76[a]	1.61[b]	1.68[b]	0.07	<0.01
SNF yield, kg/d	3.15[a]	2.92[c]	3.05[b]	0.11	<0.01
MUN, mg/dL	11.3[a]	11.1[a]	10.4[b]	0.4	<0.01
Protozoa, x 106 cells/ml	5.71[a]	3.45[b]	3.29[b]	0.21	<0.01

[a,b,c]LSM with different superscriptions differ (P<0.05)

Key Words: coconut oil, protozoa, dairy cows

W258 Evaluation of camelina meal as a protein and omega-3 source for lactating dairy cattle. B. Hatch*, K. Boydston, P. Rezamand, and M. A. McGuire, *University of Idaho, Moscow*.

Camelina (*camelina sativa*) is a dry land winter oil crop and its meal is similar in nutrient content to canola meal with a greater concentration of alpha-linolenic (41.3%). In order to identify the optimum feeding rate of camelina meal, lactating primiparous cattle (*n*=18) were randomly assigned to a treatment sequence in a 4x4 Latin square design. The four diets were designed for inclusion of camelina meal in place of canola at 0, 3, 6, and 9% diet DM. Animals were fed individually using Calan gates with intakes recorded daily. Each period lasted 16 d with milk production measured during the final 2 d of each period. Data were analyzed using the MIXED procedure in SAS. Milk yield was unaffected by inclusion of camelina meal (27.8, 28.5, 27.7, and 27.1 ± 1.7 kg/d for the 0, 3, 6, and 9% diets, respectively). Dry matter intake (19.7, 18.9, 19.2, and 17.9 ± 0.8 kg/d for the 0, 3, 6, and 9% diets, respectively) was reduced for cows fed 9% camelina meal compared with cows fed diets containing up to 6% camelina meal. There was a linear reduction (P <0.05) in milk fat concentration from 0 to 9% diets; however, significance (P <0.05) was only detected when cows were fed a diet containing 9% camelina meal (3.01% milk fat) as compared with the 0% diet (3.51% milk fat). Neither milk protein concentration (2.92, 2.91, 2.94, and 2.95 ± 0.08%

for the 0, 3, 6, and 9% diets, respectively) nor protein yield (0.81, 0.83, 0.81, and 0.79 ± 0.52 kg/d for the 0, 3, 6, and 9% diets, respectively) was affected by feeding camelina meal. Milk concentrations of alpha-linolenic acid was linearly enhanced as the feeding rate of camelina increased from 0 to 9% (0.45, 0.51, 0.68, 0.81 ± 0.04% of total lipid for 0, 3, 6, and 9% diets, respectively; P <0.001). Overall, inclusion of camelina meal up to 6% of diet DM supported production of milk and milk components similar to canola meal.

Key Words: camelina, milk fat, dairy cattle

W259 Assessment of whole Nutrasaff safflower seed as a fat supplement to lactating Holstein dairy cows. C. M. Dschaak*[1], J.-S. Eun[1], A. J. Young[1], and J. W. Bergman[2], [1]*Utah State University*, *Logan*, [2]*Safflower Technologies International*, *Sidney, MT*.

A lactating dairy trial was conducted to determine lactational performance of dairy cows and their milk fat production when fed whole Nutrasaff safflower seed (NSS; Safflower Technologies International, Sidney, MT) at varying levels. The NSS is a new variety of safflower seed containing high fat and low fiber. Fifteen Holstein dairy cows in midlactation (DIM = 118 ± 39) were assigned randomly to 3 balanced 5 × 5 Latin squares. Each period lasted 21 d with 14 d of treatment adaptation and 7 d of data collection. The animals were fed diets containing approximately 56% forage (69% alfalfa hay and 31% corn silage) and 44% concentrate mix supplemented with 0 (control), 1, 2, 3, or 4% whole NSS. Data were analyzed using the MIXED procedure of SAS. Intake of DM did not differ due to NSS inclusion. Digestibility of DM (P = 0.12) tended to increase when NSS was supplemented at 1, 2, or 3%, whereas N and fiber digestibilities were not affected. Milk yield was similar among treatments (average 33.7 kg/d). Milk fat percentage decreased with increasing NSS inclusion, while milk protein and lactose concentrations did not differ among treatments. Milk fat concentration was greatly affected when NSS was included at 4% with an 11% reduction. Feeding NSS at 1, 2, or 3% resulted in a similar milk fat concentration, and these diets also had similar milk fat percentage compared with the control diet. Milk urea N concentration decreased by NSS inclusion regardless of level of NSS inclusion, implying that NSS supplementation improved dietary N use for milk production. *Cis*-9, *trans*-11 conjugated linoleic acid (CLA) linearly increased as the NSS inclusion increased. This study clearly demonstrated that supplementing NSS in dairy diets can be a promising means of fat supplementation to lactating dairy cows without negative impact on lactational performance if added at maximum of 3% dietary DM. The increased *cis*-9, *trans*-11 CLA concentration by the addition of NSS can enhance milk quality because of its potentially beneficial health effects.

Key Words: Nutrasaff safflower seed, milk fatty acids, lactating dairy cows

W260 Effects of protected fat supplements on total tract digestion and plasma metabolites of early lactation Holstein cows. M. Ganjkhanlou*[1], K. Reza Yazdi[1], G. R. Ghorbani[2], M. Dehghan Banadaky[1], H. Morraveg[1], W. Z. Yang[3], and A. Zali[1], [1]*University of Tehran*, *Karaj-Tehran, Iran*, [2]*Isfahan University of Technology*, *Isfahan, Iran*, [3]*Lethbridge Research Centre*, *Lethbridge, AB, Canada*.

This study was conducted to evaluate the digestibilities of commercial fat supplements in early lactation cows. Twelve (nine multiparous and three primiparous) Holstein cows (26 ± 4 day in milk) were used in a replicated 3 × 3 Latin square design with 21-d experimental period and three treatments: control (no fat supplementation), and supplemented with 30 g/kg prilled protected fat (Energizer-10) or 35 g/kg Ca salt of protected fat (Magnapac). Cows were fed ad libitum a total mixed ration consisting of 200 g/kg corn silage, 200 g/kg alfalfa hay and 600 g/kg concentrate mix. Each period had 14 days of adaptation and 7 days for sampling. Ether extract digestibility was increased by 7% and 8% with supplementation of rumen protected fat in multiparous and primiparous cows respectively, but total tract digestibilities of DM, OM, CP, NFC, ADF, or NDF(66%, 69%, 68%, 86%, 50%, 55%; 63%, 68%, 72%, 86%, 42%, 53% respectively for multiparous and primriparous) were not affected (p>0.05) by fat supplements in all cows. Mean apparent digestibility of fat were not influenced by source of fat supplemented and the TMR containing Ca salt of protected fat had similar digestibility of fat than did TMR containing prilled fat. Plasma urea; glucose; triglyceride; LDL and plasma HDL were unaffected by supplemental fat (P > 0.05). Total cholesterol and NEFA in plasma was greater (p<0.05) in cows fed inert fat than in cows fed the control diet in multiparous and primiparous cows (256.71, 258.79 vs 220.56 mg/dl and 267.32 ,268.33 vs 249.33 mg/dl and 0.47, 0.48 vs 0.45 mmol/l and 0.40, 0.44 vs 0.36 mmol/l respectively). These results indicate that supplementation of early lactating diet with rumen protected fat increased ether extract digestibility but without altering digestibilities of DM; OM; CP; NFC; ADF; or NDF.

Key Words: rumen protected fat, inert fat, digestibility

W261 Effect of lipids source and supplementation frequency on ingestive behavior of beef heifers grazing tropical grass. M. Cristina Araújo Santana[1], T. Teresinha Berchielli[1], R. Andrade Reis[1], A. Vaz Pires[2], G. Fiorentini[1], P. Henrique de Moura Dian[1], J. Cesar Martinez*[1], and M. Antonio Alvares Balsalobre[3], [1]*São Paulo State University*, *Jaboticabal,São Paulo, Brazil*, [2]*São Paulo University*, *Piracicaba, São Paulo, Brazil*, [3]*Bellman*, *Mirassol, São Paulo, Brazil*.

The objective of this trial was to evaluate the effect of different sources of lipids and frequency of supplementation of beef heifers grazing palisade grass (*Brachiaria brizantha* cv. Marandu) pasture. Twelve heifers, 270 kg average initial body weight (BW) were distributed in six palisade grass paddocks of two hectares each. The sources of lipids were soybean oil, soybean seed or Megalac-E. Supplementation (0.75% of BW) was offered at 8:00 am daily or on 3 alternate days of each week (Monday, Wednesday and Friday). Heifers were submitted to visual observation for ingestive behavior evaluation every 15 minutes from 8:00 AM to 5:00 PM (total time). The times expended in grazing, in the consumption of the supplements, drinking water, standing and lying were determined. The experiment was analyzed using Mixed Procedure of SAS (2000). There was no effect of source, supplementation frequency and interaction between source and frequency (P > 0.05). Treatments did not affect (P > 0.05) the time expended in grazing, consumption of the supplements, remaining lying or standing, drinking water or other activities (Table 1). It was concluded that lipid source and supplementation frequency did not affect the ingestive behavior of heifers grazing palisade grass pasture, suggesting producers should consider using the less expensive lipid source delivered on alternate days.

Table 1. Ingestive behavior (% of the Total Time) of heifers supplied with different sources of lipids and frequency

		Source				
		MEG[1]	SO[2]	SS[3]	Mean[4]	Pr(t)
Daily	Grazing	43.5	51.7	55.1	50.1	0.1
	E. suppl.	3.9	4.8	6.7	5.2	0.9
	Stand	18.4	15.7	13.0	15.7	0.2
	Lay down	20.6	17.8	16.8	18.4	0.3
	D. water	2.6	2.3	2.6	2.5	0.6
3x/Week	Grazing	53.6	44.	48.9	49.0	0.1
	E. suppl.	3.4	3.2	6.5	4.4	0.9
	Stand	13.8	19.4	18.8	17.3	0.2
	Lay down	16.2	25.0	20.5	20.5	0.3
	D. water	2.7	1.9	1.0	1.9	0.6

[1] Megalac-E; [2, 3] Soybean oil and seeds; [4] Mean;

Key Words: tropical pastures, beef cattle, energy supplementation

W262 Degree of dietary fatty acid saturation affects plasma glucose kinetics in growing beef steers. S. E. Cartiff*, V. Fellner, and J. H. Eisemann, *North Carolina State University*, *Raleigh*.

The objective was to determine the effect of type of fatty acid on insulin sensitivity in growing steers. Steers (n=12, initial BW=336.3 kg, SEM=7.7) were adapted to a basal diet that was 70% concentrate mix and 30% orchardgrass hay and contained 13.1% CP and 2.7 Mcal ME/kg DM. Steers were fed a daily amount of 0.26 Mcal ME per kg $BW^{.75}$. The basal diet contained no added fat. After 3 wks steers were transitioned to one of 2 treatment (Trt) diets (n=6 per diet) containing added Ca salts of fatty acids (FA; Virtus Nutrition) at 4% of DM using a source of fat that was enriched in omega-3 fatty acids (StrataG) or a source of fat without omega-3 fatty acids and a greater percentage of C16:0 and C18:1 (EnergII). Three i.v. glucose tolerance tests (IVGTT; 0.9 g glucose/kg $BW^{.75}$) were conducted; one while on the basal diet, and two while on treatment diets at time 1(T1; d3 Trt), and time 2(T2; d38 Trt). Three i.v. insulin tolerance tests (IVITT; 0.45 IU insulin/kg $BW^{.75}$) were conducted the day after each IVGTT. Blood samples were taken at 30, 15, and 5 min before and 2.5, 5, 10, 15, 20, 30, 40, 50, 60, 75, 90, 120, and 150 min after infusion. Variables were analyzed for effect of time, diet, and diet*time. Measurements of glucose kinetics on the basal diet were used as covariates. For IVGTT, peak glucose tended to be greater (p=0.06) at T2 (12.4mM) than TI (12.0mM). There was a diet by time interaction (p<0.05) for area under the response curve (AUC). The AUC (mM glucose*50min) at T1 was less (p=0.02) for EnergII (126.2) than StrataG (151.8), AUC at T2 tended to be greater (p=0.07) for EnergII (165.9) than StrataG (146.0). For IVITT, minimum glucose value was less (p=0.02) on StrataG (1.5mM) than EnergII (1.8mM); AUC (mM glucose*150min) was less (P=0.001) for EnergII (203.1) than StrataG (263.6). Results show that the amount of time steers were on diets affected glucose kinetics, and response to insulin was greater in steers supplemented with omega-3 FA compared to more saturated FA.

Key Words: fatty acid, insulin sensitivity

W263 Seminal characteristics in beef bulls supplemented with rumen bypass fat. H. O. Patino*[1], M. M. H. Ramirez[3], J. C. C. Angel[1], K. C. Swanson[2], and R. M. Gregory[3], [1]*Dep. Zootecnia, UFRGS*, *Porto Alegre, RS, Brazil*, [2]*Dept. Animal and Poultry Science, University of Guelph*, *Guelph, ON, Canada*, [3]*Faculdade Veterinaria, UFRGS*, *Porto Alegre, RS, Brazil*.

Twenty Hereford, Angus, Brangus and Braford mature bulls (950 kg average body weight) were used in a completely randomized design to evaluate the effect of bypass fat supplementation on fresh semen characteristics. Bulls were fed diets with similar levels of crude protein and metabolizable energy consisting of green forage and concentrate supplemented with rumen bypass fat (BF) or energy supplement (ES). For 75 days bulls in the BF treatment received Megalac-E® (200 g/day) and bulls in the ES treatment received Cassava meal (750 g/day). Bulls were naturally stimulated by androgenic cows and semen samples were collected with an artificial vagina every 15 days. There were no differences due to treatment on seminal volume (6.38 ml/ejaculate), concentration (983,000/ml) and mass motility of spermatozoa (3.6 ; p>0.05). Semen of bulls supplemented with rumen bypass fat had a 10% increase in individual motility (83.2 vs 75.8%) and a 11% increase in vigor (3.62 vs 3.26) in relationship to semen of bulls supplemented with cassava meal (p<0.05). Energy supplementation in the form of rumen bypass fat resulted in greater individual motility and vigor of spermatozoa in semen from bulls.

Key Words: bypass fat, semen, cassava meal

Ruminant Nutrition: Metabolism

W264 Malate and fumarate enhanced CLA production and reduced methane emission by rumen microbes when incubated with linoleic acid. G. L. Jin*[1], X. Z. Li[2], C. G. Yan[2], R. J. Long[3], and M. K. Song[1], [1]*Department of Animal Science, Chungbuk National University*, *Cheong-ju, Chungbuk, Korea*, [2]*Animal Science department of Agricultrue college, Yanbian University*, *Yanji, Jilin, China*, [3]*International Centre for Tibetan Plateau Ecosystem Management, Lanzhou University*, *Lanzhou, Gansu, China*.

An in vitro study was conducted to investigate the effect of malate or fumarate on production of conjugated linoleic acid (CLA) and methane (CH4) by rumen microbes when incubated with linoleic acid (C18:2). Sixty mg of C18:2 (LA), or C18:2 (60mg) with 24mM malic acid (M-LA) or C18:2 (60mg) with 24mM fumaric acid (F-LA) was added to the 150mL culture solution consisting of 75 ml rumen fluid and 75ml artificial saliva. Culture solution was also prepared without any supplements (Control). Two grams of feed (70% concentrate and 30% ground alfalfa hay, DM) were added to the culture solution. The incubation was made anaerobically in a shaking incubator up to 12 hours at 39 C. Malate (M-LA) or fumarate (F-LA) increased pH (P<0.0001) and total VFA (P<0.032) in culture solution from 3h compared to other treatments. The F-LA increased proportion of C3 from 3h incubation (P<0.001-0.0015) compared to other treatments while M-LA increased (P<0.001) its proportion at 6h and 12h incubation times compared to control and LA. Increased (P<0.0007) total gas production was observed from M-LA or F-LA at 12h but was not influenced by LA. Total CH4 production for 12h incubation was greatly reduced (P<0.0001) by all the supplements and its production from M-LA or F-LA was smaller than that from LA. Malate or fumarate with C18:2 also increased concentrations of c9,t11-CLA (P<0.039 - 0.001) and t10,c12-CLA at 1h (P<0.013), 3h (P<0.036) and 12h (P<0.025) incubation times compared to LA. It