pooled, there was a negative correlation between gestation length and breeding date (r= -0.628; P<0.001; n=39). Neither birth weight (P=0.794; $t_{df=31}$=0.264) nor gestation length (P=0.239; $t_{df=36}$=1.198) differed between male and female calves and there was no significant correlation between pooled birth weight and gestation length (r=0.323; P=0.067; n=33). Dam body weight at conception was positively correlated with gestation length (r=0.466; P=0.016; n=26). While sample size in the historical data set is small, the negative relationship between conception date and gestation length coupled with the poor association between gestation length and both calf gender and birth weight is intriguing. The idea that gestation length may vary in response to social and environmental cues has been suggested in other species, although hard evidence and a mechanistic explanation are lacking. To address the phenomenon of a negative relationship between conception date and gestation length, a controlled study was initiated during the 2005 breeding season that included early and late season breeding to synchronized estrus in reindeer cows. These cows will calve in April/May, 2006.

Key Words: Reindeer, Gestation length

M163 The diversity of bacterial community in the gut differs between different hatches of broiler chicks. G. W. Tannock[1], S. Musa[1], K. Munro[1], and V. Ravindran*[2], [1]*University of Otago*, *Dunedin, New Zealand*, [2]*Monogastric Research Centre, Massey University*, *Palmerston North, New Zealand*.

The aim of the experiment was to determine whether the gut microbiota of chicks entering a broiler shed was consistent in composition between different hatches. A variable degree of contamination of the chick gut at hatching might influence the subsequent development of gut microbiota in the broiler and disease resistance. Male, day-old chicks (Ross) were obtained at monthly intervals from six different hatches from the same commercial hatchery. Upon arrival at the farm, the chicks were placed in the same broiler facility and fed the same standard commercial diet (without antibiotics). Twenty four hrs after the introduction into the facility, the chicks were killed by cervical dislocation and, digesta samples were collected from the crop, ileum and cecum of 10 chicks. Denaturing gradient gel electrophoresis (DGGE) of DNA fragments obtained by polymerase chain reaction (PCR) amplification was used to define the microflora profile. Bacterial DNA was extracted from each sample and the V2-V3 regions of the 16S ribosomal RNA gene were amplified by PCR using bacterial primers HDA1-GC and HDA2. The 16S rDNA fragments in the PCR products were separated by DGGE to generate a profile of the bacterial community in the gut samples. DNA fragments of interest were cut from the DGGE gel and sequenced to permit bacterial identification. There was hatch-to-hatch variation in the crop, ileal, and cecal microbiota profiles. One fragment was observed to be common to most chicks in all hatches. The bacterial community was dominated by *Lactobacillus* species, but distinctive ileal and cecal profiles were obtained for each hatch. These data show that the microbiota of broiler chicks entering sheds will be different for each production cycle.

Key Words: Gut microbiota, Polymerase chain reaction, Broiler

Ruminant Nutrition: Fat Feeding, Metabolism, and Composition

M164 Influence of short-term feed restriction on milk production traits of Sarda dairy ewes. G. Pulina*, A. Mazzette, G. Battacone, and A. Nudda, *Dipartimento di Scienze Zootecniche, University of Sassari*, *Sassari, Italy*.

The effects of short-term feed restriction on milk yield and milk composition of Sarda dairy ewes were studied in a 17–d experiment. Twenty sheep were housed in individual pens and divided in two isoproductive groups. Ten ewes (feed restricted group, FRG) were fed a total mixed ration pelleted diet (TMR–PD) *ad libitum* (average intake of 2.5 kg/head per day) for 7 days (preliminary period), followed by 3 days of feed restriction of 50% of their previous intake (1.25 kg/head per day of TMR–PD) and 7 days of recovery. The other ten ewes (control, C group) were fed TMR–PD *ad libitum* during all the experimental period (average intake of 2.5 kg/head per day). There were no differences in milk yield between the two groups during the preliminary period (1485 and 1493 g/d for FRG and C group, respectively). Milk yield for the FRG decreased during the feed restriction period and averaged 72% of the values of the C group (1009 vs 1389 g/d, P≤0.001). Milk yield of the FRG was not completely restored during the 7–d recovery period, remaining lower than that of the C group (1278 vs 1451 g/d, P=0.12). Fat percentage tended to increase in FRG during the feed restriction period (5.87% vs 5.27%, P=0.08), and remained higher than that of the C group during recovery (6.04% vs 5.20%, P≤0.01). No effects of feed restriction on protein percentage (5.52% vs 5.53% for FRG and C group, respectively) were observed. SCC was lower in the FRG than in the C group during the preliminary period (Ln SSC 4.51 vs 4.71, P=0.06), increased by more than 4 fold during the feed restriction period (Ln SSC 5.34 vs 4.76, P=0.02) and remained higher during the recovery period (Ln SSC 5.4 vs 4.8, P=0.10). Short-term feed restriction caused a permanent drop in milk production and an increase in SCC on dairy ewes.

Funded by the PRIN–MIUR, Intellatte project

Key Words: Feed restriction, Milk, Dairy ewes

M165 Influence of short-term feed restriction on milk fatty acid profile in dairy ewes fed complete pelleted diet. A. Nudda, S. Fancellu, A. Mazzette, G. Battacone, and G. Pulina*, *Università di Sassari*, *Sassari, Italia*.

During feed restriction, changes in metabolism occur and often result in the mobilization of energy from the adipose tissue. The objective of this work was to evaluate changes in the fatty acid (FA) profile of milk fat during short-term feed restriction in dairy ewes. Six ewes (3 at low-body condition score and 3 at high-BCS) were fed a complete pelleted diet (CPD) ad libitum (average intake of 2.5 kg/head per d) for 7 days, followed by 3 days of feed restriction of 50% of their previous intake (feed restriction group, FRG). Other 6 ewes (control, C group), divided into 3 low-BCS and 3 high-BCS sheep, were always fed CPD ad libitum (average intake of 2.5 kg/head per d). The CPD composition was (on a DM basis) 38.3% NDF, 16.0% CP and 4.5% EE (of which 2% of palm oil). The data of the 3-d treatment were analysed by a

mixed model using BCS, group and their interaction as fixed factors and ewe as random factor. Milk fat content was higher in the FRG than in the C group (5.92 vs 4.67%), whereas fat yield was similar between groups. No effects of short-term feed restriction on C4-C14 fatty acids were observed. The FRG showed a lower content of C16:0 (26.46 vs 29.59%; P≤0.05) and cis9,cis12 C18:2 (4.42 vs 5.38%; P≤0.10) and a higher content of cis9 C18:1 (20.81 vs 17.56%; P≤0.05) than the C group. The content of total CLA (1.47 and 1.27 in the FRG and C group, respectively) was not influenced by the feed restriction treatment. The extent of variation in milk fatty acid profile in FRG group (expressed as percentage respect to C group) was influenced by BCS of ewes. The results suggest that feed restriction for a 3–d period is enough to cause changes in the FA profile of milk fat. The different responses observed in animals with high and low BCS was probably due to a different extent of body store mobilization when feed restriction occurred.

Funded by the FISR-MIUR project.

Key Words: Dairy sheep, Milk fatty acid, Feed restriction

M166 Fat stability and preservation of fatty acids with AGRADO® antioxidant in feed ingredients used in ruminant rations. J. Andrews* and M. Vazquez-Anon, *Novus International*, *St. Louis, MO*.

Oxidation can have negative effects on fat quality and animal performance. Nutrients most susceptible to oxidation are fats, fat soluble vitamins, carotenoids. A series of experimental trials were run to evaluate the stability of fats from soybean oil (SO), menhaden fish oil (FO), yellow-grease (YG), a blend of corn oil, yellow grease, and fish oil (BO), and wet distiller grains (WDG) in the presence and absence of AGRADO antioxidant (A). Fats were oxidized in the presence or absence of A by bubbling air through the fat at elevated temperatures and a given time period. Peroxide values, fatty acid profiles, Active Oxygen Method (AOM) and Oil Stability Index (OSI) were used to asses the quality and stability of the fats. All fats tested were readily oxidized under artificial oxidative stress, but were stabilized in the presence of A as indicated by the reduction in the AOM values of 191.5, 346, 288, and 191 meq of peroxides from control for SO, YG, BO, and WDG, respectively (P =0.05). In the presence of A, the OSI values were improved by 7, 14.5, 6, 4.9, and 43 h compared to control for SO, FO, YG, BO, WDG, respectively (P = 0.05). The concentration of linoleic, linolenic in SO, YG, WDG and concentration of EPA and DHA in FO and BO were reduced during artificial oxidation but preserved in the presence of A. Across all sources of fats evaluated in the study, addition of A significantly improved the stability and quality of the fat as reflected by the AOM and OSI values and preservation of essential fatty acids. AGRADO is a trademark of Novus International, Inc. and is registered in the United States and other countries.

Key Words: Oxidized fat, Agrado, Antioxidants

M167 Meta-analysis on the effects of lipid supplementation on methane emissions and milk performance of lactating dairy cows. M. Eugène*, C. Benchaar, J. Chiquette, and D. Massé, *Agriculture and Agri-Food Canada, Dairy and Swine R&D Centre*, *Lennoxville, QC, Canada*.

The objective of this study was to statistically assess the effect of lipid supplementation on methane (CH_4) emissions from lactating dairy cows. For this purpose, a meta-analysis was conducted using 20 trials from 7 scientific papers published between 1972 and 2004. Response variables evaluated were CH_4, DMI, milk yield, milk composition, and milk efficiency (kg of 4% FCM/kg of DMI). Lipid sources examined were oilseeds, either free oils or seeds, and tallow. Data were analyzed with PROC MIXED procedure of SAS to evaluate cow response to lipid supplementation (L) expressed as the difference from the control (C). The linear model included lipid supplementation as a fixed effect and study as a random effect. Responses to L were weighed by the number of animals used to test the response. Significance was declared at $P \leq 0.05$. Lipid supplementation decreased ($P < 0.05$) DMI (kg/d) by 5.6% and increased ($P < 0.05$) milk efficiency by 5.9% compared to C. There was no effect ($P > 0.05$) of L on milk yield (25.17 kg/d), 4% FCM (24.0 kg/d) and milk composition. Emissions of CH_4, expressed in g/d or as percentage of GE intake were lower ($P = 0.01$) for cows fed L compared to cows fed C (315.62 vs. 345.38 g/d and 5.63 vs. 6.17 %GE, respectively). When expressed relatively to milk yield or 4% FCM, CH_4 emissions were lower ($P = 0.01$) with L diets than with C diets (13.4 vs. 14.8 g/kg of milk and 14.0 vs. 15.4 g/kg of 4% FCM, respectively). Results from this study suggest that the addition of lipids to lactating dairy cow diets decreased methane emissions (g/d) by 8.6%. This reduction was mainly a consequence of a decreased DMI.

Key Words: Lipid supplementation, Methane, Lactating cows

M168 Fatty acid composition in milk from Flemish conventional and organic dairy farm management systems. V. Fievez* and B. Vlaeminck, *Laboratory for Animal Nutrition and Animal Product Quality, Ghent University*, *Melle, Belgium*.

The aim of this study was to compare the fatty acid composition (expressed as g/100 g fatty acid methyl esters) of organic certified raw milk and milk produced by conventional systems. Representative samples (n = 12) of both management systems were collected from a Flemish dairy plant in January, February and March (winter samples) and May, June and July 2005 (summer samples). No systematic linseed supplementation was applied in either of the systems. Both in winter (W) and summer (S) samples, significantly higher (P < 0.05) cis-9 trans-11 C18:2 (W: 0.61 vs. 0.41; S: 1.11 vs. 0.90; SEM = 0.038), C18:3 n-3 (W: 0.67 vs. 0.38; S: 0.71 vs. 0.55; SEM = 0.034) and trans-11 C18:1 (W: 1.36 vs. 0.96; S: 2.50 vs. 1.86; SEM = 0.105) proportions were measured in organic milk. Differences between both management systems are related to higher dietary proportions of grass/clover either as silage or grazed in organic management systems. As standard Flemish dairy practise allows grazing during the summer period, differences between both management systems were smaller in summer milk. This confirms results of Italian, German and Dutch research which earlier reported organic dairy products to be enriched in omega-3 and conjugated linoleic acids. Cholesterol-raising medium chain fatty acid proportions (sum of C12:0, C14:0 and C16:0) did not differ significantly between organic and conventional milk (W: 42.3 vs. 44.6; S: 38.2 vs. 38.4; SEM = 0.69). Milk odd and branched chain fatty acid (OBCFA) proportions, which recently gained interest as potential indicators of rumen function and dairy product intake in epidemiological studies as well as for their anticarcinogenic effects on cancer cells, did not differ between both management systems (W: 3.26 vs. 3.32; S: 3.54 vs. 3.30; SEM = 0.056), but consisted of a higher proportion (g/100 g OBCFA) of branched chain fatty acids in conventional summer milk (W: 48.5 vs. 47.9; S: 54.1 vs. 57.1; SEM = 0.55).

Key Words: Dairy, Organic, Fatty acid

M169 Feed a pound of fat strategy to improve productivity of dairy cows. B. F. Richards*[1], T. R. Dhiman[1], D. R. Mertens[2], A. J. Young[1], and L. C. Solorzano[3], [1]*Utah State University*, *Logan*, [2]*US Dairy Forage Research Center*, *Madison, WI*, [3]*Milk Specialties Company*, *Dundee, IL*.

The objective of this study was to determine the influence of increasing the forage in the diet, while maintaining the energy level through supplemental fat, on production, health and reproductive efficiency of dairy cows. Forty-five Holstein cows were blocked according to expected due date and milk yield of previous lactation. Cows within blocks were assigned to 3 treatments and fed a standard diet for the first 15-20 d of lactation. The experiment lasted for 15 wk. During the experiment cows were fed either a diet containing 43% forage (CTL), 56% forage without fat supplement (FR), or 56% forage with fat supplement (1.61% of diet; FRF). Forage and fat supplement were added by replacing corn grain. Calculated energy and metabolizable protein contents of the diets were 1.57, 1.57, and 1.62 Mcal NE_L /kg and 11.7, 11.6, 11.5% of diet DM in the CTL, FR and FRF, respectively. Weekly milk samples from 2 milkings were analyzed for composition. Cows ate 25.3[ab], 26.1[a], and 23.1[b] kg DM/d (DMI; P=0.06) and produced 36.4[b], 39.4[a], and 38.9[a] kg/d of energy corrected milk (ECM) in CTL, FR and FRF, respectively (P=0.01). The DMI as a percent of BW were 3.19[a], 3.11[a], 2.83[b] (P=0.06) in CTL, FR and FRF, respectively. Gross feed efficiencies (ECM/DMI) were 1.52[b], 1.59[ab], and 1.79[a] (P=0.01) for the CTL, FR, and FRF, respectively. Milk fat and protein contents were 3.53, 3.67, 3.71% (P=0.17) and 2.88[a], 2.76[b], and 2.77[b]% (P=0.03) in the CTL, FR and FRF, respectively. Daily fat and protein yields were 1.27[b], 1.44[a], and 1.45[a] kg (P=0.001) and 1.03, 1.08, and 1.06 kg/d (P=0.44) for CTL, FR and FRF, respectively. Cows gained 37.6, 13.6, and 28.6 kg (P=0.13) during the experiment in CTL, FR and FRF, respectively. No noticeable trends were detected in health and reproductive parameters among treatments. Cows fed a diet high in forage with supplemental fat consumed less feed than cows fed high grain diet and produced the same amount of milk. Feeding high forage diets decreased protein content of the milk, however protein yield was not different. Feeding a pound of fat to cows fed high forage diets improved feed utilization efficiency while maintaining milk production.

Key Words: Cow, Forage, Fat

M170 Milk production response to increased fatty acid level in the feed. M. R. Weisbjerg* and L. Wiking, *Danish Institute of Agricultural Sciences*, *Tjele, Denmark*.

Milk production response to increased dietary fatty acid (FA) level was investigated using 16 Danish Holstein cows at two production levels (8 cows 32.2 kg energy corrected milk (ECM)/d, LM; 8 cows 40.0 kg ECM/d, HM) in a Latin square design. LM and HM groups were in average 158 and 74 DIM at experimental onset, respectively. Treatments were four levels of FA in ration dry matter (DM), unsupplemented (17 g FA/kg DM) and three increasing substitutions of barley with Palm Fatty Acid Distillate (PFAD) fat, resulting in 29, 40 and 52 g FA/kg DM, respectively. PFAD fat is free FA, mainly C16 and C18:1. Rations were fed as total mixed rations, 63% of ration DM was grass/clover silage. Milk production and composition were recorded the last 3 days in each of the four 3 week periods. DM intake decreased with increased FA level, resulting in a constant net energy intake. The general linear responses to increased FA level when FA level was increased with 10 g/kg DM (1% of ration DM) were 1.1 kg ECM (P<0.0001), 0.061 kg milk fat (P<0.0001), 0.012 kg milk protein (P=0.09) and 0.052 kg lactose (P=0.0002) per day, and linear responses in milk composition were 0.39 g fat (P=0.07), -0.71 g protein (P<0.0001) and 0.05 g lactose (P=0.3) per kg milk, and in milk fat average globule diameter 0.092 µm (P<0.0001). It was expected that the response in milk production to increased dietary FA would be almost proportional to cows′ actual milk yield, however, the opposite was the case. When responses were analysed separately for the two groups of cows, response in kg ECM from lowest to highest FA level was slightly larger for the medium than for the high yielding group. Statistical analysis with likelihood ratio tests, using random regression in PROC MIXED across all cows, confirmed that the ECM response (regression coefficient) was significantly negatively correlated to the production level of the cows (intercept). A negative correlation was also found for the other milk production and concentration parameters except for milk fat concentration. However, the correlations were only significantly different from zero for kg milk, kg ECM, kg protein, kg lactose and fat concentration.

Key Words: Milk, Fatty acids, Fat globule diameter

M171 Performance of dairy cows fed Ca-salts of saturated and unsaturated fatty acids. T. R. Dhiman*[1], A. Hopkins[1], R. Thompson[1], L. R. Godfrey[1], and N. D. Luchini[2], [1]*Utah State University*, *Logan*, [2]*NutriScience Technologies Company*, *Fairlawn, OH*.

The objective of this study was to determine the optimum combination of Ca-salts of saturated and unsaturated fatty acids in an ideal fat supplement for dairy cows. Twelve mid-lactation Holstein cows were assigned to one of four treatments. Experimental design was 4 x 4 Latin squares with three replicates and four periods. Each period was 3 wk. Measurements were made during the last week in each period. Cows in 4 treatments were fed a diet containing 50% forage and 50% grain including either 2.1% of dietary DM as Ca-salts of palm oil fatty acids (saturated fatty acids) and 0% calcium salts of unsaturated fatty acids (UF0) , 1.4% saturated and 0.7% unsaturated (UF33), 0.7% saturated and 1.4% unsaturated (UF67) or 2.1% unsaturated (UF100). Diets were fed as a total mixed ration. Diets contained 1.65, 1.65, 1.66, and 1.66 NE_L Mcal/kg DM in UF0, UF33, UF67 and UF100, respectively. Diets had similar CP contents. Daily feed intake and milk yield were recorded. Milk samples were collected from 6 consecutive milkings (a.m. and p.m.) during week 3 in each period and analyzed for composition and fatty acid profile. Daily feed DM intake and energy corrected milk yield (ECM) of cows were 24.4, 24.4, 24.4, and 24.7 kg (P=0.97) and 36.8, 37.4, 36.8, and 35.1 kg (P=0.30) in UF0, UF33, UF67 and UF100, respectively. Milk protein, lactose, and urea contents were not different among treatments. Milk fat contents were 3.71[a], 3.83[a], 3.54[ab], and 3.41[b] (P=0.05) in UF0, UF33, UF67 and UF100, respectively. Gross feed efficiencies (ECM/DMI) were 1.50, 1.55, 1.50, and 1.42 (P=0.17) in UF0, UF33, UF67 and UF100, respectively. The proportions of C18:1 trans-11 and C18:2 cis-9, trans-11 were 2.16[b], 2.31[b], 2.94[ab], and 3.67[a] (P=0.001) and 0.64[a], 0.64[b], 0.78[ab], and 0.85[a] % of total fatty acids in UF0, UF33, UF67 and UF100, respectively. The proportions of unsaturated fatty acids were 35.2[b], 36.1b[b], 38.1[a], and 38.6[a] (P=0.03) % of total fatty acids in UF0, UF33, UF67 and UF100, respectively. In the present study the best combination of Ca-salts of saturated and unsaturated fatty acids in a fat supplement was 33:67, respectively for optimum productivity and fatty acid profile of milk from dairy cows.

Key Words: Dairy, Milk, Fat

M172 Influence of method of processing and feeding level of safflower seeds on the performance of dairy cows. L. R. Godfrey and T. R. Dhiman*, *Utah State University*, *Logan*.

Optimum method of processing safflower seeds and level of feeding was determined in 3 experiments. In Expt 1, using the criteria of reduction in seed particle size and ease of grinding without plugging hammer mill it was found that the optimum method of processing safflower seeds was with a 50:50 mixture of corn and safflower seeds using a screen of 0.635 cm size mesh. In Expt 2, 12 cows (99±42 DIM) in a crossover design repeated 3 times over a period of 12 wk were fed a diet containing 48.4% forage and 51.6% grain supplemented with ground safflower seeds either 0% (CTG), 2.1% (SG2), or 4.2% (SG4) of diet. Safflower seeds were added to the diet by replacing linted cottonseed. In Expt 3, another group of 12 cows (85±42 DIM) were fed a diet similar to the Expt 2, except supplemented with extruded safflower seeds either 0% (CTE), 2.1%(SE2), or 4.2% (SE4) of diet. Safflower seeds were extruded dry using 50:50 mix of corn and safflower at 132ºC. Diets had 1.56, 1.58, 1.60, 1.56, 1.58, and 1.60 Mcal NE_L /kg in CTG, SG2, SG4, CTE, SE2, and SE4, respectively. Diets were isonitrogenous. DM intakes of cows were 26.9, 25.7, and 26.8 (P=0.16) 26.95, 27.6, and 27.62 kg/d (P=0.27) in CTG, SG2, SG4, CTE, SE2, and SE4, respectively. Cows produced 38.3, 39.5, and 38.8 (P=0.56) 40.2, 41.2, and 38.7 kg/d (P=0.21) of energy corrected milk (ECM) in CTG, SG2, SG4, CTE, SE2, and SE4, respectively. Milk protein contents and yields were similar among treatments in Expt 2 and 3. Milk fat contents were 3.40[ab], 3.58[a], and 3.15[b] (P=0.006) 3.58[a], 3.71[a], and 3.24[b] % (P=0.04) in CTG, SG2, SG4, CTE, SE2, and SE4, respectively. Daily milk fat yields were 1.33, 1.41, and 1.28 (P=0.21) 1.47, 1.49, and 1.33 kg/d (P=0.11) in CTG, SG2, SG4, CTE, SE2, and SE4, respectively. Gross feed efficiencies (ECM/DMI) were 1.43, 1.55, and 1.45 (P=0.10) 1.48, 1.50, and 1.39 (P=0.16) in CTG, SG2, SG4, CTE, SE2, and SE4, respectively. Ground or dry extruded safflower seeds can be fed to dairy cows up to 2% of diet without negative impact on feed intake, milk yield or milk composition. Feeding processed safflower seeds at 4% of diet will result in decreased milk fat content and maybe fat yield.

Key Words: Cow, Safflower, Milk

M173 Milk production, milk composition, digestion, and feed intake of cows fed different concentrations of whole flaxseed. H. V. Petit*[1] and P. Mir[2], [1]*Agriculture and Agri-Food Canada*, *Lennoxville, QC, Canada*, [2]*Agriculture and Agri-Food Canada*, *Lethbridge, AB, Canada*.

Thirty-two lactating multiparous Holstein cows averaging 622 kg of BW were used from week 25 to 29 of lactation to determine the effects of different concentrations of whole flaxseed in the diet on milk production, milk composition, digestion, and feed intake. Cows within groups were assigned randomly to one of four TMR: a control diet (CON) with no fat supplement or diets containing either 5, 10 or 15 % whole flaxseed (FS) on a DM basis. Feed consumption and milk yield were recorded daily. Milk samples were obtained from each cow for two consecutive milkings on the fifth week of the experiment to determine milk composition. Total collection of feces and urine was carried out on the fifth week of the experiment. Milk production averaged 25.9 kg/d and was similar among treatments. Milk concentrations of protein and lactose, and yields of protein, lactose, and fat were not affected ($P > 0.10$) by diet. Cows fed 10% FS had the highest milk fat concentration (4.71%). Intake of DM averaged 19.2 kg/d and was similar ($P > 0.10$) among treatments. Feeding 10% FS resulted in the highest ($P = 0.06$) DM digestibility and tended to lead to the highest digestibility of ADF and NDF ($P = 0.11$ and 0.12, respectively). Digestion of N was similar ($P > 0.10$) among treatments. Milk concentrations of short- and medium-chain fatty acids (FA) decreased linearly and those of long-chain FA increased linearly with greater concentrations of FS in the diet. Feeding greater concentrations of FS increased linearly milk concentrations of C18:1c9, C18:1t11, C18:2t9,t12, C18:3n3, and total omega 3 FA and decreased linearly the omega 6 to omega 3 FA ratio. Although there is a linear increase in concentrations of many FA important for human health, differences in milk FA composition between cows fed 10 and 15% FS would be of little biological significance. These results suggest that 10% would be the optimal concentration of FS to feed in the diet of mid-lactating dairy cows as it generally leads to better feed digestion, and higher milk fat concentration and milk enrichment in omega 3 and long-chain FA.

Key Words: Dairy, Milk composition, Fatty acids

M174 Effect of flaxseed and flaxseed oil supplementation on milk fatty acid composition in dairy cows fed high- or low- forage diets. C. Benchaar*[1], H. V. Petit[1], T. A. McAllister[2], and P. Y. Chouinard[3], [1]*Agriculture and Agri-Food Canada, Dairy and Swine R&D Centre*, *Lennoxville, QC, Canada*, [2]*Agriculture and Agri-Food Canada*, *Lethbridge, AB, Canada*, [3]*Université Laval*, *Quebec, QC, Canada*.

The objective of this study was to examine the effect of flaxseed (FS) and flaxseed oil (FO) supplementation (10 and 3%, respectively; DM basis) on milk fatty (FA) composition in dairy cows fed high- (H) or low- (L) forage diets (70 and 30%, respectively; DM basis). Four lactating cows (BW=647 kg; DIM=96 d) used in a 4x4 Latin square design were fed: H+FS (HFS), H+FO (HFO), L+FS (LFS), and L+FO (LFO). Orthogonal contrasts were used to test the main effects of forage level (F), flaxseed source (FLA) and their interaction (F x FLA). Significance was declared at $P<0.05$. Contents of C10:0 (3.04 vs. 2.49%), C12:0 (3.55 vs. 2.65%), C14:0 (12.36 vs. 10.53%), C14:1 (1.18 vs. 0.84%), C15:0 (1.38 vs. 1.10%), *cis*-11 C18:1 (1.04 vs. 0.72%), and *cis*-9, *cis*-12 C18:2 (1.83 vs. 1.49%) were higher and those of C4:0 (4.05 vs. 5.18%), C18:0 (11.3 vs. 14.5%), and *cis*-9, *trans*-11, *cis*-15 C18:3 (0.09 vs. 0.06%) were lower in milk of cows fed L than in that of cows fed H diets. Feeding L diets tended ($P=0.07$) to decrease milk content of *cis*-9, *cis*-12, *cis*-15 C18:3 (0.53 vs. 0.67%) as compared to H diets. Cows fed FS produced milk with lower contents of *cis*-11 C18:1 (0.77 vs. 0.99%), *cis*-15 C18:1 (0.37 vs. 0.65%), *trans*-9 C18:1 (0.26 vs. 0.49%), *trans*-11 C18:1 (1.27 vs. 2.91%), *trans*-12 C18:1 (0.69 vs. 1.10%), *cis*-9, *trans*-11 C18:2 (CLA, 1.11 vs. 0.47%), *trans*-11, *cis*-15 C18:2 (0.40 vs. 1.16%), and higher contents of C10:0 (3.03 vs. 2.50%), C12:0 (3.38 vs. 2.83%), C16:0 (25.8 vs. 22.8%), C18:0 (13.5 vs. 12.3%), and *cis*-9, *cis*-12, *cis*-15 C18:3 (0.67 vs. 0.45%) than cows fed FO. Milk fat contents of *trans*-10 C18:1 were 0.53, 0.30, 2.41, and 0.43% for HFO, HFS, LFO, and LFS, respectively (interaction of F x FLA). Feeding L diets modified the pathway of biohydrogenation, leading to the production of more *trans*-10 C18:1 in milk fat and this effect was of greater magnitude when FO was added in the diet as compared to FS. Feeding FS increased milk fat content of *cis*-9, *cis*-12, *cis*-15 C18:3, the major FA present in flaxseed, and decreased the content of *trans* intermediates of ruminal biohydrogenation as compared with FO.

Key Words: Flaxseed/flaxseed oil, Milk fatty acid, Dairy cows

M175 Bovine somatotropin and dietary fat enriched with omega-3 fatty acids in dairy cows: I. Lactation performance. M. Carriquiry*, W. J. Weber, C. R. Dahlen, G. C. Lamb, and B. A. Crooker, *University of Minnesota*, *St. Paul*.

Multiparous cows (n=59) were blocked by expected calving date and previous 305ME and assigned randomly to a 2x2 factorial design to determine effects of bST (POSILAC®) and dietary fat during 280 DIM. Diets (1.98 Mcal NEL_{1x}, 184 g CP, and 185 g ADF per kg DM) included whole, high-oil sunflower seeds (10% of dietary DM, **SS**) or a mixture of Alifet-High Energy® and Alifet-Repro® (3.4 and 1.5% of dietary DM, **AF**) and were provided from calving. Cows received 0 or 500 mg bST (**N**, **Y**) every 10 d from 12 to 70 DIM and at 14 d-intervals thereafter. Blood was collected weekly through 150 DIM. Means from a repeated measures analysis differed when P<0.05. Daily 4%FCM yield was 4.7 kg/d greater after 23 d of bST but was not altered by diet. Peak milk was delayed (54.9 vs 72.0 ± 3.9 DIM) and tended (P=0.07) to increase (48.9 vs 51.1 ± 1.0 kg) with bST. Milk fat, protein, and lactose yields increased with bST but did not differ between diets. Daily DMI did not differ among treatments but BCS was reduced with bST (3.30 vs 3.18 ± 0.06). Energy balance (EB) nadir (-11.2 ± 0.75 Mcal NEL/d) occurred at 15 DIM and did not differ among treatments. There was an interaction of bST and diet on EB as AF decreased the impact of bST on mean EB (2.04^a, -2.75^c, 2.00^a, 0.13^b ± 0.69 Mcal NEL/d for SSN, SSY, AFN, and AFY) and allowed AFY cows to reach positive EB earlier than SSY cows (70 for SSN, AFN, and AFY vs 105 DIM for SSY). Adjusted gross efficiency was greater for bST cows (1.10 vs 1.24 ± 0.02 kg FCM/Mcal NEL intake). Plasma NEFA and glucose were similar among treatments. The postpartum decrease in IGF-I did not differ among treatments but mean IGF-I during lactation was less for SS than AF (98.6 vs 112.2 ± 6.7 ng/mL) and for non-bST than bST (85.7 vs 126.1 ± 6.7 ng/mL) cows. Plasma IGF-I increased by 35 DIM for bST cows. Pre-calving concentrations of IGF-I were reached by 84 DIM for bST and after 168 DIM for non-bST cows. Initiation of bST at 12 DIM in cows fed AF increased FCM yield and plasma IGF-I by 35 DIM without detrimental effects on EB.

Key Words: bST, Omega-3 fatty acids, Lactation

M176 Bovine somatotropin and dietary fat enriched with omega-3 fatty acids in dairy cows: II. Milk fatty acid composition. M. Carriquiry*[1], W. J. Weber[1], C. R. Dahlen[1], G. C. Lamb[1], S. R. Sanders[2], L. H. Baumgard[2], and B. A. Crooker[1], [1]*University of Minnesota*, *St. Paul*, [2]*University of Arizona*, *Tucson*.

Multiparous cows (n=32) were blocked by expected calving date and previous 305ME and assigned randomly to a 2x2 factorial design to determine effects of bST (POSILAC®) and dietary fat on milk fatty acid (FA) composition during the first 140 DIM. Isocaloric diets (1.98 Mcal NEL1x) that included whole, high-oil sunflower seeds (10% of dietary DM, **SS**) or a mixture of Alifet-High Energy® and Alifet-Repro® (3.4 and 1.5% of dietary DM, **AF**) were provided from calving. Alifet-Repro® contained protected omega-3 FA (15.7% 18:3, 1.3% 20:5, and 1.3% 22:6). Cows received 0 or 500 mg bST (**N**,**Y**) every 10 d from 12 to 70 DIM and at 14 d-intervals thereafter. Milk samples from wk 2, 8, and 20 of lactation were analyzed for FA composition. Means from a repeated measures analysis differed when P<0.05. Proportions of *de novo* synthesized FA (200 vs 185 ± 6 mg/g FA) tended to decrease (P=0.06) and preformed FA (533 vs 558 ± 5 mg/g FA) increased in milk with bST. Diet did not modify the proportions of *de novo* or preformed FA but 18:3, 20:5, and 22:6 FA were greater with AF. As lactation progressed, the proportion of *de novo* and mixed origin FA increased, while preformed FA decreased. The saturated to unsaturated FA ratio (S/U) did not differ among treatments and increased as lactation progressed. However, the increase in *de novo* FA, the decrease in preformed FA, and the increase in S/U ratio were detected later in lactation for bST cows (wk 8 vs 20). The omega-6 to omega-3 FA ratio in milk was reduced in cows fed AF (8.80 vs 7.39 ± 0.29) and increased by bST as lactation progressed. The *cis*-9, *trans*-11 CLA tended (P = 0.07) to be reduced by AF and increased between wk 2 and 8 of lactation despite the decrease in *trans*-11 18:1. The 14:1/14:0 ratio increased with wk of lactation. Alifet-Repro® induced an increase in omega-3 FA in milk and bST prolonged the mobilization period in milk FA composition.

Key Words: bST, Omega-3 fatty acids, Milk fat

M177 The abomasal infusion of wheat starch or cottonseed oil with casein on milk yield and compositions in Sannen dairy goats. M. Bashtani*[1], A. A. Naserian[2], and R. Valizadeh[2], [1]*Birjand University*, *Birjand, Southern Khorasan, Iran*, [2]*Mashhad University*, *Mashhad, Khorasan, Iran*.

To determine effects of the abomasal infusion wheat starch or cottonseed oil with casein on milk production and composition of Sannen dairy goats, from three multiparous lactating Sannen dairy goats in mid-lactation were used with mean yield and DIM of 1.6 ± 0.22 and 167 ± 4 days.Goats were fed ad libitum with basal diet include, 40% hay and 60% concentrate. Treatments were abomasal infusion of 1) wheat starch (100 g/d), 2) wheat starch and casein (100 and 50 g/d respectively) and 3) cottonseed oil and casein (45 and 50 g/d respectively). The DMI was not different among treatments. Infusion of starch or cottonseed oil with casein increased milk yield, percentage and yield of total protein, total solids, casein and true protein, but percentage and yield of lactose, NPN, and whey protein were not affected by treatments. Infusion of wheat starch with casein decreased milk fat concentration. Digestibilities of DM, OM, CP, NDF, ADF and EE in total tract were not different among treatments. No effect on ruminal pH, rumen ammonia concentration and glucose, blood urea nitrogen and triglyceride of plasma were observed. In general, it is concluded using of casein with starch and oil in postruminal had positive effect on milk yield and milk protein.

Key Words: Casein, Starch, Cottonseed oil

M178 Effects of adding whole safflower seeds to dairy Lacaune sheep diets on CLA in milk, fatty acids profile and dairy performances. M. A. Bouattour, R. Casals*, E. Albanell, X. Such, and G. Caja, *Universitat Autònoma de Barcelona*, *Bellaterra, Spain*.

A total of 24 Lacaune dairy ewes milked twice daily were used to study the effects of adding whole safflower seeds (WSF) to their concentrate, on dairy performances, milk, fatty acids (FA) profile and CLA. Ewes were allocated to two balanced groups according to number of lactation, BW and daily milk yield, and kept in two separate pens. TMR fed to ewes was a mixture of 55% forage (dehydrated fescue:alfalfa hay; 1:1), and 45% concentrate, to which the WSF was or not added. Dietary treatments were: C (control) and WSF (16.2% in the concentrate). Ether extract in the two experimental concentrates were similar (8.01%) due to the incorporation of calcium soaps of palm oil FA (6.25%) to the control concentrate. The experiment consisted of a two periods crossover design (20d each), during which the TMR was offered ad libitum in the pens (09:00 and 18:00). Addition of WSF decreased (P<0.05) DMI (2.42 vs. 2.34 kg/d), milk yield (1.58 vs. 1.48 L/d), ECM (1.47 vs. 1.34 L/d) and milk conversion rate (0.60 vs. 0.57

L/kg DM), but did not modify milk fat (6.7%), protein (5.3%), casein (4.19%) and TS (17.9%) contents. True protein content was increased (5.16 vs. 5.43%; P<0.0001) and fat (108 vs. 96g) and protein (83 vs. 73) yields were decreased (P<0.05) by WSF, mainly because of the milk yield depression. The WSF treatment increased (P<0.05) ewes BCS (3.11 vs. 3.24) but decreased (P<0.05) blood concentrations of cholesterol (96.2 vs. 84.5 mg/dL) and glucose (51.6 vs. 44.9 mg/dL). Safflower addition increased (P<0.0001) LCFA (35.2 vs. 45.4%) and MUFA (24.4 vs. 27.1%), and decreased MCFA (49.3 vs. 39.9%), but no changes were observed in SCFA (12.7%), PUFA (4.1%), n3 (0.86%) and n6 (3.25%). In contrast, the addition of WSF increased (P<0.01) the concentration of cis 9- trans 11 C18:2 (CLA, 0.62 vs. 0.93%), reduced (P<0.05) the saturated/unsaturated ratio (2.52 vs. 2.12) and the atherogenicity index (2.75 vs. 2.2), which is positive in terms of human health.

Key Words: Safflower, Dairy ewes, CLA

M179 Milk fatty acid composition and dairy performances in Lacaune sheep fed whole linseed and linseed oil with reference to CLA. M. A. Bouattour, R. Casals*, E. Albanell, X. Such, and G. Caja, *Universitat Autónoma de Barcelona*, *Bellaterra, Spain*.

This study was performed to investigate the effects of feeding whole linseed (WLS) or linseed oil (LSO) to dairy ewes on lactational performances, and milk fatty acids profile and CLA content. Thirty Lacaune dairy ewes were blocked in 3 pens of 10 animals, and used in a 3 × 3 Latin square (20 d periods). Ewes were fed a TMR with 55% forage (alfalfa and fescue dehydrated mixture, 1:1) and 45% concentrate. Treatments were: 1) C (control); 2) WLS (8.2% of TMR, DM basis); and, 3) LSO (2.7%). Diets were isonitrogenous (18.5% CP), and had the same level of fat (5.3% EE), being a 6.3% of calcium soap of palm oil included in the control concentrate. Feed intake (C: 2.65; WLS: 2.72; LSO: 2.7 kg DM/d) was increased (P<0.05) by WLS, but milk yield (1.9 L/d), ECM (1.6 L/d) and milk protein (5.23%) and casein (4.1%) contents were unaffected by treatments. In contrast, true protein content (5.2; 5.11; 4.97%) was reduced and milk fat (5.7; 5.85; 6.08%) content and yield (107; 107; 114 g/d) and total solids content (16.3; 16.6;16.9%) where increased (P<0.05) by LSO. Regarding blood metabolites, both linseed treatments increased (P<0.01) triglycerides concentration (12.7; 19.2; 17.6%) but did not affect glucose (53.6 mg/dL), cholesterol (100.6 mg/dL), NEFA (0.11 mmol/L), HDL (1.78 mmol/L) or LDL (0.67 mmol/L) concentrations. Both linseed treatments increased (P<0.01) SCFA and LCFA, but decreased (P<0.0001) MCFA. The cis 9- trans 11 C18:2 (CLA) was only improved by LSO (0.65; 0.6; 1.23%) and no changes were observed in C18:1 (23.4%) and MUFA (24.6%), while PUFA (4.03; 4.68; 4.54) were higher (P<0.05), and saturated FA (70.02; 67.6; 68.8%) and atherogenicity index (2.66; 2.31; 2.35%) lower (P<0.05) in linseed treatments than in control. In conclusion, LSO was more effective than WLS to increase CLA in milk, but both linseed treatments were useful to increase PUFA and reduce atherogenicity index of milk fat.

Key Words: Dairy ewes, Linseed, CLA

M180 The long term effect of supplementing grazing dairy cows diet with fish oil and sunflower oil on milk conjugated linoleic acid. L. Holmes* and A. AbuGhazaleh, *Southern Illinois University*, *Carbondale*.

The objective of this study was to determine the effect of adding fish oil (FO) and sunflower oil (SFO) to grazing dairy cows diet on milk cis-9 trans-11 conjugated linoleic acid (CLA) and other fatty acids commonly found in milk. Fourteen Holstein cows (105 ± 19 DIM) were fed a TMR (50:50) diet for 1 wk then divided into 2 groups (7 cows/treatment) and offered fat supplements for 8 wks while in pasture. Cows in group one were fed a basal diet (7.5 kg DM basis) consisting of corn, soybean meal, molasses, vitamin/mineral premix plus 500 g animal fat (CONT). Cows in the second group were fed the basal diet plus 100 g of FO and 400 g of SFO (FOSFO). Cows were milked twice a day and milk samples were collected weekly throughout the trial. Both groups grazed together on alfalfa-grass mix pasture for ad libitum and fed treatment diets after the morning and afternoon milking. Analysis of variance was conducted using the MIXED procedure of SAS for a completely randomized design with repeated measures. The model contained the effects of covariance, diet, week, and diet × week. Milk production (30.4 and 31.4 kg/d), milk fat percentages (3.7 and 3.6), milk fat yield (1.12 and 1.12 kg/d) and milk protein yield (0.90 and 0.91 kg/d) for diet 1 and 2, respectively, were not affected (P > 0.05) by treatment diets. Compared with CONT, milk protein percentages (3.0 and 2.9) were lower (P < 0.05) with FOSFO diet. The concentrations of cis-9 trans- 11 CLA (0.78 and 1.47 g/100g fatty acid) and vaccenic acid (2.02 and 4.57 g/100g fatty acid) in milk fat were higher (P < 0.05) for cows fed the FOSFO over the 8 wks of oil supplementation. The concentration of cis-9 trans- 11 CLA in milk fat reached maximum (1.0 and 1.64 g/100g fatty acid for diets 1 and 2, respectively) on week 1 with both diets and remained relatively constant thereafter. In conclusion, supplementing grazing cows diet with FO and SFO enhances milk cis-9 trans- 11 CLA content without affecting cows performance and that increase remains relatively constant after the first week of oil supplementation.

Key Words: Grazing, Fish oil, CLA

M181 Effectiveness of linoleic and linolenic acid for enhancing conjugated linoleic acid in milk from dairy cows. B. Dengpan[1], J. Wang*[1], T. R. Dhiman[2], and L. Shijun[1], [1]*Institute of Animal Science, Chinese Academy of Agricultural Sciences*, *Beijing, P.R. China*, [2]*Animal, Dairy and Veterinary Sciences Department, Utah State University*, *Logan, UT*.

Feeding feeds rich in linoleic acid or linolenic acid increases the conjugated linoleic acid (CLA) content of milk from dairy cows. Objective of this study was to determine the comparative effectiveness of linoleic and linolenic acid in enhancing CLA in milk when fed at the same levels to mid lactation dairy cows. Forty dairy cows producing an average of 25 kg of milk and 170 days in milk were randomly assigned to 4 treatments. Cows in four treatments were fed a basal diet containing 59% forage and 41% grain either without oil supplement (CTL), 4% soybean oil (SO), 4% flaxseed oil (FO) or 4% 50:50 mix of soybean and flaxseed oil (SFO) on DM basis. Oils were added by replacing the corn in the diet. Soybean and flaxseed oils contained 43% linoleic and 57% linolenic acid, respectively. Diets were fed as a total mixed ration 3 times a day. Diets had 1.48, 1.64, 1.64, and 1.64 Mcal NE_L/kg DM in CTL, SO, FO, and SFO, respectively. Diets were isonitrogenous and contained an average of 16.1% CP. Experimental duration was 9 wk. Measurements were made during the last 6 wk of the experiment. Data was analyzed using mixed Models procedures of SAS package 9. Cows ate 16.2, 16.2, 15.6, and 15.9 kg/d feed DM (P=0.10) and produced 23.1, 24.6, 24.2, and 24.3 (P=0.77) kg/d of energy corrected milk (ECM) in CTL, SO, FO, and SFO, respectively. Milk fat and protein contents were 3.49, 3.21, 3.26, and 3.30% (P=0.36) 3.15, 3.20, 3.17, and 3.15% (P=0.95) in CTL, SO, FO, and SFO, respectively. Milk fat yields were 0.77, 0.83, 0.81, and 0.82 kg/d

(P=0.19) in CTL, SO, FO, and SFO, respectively. The proportions of C18:1 *trans*-11 (VA) and C18:2 *cis*-9, *trans*-11 CLA isomer were 1.48^c, 6.19^a, 3.04^b, and 4.53^{ab} (P=0.01) 0.64^c, 2.39^a, 1.60^b, and 1.81b^b% of total fatty acid methyl esters in CTL, SO, FO, and SFO, respectively. The proportions of unsaturated fatty acids were 27.9^b, 33.6^a, 36.4^a, and 33.8^a (P=0.001) in CTL, SO, FO and SFO, respectively. Feeding free oil rich in linoleic acid is 100 and 50% more effective in enhancing VA and CLA in milk fat, respectively, than feeding free oil rich in linolenic acid fed at the similar levels in the diet.

Key Words: Milk, Conjugated linoleic acid, Oils

M182 The effect of pH and polyunsaturated C18 fatty acid source on the production of vaccenic acid and conjugated linoleic acids in ruminal cultures incubated with docosahexaenoic acid. A. AbuGhazaleh* and B. Jacobson, *Southern Illinois University*, *Carbondale*.

Previously, combining docosahexaenoic acid (DHA) with linoleic acid in rumen cultures enhanced vaccenic acid (VA) and conjugated linoleic acid (CLA) accumulations. The objective of this experiment was to examine the effect of two pH levels and two polyunsaturated C18 fatty acid sources on VA and CLA accumulations in rumen cultures incubated with DHA. High pH culture treatments consisted of 10 mg DHA plus 20 mg linoleic acid (LOH), or 10 mg DHA plus 20 mg linolenic acid (LNH). Low pH culture treatments consisted of 10 mg DHA plus 20 mg linoleic acid (LOL), or 10 mg DHA plus 20 mg linolenic acid (LNL). Treatments were incubated in triplicate in 125 ml flasks containing 500 mg finely ground TMR, 10 ml strained ruminal fluid, 40 ml media, and 2 ml reducing solution. Ruminal fluid was collected from fermenters fed high forage (pH 6.7) or high grain diets (pH 5.4). A 5-ml sample of culture contents was taken at 0 and 24 h for fatty acid analysis by gas liquid chromatography. After 24 h of incubation, VA was the predominant trans C18:1 FA isomer in the high pH cultures and its concentration was greater (P > 0.05) with LOH (20.9 mg/culture) than with LNH (9.3 mg/culture). Similarly, t10 C18:1 was the predominant trans C18:1 FA isomer in the low pH cultures and its concentration was greater (P > 0.05) with LOL (12.8 mg/culture) than with LNL (4.5 mg/culture). The c9t11 CLA (0.74 mg/culture) and tt CLA (0.67 mg/culture) were the predominant CLA isomers in the LOH cultures, while t10c12 CLA (1.47 mg/culture) and tt CLA (1.27 mg/culture) were the predominant CLA isomers in the LOL cultures. Additions of linolenic acid to cultures caused a dramatic increase (P > 0.05) in the concentration of t11c15 C18:2 (9.84 and 8.45 mg/culture, for treatments LNH and LNL, respectively). The concentrations of VA and c9t11 CLA in rumen cultures were greatest (P > 0.05) when DHA was incubated with linoleic acid at high pH. In contrast, t10 C18:1 replaced VA and c9t11 CLA disappeared when linoleic and linolenic acids were incubated under the low pH condition.

Key Words: DHA, PUFA, Trans FA

M183 The relationship between the concentration in milk of c18:1 t10 and the concentration of total milk fat. P. J. Moate*[1], R. C. Boston[1], I. J. Lean[2], and W. Chalupa[1], [1]*University of Pennsylvania*, *Kennett Square*, [2]*University of Sydney*, *Sydney, NSW, Australia*.

A model is being developed to describe how diet and cow factors influence milk fat concentration and the concentrations of individual long chain fatty acids (LCFA) in milk. Much recent research has focused on C18:1 t10 as a fatty acids that may decrease milk fat content. In this work we collated recent data from 23 published experiments that described a total of 58 diets, did not involve administration of exogenous CLA and which reported the concentrations (g/L) in milk of total milk fat and of C18:1 t10. Unweighted univariate regressions, were performed on these data. For total milk fat concentration, the mean, standard deviation, minimum and maximum values were respectively 33.9, 5.3, 22.2 and 45.7, while for C18:1 t 10, the corresponding values were 0.25, 0.16, 0.01, and 0.82. The total concentration of milk fat was significantly (P<0.01) negatively related to the concentration of C18:1 t10 in milk, but this only accounted for 25% of the total variation in milk fat concentration. [Milkfat] = 40.0±1.1 – 24.8±5.7 * [C18:1 t10] R^2 = 0.25. Most of the milk fat depressive effect of C18:1 t10 was due to a significant (P<0.01) effect on concentrations of de novo milk fatty acids (C4-C14); but only accounted for 19% of the variation in these concentrations. [Total de novo] = 9.9±0.5 – 6.1±1.7 * [C18:1 t10] R^2 = 0 .19. Although TMR fed cows had higher concentrations of C18:1 t10 than did pasture fed cows, these also had lower concentrations of C18:2 t10, c12. Since C18:2 t10, c12 also can depress milk fat concentration this observation may explain why there was no significant difference in total milk fat concentration between TMR and pasture fed cows. In conclusion, factors other than C18:1 t10 must be taken into account to describe the majority of the variation that occurs in the concentration of total milk fat.

Table 1. Influence of TMR and pasture diets on milk fat composition

Parameter	N	TMR Concentration	N	Pasture Concentration	Significance
		(g/L)		(g/L)	
Milk fat	43	33.4 ± 4.9	15	35.4 ± 6.2	P≥0.5
C18:1 t10	43	0.29 ± 0.15	15	0.11 ± 0.05	P≤0.01
C18:2 t10, c12	33	0.007 ± 0.006	9	0.017 ± 0.009	P≤0.03

Key Words: Milk fat, c18:1 t10

M184 The effect of *trans*-10, *cis*-12 CLA on milk fat synthesis and cheese yield in sheep fed at two levels of energy intake. A. L. Lock*[1], R. M. Early[2], D. E. Bauman[1], and L. A. Sinclair[2], [1]*Cornell University*, *Ithaca, NY*, [2]*Harper Adams University College*, *Newport, UK*.

Sheep milk is characterized by a high ratio of fat to protein but for cheese production this is a disadvantage as the excess fat is lost in the whey. *Trans*-10, *cis*-12 conjugated linoleic acid (CLA) is a potent inhibitor of milk fat synthesis in sheep and can result in increased milk and milk protein yield, particularly when energy intake is inadequate. The objectives of this study were to examine the effects of a rumen protected source of CLA at a high and low level of energy intake on milk fat synthesis and cheese yield. Sixteen multiparous ewes (59±9.0 kg) were randomly assigned to one of two restricted energy levels; High (H; 28MJ ME/d) or low (L; 21MJ ME/d), and supplemented with either Megalac (U: Volac, Royston, UK) or lipid-encapsulated CLA (S: BASF AG, Ludwigshafen, Germany) in each of 4 periods of 21 d duration in a Latin square design. Megalac and CLA supplements were fed at 25 g/ewe/d, providing 2.4 g/d of CLA to ewes on treatment S. During the final 5 d of each period milk was collected, yield and composition determined and the milk made into a cheddar type cheese. There was no effect (P > 0.05) of treatment on milk or cheese curd yield (Table 1). Milk fat content and yield were reduced when ewes were supplemented with CLA (P < 0.001) whilst milk protein yield was lower and liveweight gain higher (P < 0.05) when ewes were fed the high vs. low feed level. Supplementation with CLA reduced milk fat content and yield similar to that recorded previously in dairy cows and sheep, but there was no effect on curd yield. Ewes responded to the greater level of energy intake by increasing weight gain rather than milk yield.

Table 1.

	Treatment					Significance	
	HU	HS	LU	LS	SEM	Feed level	Fat source
Milk yield g/d	1188	1225	1204	1244	40.4	0.66	0.35
Fat content, %	6.36	4.87	6.17	4.79	0.093	0.15	<0.001
Fat yield, g/d	75.2	59.1	73.8	59.9	2.12	0.89	<0.001
Protein content, %	4.69	4.52	4.80	4.73	0.049	0.003	0.02
Protein yield, g/d	54.8	55.1	57.2	58.6	1.45	0.05	0.58
Live weight change, kg/d	0.134	0.130	0.034	0.066	0.0215	<0.001	0.52
Green curd yield, kg/kg	0.164	0.156	0.151	0.162	0.0073	0.66	0.85

Key Words: CLA, Sheep, Milk fat

M185 Distrubution of supplemental L-carnitine among tissues and fluids of periparturient dairy cows. D. B. Carlson*[1], N. B. Litherland[1], J. C. Woodworth[2], and J. K. Drackley[1], [1]*University of Illinois*, *Urbana*, [2]*Lonza, Inc.*, *Allendale, NJ*.

Our hypothesis was that supplemental L-carnitine would increase liver carnitine concentration and hepatic fatty acid oxidation. Previously, we have demonstrated that dietary L-carnitine effectively decreased liver lipid accumulation during the periparturient period. Multiparous Holstein cows (n = 56) were supplemented with four amounts of Carniking (50% L-carnitine; Lonza, Inc.), mixed with 227 g ground corn plus 227 g dried molasses, as a topdress from d 14 before expected calving until 21 days in milk. Treatments were: control (CON; 0 g L-carnitine), low (LC; 6 g L-carnitine), medium (MC; 50 g L-carnitine), and high (HC; 100 g L-carnitine). All cows were fed the same basal diet prepartum (21 d before expected calving) and same postpartum diet (calving until d 56). Liver and skeletal muscle were biopsied on d 21 before expected calving and at d 2, 10, and 28. Free, short-chain, and long-chain carnitine esters were quantified using a radioenzymatic procedure and ion exchange chromatography. Orthogonal contrasts were used to compare carnitine treatments vs. CON; LC vs. MC and HC; and MC vs. HC. Carnitine supplementation increased free carnitine and carnitine ester concentration in liver tissue ($P = 0.01$). The MC and HC treatments resulted in higher liver carnitine content than did the LC treatment ($P < 0.01$), although concentrations of free carnitine and carnitine esters did not differ between the MC and HC treatments at any point during the periparturient period ($P > 0.15$). Carnitine supplementation caused greater free carnitine and carnitine ester concentrations in liver on d 2 and 10 after calving compared with the CON treatment, but differences were diminished by d 28 after calving (treatment x time; $P < 0.01$). These results suggest that dietary L-carnitine increased liver carnitine concentration in periparturient cows, which likely contributed to the reduction in liver lipid accumulation around calving by stimulating fatty acid oxidation.

Key Words: L-Carnitine, Liver, Periparturient period

M186 Effect of feeding Ca salts of *trans*-octadecenoic fatty acids and linoleic acid on productive and metabolic responses of dairy cows during the transition period. S. G. Onetti[1], S. J. Bertics[1], N. D. Luchini[2], and R. R. Grummer*[1], [1]*University of Wisconsin*, *Madison*, [2]*Virtus Nutrition*, *Fairlawn, OH*.

Fifty-eight multiparous Holstein cows were used in a completely randomized block design to evaluate the effects of feeding Ca salts of *trans*-octadecenoic fatty acids and linoleic acid on animal performance and lipid metabolism during the transition period. Three weeks before expected calving, cows were fed 1% of the diet dry matter (DM) as Ca salts of palm oil (PFA) or as Ca salts of *trans*-octadecenoic fatty acids and linoleic acid (TFAL). After calving and until d 28 postpartum, half of the cows from each prepartum treatment were assigned to a diet containing PFA or TFAL at 2% of dietary DM. Pre- and postpartum diets differed only in the type of supplemental fatty acids. After d 28 postpartum, all cows were fed the PFA lactation diet until d 42. Fatty acid supplementation had no effect on pre- or postpartum DM intake or milk production. Milk fat % was lower ($P < 0.01$) and milk fat yield tended to be lower ($P < 0.15$) for cows fed TFAL than for cows fed PFA prepartum (3.8 vs. 4.1%, and 1.51 vs. 1.39 kg/d, respectively). Cows fed TFAL postpartum had lower ($P < 0.03$) milk fat test than cows fed PFA (3.8 vs. 4.0%, respectively), but no effect of postpartum treatment was observed for milk fat yield. Prepartum plasma concentration of nonesterified fatty acids (NEFA) tended to be lower ($P < 0.10$) for cows fed TFAL than for cows fed PFA (369 vs. 451 μEq/L, respectively). Cows fed TFAL prepartum tended to have lower ($P < 0.11$) plasma NEFA concentration at d 1 postpartum than cows fed PFA prepartum (792 vs. 989 μEq/L, respectively). Postpartum treatments had no effect on plasma NEFA concentration. No effect of prepartum treatment was observed for liver triglyceride content at d 1 postpartum. Results of this study suggest that feeding Ca salts of *trans*-octadecenoic acids and linoleic acid during late gestation may cause milk fat depression and lower NEFA mobilization at parturition compared to feeding palm oil fatty acids.

Key Words: *Trans*-fatty acid, Transition period, Lipid metabolism

M187 Production, metabolic and reproductive responses of transition Holstein cows fed *trans* fatty acids. C. J. Rodríguez-Sallaberry*, C. Caldari-Torres, E. S. Greene, C. R. Staples, and L. Badinga, *University of Florida*, *Gainesville*.

The objective of this study was to examine the effect of feeding calcium salts of *trans*-octadecenoic fatty acids on performance and metabolic responses of dairy cows during the periparturient period. Eighteen multiparous and 12 primiparous Holstein cows were assigned randomly to be supplemented with a highly saturated fat (RBF, Cargill; n=15) or a Ca salt fat enriched in *trans* $C_{18:1}$ fatty acids (*TRANS*, EnerG TR, Virtus Nutrition; n=15). Dietary treatments started at approximately 28 d prepartum and continued through 21 DIM. The diets were formulated to contain 1.50 and 1.75% of RBF and *TRANS*, respectively, so as to provide isolipid supplementation. Dry matter intake (12.9 ± 0.7 kg/d), body weight (618 ± 16 kg), BCS (3.09 ± 0.05) and milk (32.4 ± 1.4 kg/d) did not differ between dietary treatments. Milk composition at week 3 of lactation (fat = 3.5 ± 0.1%; true protein = 2.76 ± 0.05%; SCC = 90,700 ± 20,000) did not differ between dietary treatments. Plasma NEFA (302.4 ± 37.9 μEq/L), BHBA (3.9 ± 0.4 mg/dL) and glucose (56.4 ± 1.14 mg/dL) concentrations were not different between dietary groups. Compared to cows fed saturated fat, cows given supplemental *trans* fatty acids had higher $PGF_{2\alpha}$ metabolite (PGFM) concentration in plasma during the first week of lactation.

The fatty acid effect on PGFM response was minimal in first-lactation heifers. Dietary treatments had no detectable effects on follicular dynamics during the first 3 weeks of lactation. Results indicate that dietary *trans*-octadecenoic fatty acids may affect reproductive responses in early post-partum dairy cows through alteration of uterine $PGF_{2\alpha}$ production.

Key Words: Production, Reproduction, *Trans* fatty acids

M188 Lactation response of cows to intravenous infusion of conjugated linolenic acids. R. Gervais* and P. Y. Chouinard, *Université Laval, Québec, Québec, Canada*.

It has been previously established that supplementation of *trans*-10, *cis*-12 conjugated linoleic acid reduces milk fat content and fat deposition in a number of species. Recently, a mixture of isomers of conjugated linolenic acid (*cis*-9, *trans*-11, *cis*-13 C18:3 and *cis*-9, *trans*-13, *cis*-15 C18:3) has been shown to affect lipid metabolism in mice (Plourde et al. 2005, 96th AOCS An. Mtg. Exp.). The objective of this study was to evaluate the effects of an intravenous administration of conjugated linolenic acid on milk yield and composition with special emphasis on milk fat content in lactating dairy cows. Three multiparous Holstein dairy cows (DIM = 200 ± 35; BW = 648 ± 56 kg; SD), fitted with indwelling jugular catheter, were randomly assigned to a 3 × 3 Latin square design. For the first 5 d of each 14-d period, cows were infused intravenously with a 15% lipid emulsion providing: LNA) 10 g/d of *cis*-9, *cis*-12, *cis*-15 C18:3 + 1.3 g/d of *cis*-9, *cis*-12 C18:2 as control, CLA) 10 g/d of *cis*-9, *cis*-12, *cis*-15 C18:3 + 1.3 g/d of *trans*-10, *cis*-12 C18:2 as positive control, and CLNA) 10 g/d of an equal mixture of *cis*-9, *trans*-11, *cis*-15 C18:3 and *cis*-9, *trans*-13, *cis*-15 C18:3 + 1.3 g/d of *trans*-10, *cis*-12 C18:2. CLA treatment reduced milk fat concentration by 6% ($P < 0.05$) compared to LNA treatment (4.23 vs. 4.52 ± 0.50%; SEM; $P < 0.05$), whereas CLNA treatment had no effect on milk fat concentration (4.17%; $P > 0.10$) beyond that attribuable to its *trans*-10, *cis*-12 C18:2 content. Milk lactose content was increased ($P < 0.05$) when CLA treatment was infused (4.61 ± 0.11%) compared to LNA treatment (4.51%) and CLNA treatment (4.50%). Milk yield (27.4 ± 2.9 kg/d), milk fat yield (1148 ± 37 g/d), milk protein content (3.69 ± 0.32%) and yield (992 ± 36 g/d), as well as dry matter intake (20.3 ± 0.5 kg/d) were unaffected by treatments ($P > 0.10$). The intravenous infusion of an equal mixture of *cis*-9, *trans*-11, *cis*-15 C18:3 and *cis*-9, *trans*-13, *cis*-15 C18:3 did not affect milk fat concentration and yield suggesting that these isomers of conjugated linolenic acid have no effect on milk fat synthesis in lactating dairy cows.

Key Words: CLNA, CLA, Milk fat

M189 Effect of diets rich in oleic acid (cis or trans), linoleic and linolenic acids on plasma bST, IGF-I, and PGFM of Holstein cows. B. C. do Amaral*, C. R. Staples, L. Badinga, S. A. Sennikov, and W. W. Thatcher, *University of Florida*, *Gainesville*.

The objective was to evaluate how dietary fat sources of oleic, trans-octadecenoic, linoleic, or linolenic acids affected bST, IGF-1, and PGF metabolite (PGFM) concentrations in plasma of Holstein heifers (n = 22) and cows (n = 32) during the summer season. Fat supplements were the following: 1) sunflower oil (SFO; Trisun, Humko Oil, 80% C18:1), 2) Ca salt of trans-octadecenoic acids (TRANS; EnerG TR, Virtus Nutrition, 57% trans 6-12 C18:1), 3) Ca salt of vegetable oils (MEGR; Megalac-R, Church & Dwight Co, 30% C18:2), and 4) linseed oil (LSO- Archer Daniels Midland, 56% C18:3 and 16% C18:2). Supplemental fats were fed at 1.35% of dietary DM beginning at 29 d prior to expected calving date. After calving, fats were fed at 1.5% (oils) and 1.75% (Ca salts) of dietary DM for 15 wk. Blood samples were taken thrice weekly during 7 wk for measurement of IGF-1 and bST and for the first 14 DIM for PGFM. Mean concentrations of plasma IGF-1 tended to be greater (P = 0.08) in heifers compared to cows (135 vs. 124 ng/ml) but did not differ among treatment groups (122, 135, 124, and 137 ng/ml for diets 1, 2, 3, and 4 respectively). Concentrations of IGF-1 increased at a faster rate for animals fed polyunsaturated fats compared to those fed monounsaturated fats. Mean concentrations of bST were not different among treatments. Plasma concentrations of bST decreased from 7.0 to 4.1 ng/ml over DIM for primiparous cows except those fed MEGR, which increased from 7.3 to 8.3 ng/ml. For multiparous cows, bST concentrations also decreased over time but those fed MEGR decreased at a faster rate (treatment by parity by DIM interaction). Cows fed TRANS had a higher initial plasma concentration of PGFM (4065 vs. 2408 ng/ml) and decreased at a faster rate than cows fed SFO but both reached baseline by 9 DIM. The PGFM concentrations of cows fed MEGR decreased at a slower rate compared to cows fed LSO, reaching baseline 2 d later. Dietary fatty acids alter hormonal status of lactating dairy cows.

Key Words: Fat, Hormones, Periparturient cow

M190 Effect of diets enriched in oleic (cis or trans), linoleic or linolenic acids on concentration of blood and liver fatty acids of Holstein cows. B. C. do Amaral*, C. R. Staples, S. C. Kim, L. Badinga, and W. W. Thatcher, *University of Florida*, *Gainesville*.

The objective was to evaluate how dietary fat sources enriched with oleic, trans-octadecenoic, linoleic, or linolenic acids affected the plasma and liver fatty acid profiles of Holstein heifers (n = 22) and cows (n = 32) during the summer season. Fat supplements were the following: 1) sunflower oil (SFO - Trisun, Humko Oil, 80% C18:1), 2) Ca salt of trans-octadecenoic acids (TRANS- EnerG TR, Virtus Nutrition, 57% trans 6-12), 3) Ca salt of vegetable oils (MEGR-Megalac-R, Church & Dwight Co, 30% C18:2), and 4) linseed oil (LSO- Archer Daniels Midland, 56% C18:3 and 16% C18:2). Supplemental fats were fed at 1.35% of dietary DM beginning at 29 d prior to expected calving date. After calving, fats were fed at 1.5% (oils) and 1.75% (Ca salts) of dietary DM for 15 wk. Three blood samples collected on a Monday-Wednesday-Friday schedule between 21 and 28 DIM were analyzed for fatty acids using gas chromatography. Liver samples were taken via biopsy on 2, 14±2, and 28±2 DIM, immediately frozen in liquid nitrogen and kept at -80^0C for fatty acid analysis. Feeding high oleic sunflower oil did not affect the C18:1 concentrations of plasma (12.35%) or liver (21.8%). Cows fed TRANS fats had greater concentrations of plasma C18:1 trans isomers in liver tissue (1.0, 1.4, 1.0, and 1.0% for diets 1, 2, 3, and 4, respectively). Concentrations of C18:2 were greater in cows fed MEGR (44.4%) compared to cows fed LSO (41.8%) but were not different from that of cows fed SFO (43.4%) or TRANS (45.2%). Cis-9, trans-11 CLA was greater in plasma (0.13, 0.13, 0.16, and 0.14%) and liver (0.41, 0.43, 0.50, and 0.47%) of cows fed MEGR compared to those fed SFO or TRANS. Cows fed LSO had greater concentrations of C18:3 (2.4, 2.5, 2.3, and 4.9%; 0.9, 0.9, 1.0, and 1.4%) and C20:5 (0.5, 0.5, 0.5, and 0.7%; 0.6, 0.6, 0.5, and 0.9%) in plasma and liver, respectively. Feeding dietary fats enriched with particular fatty acids resulted in increased concentrations of those fatty acids in the plasma and liver.

Key Words: Fat, Blood, Liver

M191 Effects of abomasal infusion of tallow or linseed oil on responses to glucose and insulin challenges of Holstein cows. J. A. A. Pires*, A. E. Kulick, N. Silva del Rio, and R. R. Grummer, *University of Wisconsin*, *Madison*.

The objective was to test whether abomasal infusion of linseed oil, rich in C18:3, enhances the response to glucose and insulin challenges in Holstein cows when compared to tallow. Eight non-lactating, non-gestating cows were assigned to a cross-over design, fed to meet maintenance requirements and supplemented with abomasal infusions of either linseed oil (L) or tallow (T) at a rate of 0.54 g/kg of BW per d for 5.5 d. This dose is equivalent to a 735-kg cow eating a diet containing 2.7% TG (DM basis) at 2% of BW. Feed and treatments were provided in equal doses every 8 h during the first 3 d of each period, and every 4 h thereafter. Five d after initiation of treatments, glucose tolerance tests (GTT) were performed (0.25g dextrose i.v. bolus/kg BW), followed by insulin challenges (IC; 0.1 IU insulin i.v. bolus/kg BW) 12 h later. Before GTT, plasma glucose concentration was greater for L (66 vs. 63 mg/dl; $P < 0.05$) and there was no difference in serum insulin (29 vs. 28 µIU/ml; $P = 0.81$), nor plasma NEFA (113 vs. 106 µEq/L; $P = 0.41$) for L and T, respectively. There was no difference in glucose clearance parameters after GTT, but insulin concentrations were lower for L during the first 40 minutes after GTT. Accordingly, the insulin response area under the curve to GTT was lower for L than T (9810 vs. 12589 µIU/ml/180 min; $P < 0.01$). NEFA was higher for L during GTT (108 vs. 89 µEq/L; $P < 0.001$), possibly due to the lower insulin response to GTT observed with L. Before IC, glucose was similar between treatments (68 vs. 66 mg/dl; $P = 0.13$), but NEFA was higher for L (151 vs. 90 µEq/L; $P < 0.05$). Glucose was similar across treatments during the 30 min of sampling period after IC, suggesting that treatments did not affect maximum responsiveness to insulin. NEFA was reduced to same extent by 30 min after IC (20% vs. 17% for L and T; $P = 0.71$). L had an insulin sensitizing effect compared to T, because lower insulin concentrations caused similar glucose clearance during GTT.

Key Words: Linseed oil, Glucose and insulin tolerance tests, Bovine

M192 Effect of feeding whole soybeans on thermal balance and fatty acid profiles on early lactation cows during heat stress. J. D. Sampson, D. E. Spiers, and J. N. Spain*, *University of Missouri*, *Columbia*.

Elevated air temperatures during summer months cause a change in thermal balance of lactating cows. Skin secretions of heat stressed cows contain a high proportion of 18:2n6. Feeding fat has been used to increase energy intake while decreasing heat increment of the diet. This study was conducted to investigate the effects of cracked soybeans (SB) on thermal balance and plasma fatty acids of lactating dairy cows during heat stress (HS). Twenty four cows were paired based on calving date and parity and randomly assigned to one of two experimental diets (Control or SB). SB diet provided the cows with 2.5 kg raw, cracked soybean/d. Diets were fed ad libitum via Calan gates as a TMR beginning on the first day after calving. Daily DMI was recorded. On day 42 of lactation, cows were moved to the Brody Climate Lab. Cows were housed under thermoneutral conditions (19°C) for 2 wks before exposure to HS (cycling daily temperature; min. ~24°C, max. ~32°C).conditions. Blood samples were collected on day 7 and 14 during both TN and HS periods. Data were analyzed by PROC MIXED of SAS. There were no differences due to diet in thermal balance as assessed by respiration rate and rectal temperature (P>0.10). Heat stress caused decreases in milk production and DMI, but there were no differences between diets (P>0.10). Diet altered fatty acid profile of the cows during periods of heat stress. Feeding soybeans caused trends for increasing levels of plasma fatty acids with 16:0, 18:0, 18:1, and 18:2 higher in cows fed SB versus control (16:0, 76.0 vs. 141.0; P=.09), (18:0, 101.5 vs. 193.9; P=0.08), (18:1, 40.5 vs. 86.4; P=0.08), and (18:2; 339.2 vs. 538.9; P=0.14). Cows fed control diet had a significant 40% increase in NEFA immediately following heat stress (P=0.06 diet*time interaction). The addition of fat from soybeans did not alter production or thermal balance, but did increase the concentration of fatty acids in the plasma of heat stressed cows. The impact of altered fatty acid balance during heat stress on immune function and reproductive performance warrant additional study.

Key Words: Heat stress, Soybeans, Plasma fatty acids

M193 A comparison of the fatty acid profiles of red deer and sheep adipose tissues. G. A. Romero-Perez*[1], R. W. Mayes[1], and J. R. Scaife[2], [1]*The Macaulay Institute*, *Aberdeen,UK*, [2]*Writtle College*, *Essex, UK*.

The fatty acid (FA) composition of adipose tissues from grazing red deer and sheep were compared in order to examine possible implications to human health of consuming fat from these animals. For nine weeks, 12 yearling female red deer (*Cervus elaphus scoticus* L.) grazing high quality mixed grass pasture were supplemented with 60 g/d sunflower oil mixed with 135 g/d DM barley-based concentrate. Similarly, a group of 12 grazing Scottish Blackface female sheep were fed 30 g/d sunflower oil with 90 g/d DM concentrate. Separate control groups of 12 red deer and 12 sheep were fed concentrate with no oil. The statistical analysis of data was carried out using ANOVA (Genstat for Windows, release 8.1). In fat depots, the ratio saturated fatty acid (SFA):unsaturated fatty acid (UFA), was higher in deer (≈2:1) than in sheep (≈1.2:1). Total concentrations of SFA and UFA in adipose tissue in control deer were 267.35 ±43.004 and 119.70 ±20.114 mg/g, respectively and in control sheep were 341.18 ±14.290 and 288.30 ±26.762 mg/g, respectively. Oil-supplementation did not significantly affect UFA and SFA in either species (deer: 316.86 ±33.010 and 152.87 ±16.447 mg/g, respectively; sheep: 366.38 ±7.329 and 282.23 ±14.624 mg/g, respectively). The total concentrations of major FA in control deer were stearic acid (SA) (133.31 ±20.253 mg/g), palmitic acid (PA) (103.13 ±18.185 mg/g) and oleic acid (OA) (60.73 ±9.998 mg/g). FA concentrations in control sheep were OA (216.93 ±18.124 mg/g), SA (173.90 ±10.243 mg/g) and PA (132.16 ±5.185). Conjugated linoleic acid (CLA) concentration in the adipose tissues of control and oil-supplemented deer (3.22 ±0.669 and 4.16 ±0.670 mg/g respectively) was not significantly different. Although higher than in deer, CLA concentration in sheep fat depots was similarly not significantly affected by oil supplementation. The consumption by humans of fat from sheep adipose tissue may be less unhealthy than that from red deer due to deer fat having a higher SFA:UFA ratio and proportion of PA.

Key Words: Red deer, Stearic acid, CLA

M194 Differences in expression and activity of β, β-carotene-15, 15′-oxygenase between yellow and white bovine fat carcasses. A. Morales[1], A. González[1], A. Varela-Echavarria[2], A. Shimada[1], and O. Mora*[1], [1]*Facultad de Estudios Superiores Cuautitlán, UNAM*, *Querétaro, Querétaro, México*, [2]*Instituto de Neurobiología, UNAM*, *Querétaro, Querétaro, México*.

Pasture-fed cattle show yellow pigmentation of their fat due to β-carotene stored in the tissues. β, β-carotene-15,15′- oxygenase (βCO) is an enzyme expressed in different tissues, and it cleaves β-carotene into retinal. We compared the expression and activity of βCO in duodenum and liver of cattle with pigmented or non-pigmented fat. In the duodenum, *in situ* hybridizations showed expression of βCO in epithelial cells and crypts of the mucosa that was similar in pigmented and non-pigmented animals; liver showed diffuse signal at lobules, but pigmented animals showed higher signal near the portal space. Analyses by real time RT-PCR also showed amplification of mRNA for βCO, with no difference between pigmented or non-pigmented animals. Enzyme activity was similar in the duodenum, but pigmented animals had higher enzyme activity (P=0.004) in liver. Cattle with pigmented fat had higher expression and activity of βCO in liver, but its level was not high enough to prevent the storage of β-carotene in adipose tissue.

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Key Words: Cattle, Yellow-pigmentation, β-carotene

M195 Evaluation of fat tissue deposition and Leptin hormone measurement in early Angus-Nellore cattle treated with recombinant bovine somatotropin (rbST). C. L. Martins, R. D. C. Cervieri, M. D. B. Arrigoni, A. C. Silveira, C. A. de Oliveira, E. C. G. Felippe, H. N.s Oliveira, L. A. L. Chardulo, D. D. Millen*, and R. D. L. Pacheco, *FMVZ/UNESP*, *Botucatu, Sao Paulo, Brazil*.

The objective was to study the response of rbST on fat tissue deposition and leptin plasmatic concentration in early Angus-Nellore cattle. It was used 40 male calves with 20 days old supplemented with creep feeding until weaning and divided in two groups(n=20, 0.10mg/hd/day, every 14 days; n=20, not treated). The animals were weaned with 210 days old and fed in feedlot, when they were housed and divided in four treatments keeping the same dose every 14 days until 100 days prior slaughter (n=10, treated with rbST before and after weaning; n=10, treated with rbST until weaning; n=10, treated with rbST after weaning; n=10, not treated with rbST). The diet used in the feedlot had 20% of forage. Rib eye area (by ultrasound), weight gain and plasmatic concentration of leptin were measured every 28 days. The animals were slaughtered with 450kg and 13 months old. The leptin hormone was measured by RIA kit leptin multi-species (XL-85K). In the creep feeding period the calves treated with rbST had greater (P<0.05) average daily gain (1.10 vs. 1.02 kilos), total weight gain (170.8 vs. 158.1 kilos) and final weight (247.6 vs. 234.9 kilos) than calves not treated with rbST. For leptin, had no significant effect of the treatments and theirs interactions (P>0.05), showing a constant concentration during the experimental period in the calves. But, the leptin concentration increased from the beginning to the end of the experiment (P<0.05), independent of treatments (3.098 vs. 7.996 ng/mL), as well the fat tissue amount (P<0.05), from 18.7% (creep feeding period) to 30.4% (feedlot period). The animals not treated with rbST in both periods had smaller rib eye area (69.19 vs. 74.58 cm2) and lighter final weight (469.6 vs. 519.6 kilos) and hot carcass weight (257.3 vs. 286.5 kilos) than treated animals. Leptin showed to be a good metabolic indicator of animal adiposity, being able to be utilized to predict body condition score. The rbST used before weaning presents advantage for increasing the weaning weight and decrease the feedlot period, without altering the fat tissue deposition in carcasses.

Key Words: Leptin, rbST, Young cattle

M196 Effects of feeding soybean oil and high-corn silage diets on feedlot performance of beef cattle. C. K. Reynolds*, F. L. Fluharty, and S. C. Loerch, *The Ohio State University*, *Wooster*.

The objective was to determine the effect of feeding soybean oil (SO) and high corn silage (CS) diets on feedlot performance and carcass characteristics in beef steers. Angus based-steers (n = 168; BW = 287 kg) were allotted to 24 pens (7 steers each) and assigned to one of 6 treatments (4 pens each) based on 3 forage regimens with or without SO supplementation in a 3 X 2 arrangement of treatments. Forage regimens (8 pens each) were low CS diets for the entire finishing period (LO) or high CS diets for 126 (HILO) or 210 (HI) d, followed by LO until slaughter. Within each forage regimen 4 pens were fed SO (5 % of diet DM) for the entire study. There were no implants or ionophores used. Steers were harvested when s.c. back fat depth by ultrasound (pen mean) was 1 cm. Final BW (Table) increased ($P < 0.01$) with greater CS and SO. Increasing CS decreased ADG ($P < 0.01$). Feeding SO tended to decrease ADG for HI-LO and HI, but not LO ($P < 0.08$). DMI was greater for LO ($P < 0.01$) compared to HI-LO and HI, was reduced by SO ($P < 0.01$), and the reduction was less for LO ($P < 0.04$). Gain/kg feed DM was decreased ($P < 0.01$) with increased CS and increased ($P < 0.01$) by SO. Dressing % (61.3) and marbling score (569) were not affected by treatments, but kidney, heart and pelvic fat % was reduced ($P < 0.02$) by SO (2.43 vs. 2.10). In conclusion, feeding high CS diets increased total carcass yield without reducing quality, but increased time on feed and decreased ADG. Feeding SO increased gain/feed ratio, but increased feed costs and reduced ADG for the high CS diets.

Table 1. Feedlot performance of beef steers fed varying amounts of corn silage and soybean oil

Item	LO	LO-SO	HILO	HILO-SO	HI	HI-SO	SEM
Final BW, kg	488	509	548	552	583	586	13
Days fed	146	149	200	218	246	260	6
DMI, kg/d	9.19	8.77	8.46	7.58	8.79	7.76	0.22
ADG, kg/d	1.46	1.49	1.30	1.22	1.21	1.15	0.02
Gain/feed, kg/kg	0.159	0.169	0.154	0.161	0.137	0.149	0.004

Key Words: Beef, Forage, Oil

M197 Effects of adding sunflower or soybean seeds on heifers feedlot performance. J. A. Navarro*, F. J. Santini, G. J. Depetris, E. L. Villarreal, and D. H. Rearte, *EEA INTA Balcarce, Fac. Cs. Agrarias, UNMdP*, *Balcarce, Buenos Aires, Argentina*.

The objective of this trial was to evaluate dietary effects on heifers performance fed with different proportions of sunflower or whole raw soybean seed. One hundred and five Angus heifers (147±19 kg) were used in a randomized complete block design. The lipid supplementation treatments, applied for 125 d., were: no oilseeds (CON), sunflower seed at 4% (LSF), at 6% (MSF), and at 8% (HSF), soybean seed at 15% (LSB), at 20% (MSB), and at 25% (HSB) on a dry matter basis. Diets were formulated to be isonitrogenous (15% CP) and isocaloric (2.5 ME Mcal/kg). All diets consisted of corn silage, whole corn, sunflower meal and urea. Feed intake (DMI) was recorded daily and animals were weighed at the start and end of the trial and at two week intervals to obtain live weight gain (LWG). Ultrasound backfat (SBF) was measured to estimate fat deposition rate (FDR). The results of the least square means comparisons are shown on the table. Control had higher (P<0.05) DMI, LWG and FDR than sunflower and soybean treatments, and higher (P<0.05) FE than soybean treatments, but not different than sunflower treatments. Sunflower treatments had higher (P<0.05) DMI and LWG than soybean treatments; FE was better (P<0.05) for soybean treatments, and there were no difference in FDR between oilseeds. Increasing the proportion of sunflower in the diet caused a linear decrease in the DMI (P=0.02) and a quadratic effect for LWG (P=0.05), but no response in the FE and FDR. The soybean showed a linear effect for FE (P=0.03) only.

Table 1.

Item	CON	LSF	MSF	HSF	LSB	MSB	HSB	SEM
DMI, kg/d	5.79[a]	5.22[b]	5.21[b]	4.85[bc]	4.75[bcd]	4.39[cd]	4.28[d]	0.12
Initial BW, kg	148	148	149	149	148	145	149	2
Final BW, kg	260[a]	250[ab]	250[ab]	244[ab]	241[ab]	237[b]	246[ab]	4
LWG, kg/d	0.933[a]	0.831[ab]	0.867[ab]	0.772[b]	0.787[b]	0.746[b]	0.811[ab]	0.026
LWG, kg/d	0.933[a]	0.831[ab]	0.867[ab]	0.772[b]	0.787[b]	0.746[b]	0.811[ab]	0.026
LWG, kg/d	0.933[a]	0.831[ab]	0.867[ab]	0.772[b]	0.787[b]	0.746[b]	0.811[ab]	0.026
LWG, kg/d	0.933[a]	0.831[ab]	0.867[ab]	0.772[b]	0.787[b]	0.746[b]	0.811[ab]	0.026
FE, feed/gain	6.18[a]	6.27[a]	6.01[a]	6.27[a]	6.02[a]	6.02[a]	5.26[b]	0.16
Initial SBF, mm	2.44	2.58	2.60	2.49	2.58	2.22	2.40	0.10

[abcd]Means within a row with unlike superscripts differ ($P < 0.05$).

Key Words: Sunflower and soybean seeds, Beef heifers, Feedlot performance

M198 Effects of rumen-protected Ca salts of conjugated linoleic acid (CLA) and previous rate of gain on growth performance, immune function, and carcass characteristics of feedlot cattle. H. Flórez-Díaz*[1], E. B. Kegley[1], G. F. Erf[1], D. L. Kreider[1], K. P. Coffey[1], J. K. Apple[1], and N. D. Luchini[2], [1]*Department of Animal Science, Division of Agriculture, University of Arkansas, Fayetteville*, [2]*NutriScience Technologies, Inc., Fairlawn, OH*.

Crossbred beef steers (n = 35; initial BW = 402 kg), that had been on a 56-d growing study and fed diets with Ca salts of palm oil (PO) or Ca salts of CLA and formulated for a low (L; 0.68 kg/d) or a high rate of gain (H; 1.36 kg/d), were used on this finishing study to evaluate the effects of previous growth rate and growing and finishing fat source on growth performance, immune function, and carcass characteristics. Steers remained on the same fat source and were transitioned to 2 ad libitum finishing treatments consisting of a basal, corn-soybean meal based, diet with either 4% Ca salts of PO or CLA. Steers were fed to an average slaughter weight of 564 kg and data were analyzed using the GLM and MIXED procedures of SAS for a 2 × 2 factorial arrangement of treatments with pen (n = 12) as the experimental unit. Steers fed CLA had lower ($P \leq 0.05$) ADG, ADFI, final BW, HCW, dressing percent, proliferation of mononuclear cells stimulated with phytohemagglutinin and pokeweed mitogen, percentage of γδ-TCR^+CD8^- cells, and tended to have decreased total monocytes ($P = 0.07$) compared to steers fed PO. At harvest, steers fed CLA tended to have a lower ($P = 0.10$) percentage of $CD4^+CD8^+$ blood cells and a greater ($P = 0.09$) percentage of $CD4^+CD8^+$ cells in jejunal lymph nodes. Feeding CLA increased the jejunal $CD4^+/CD8^+$ ratio ($P = 0.01$) in H but not in L steers. Compared to H steers, L steers had greater ($P = 0.04$) ADG and NEFA, and a lower ($P = 0.03$) percentage of γδ-TCR^+CD8^- cells, and tended to have a higher ($P = 0.10$) G:F ratio, better ($P = 0.07$) yield grades, and lower blood $CD4^+CD8^-/CD4^-CD8^+$ ($P = 0.07$) and $CD4^+/CD8^+$ ($P = 0.08$) ratios. In conclusion, feeding CLA affected immunity, growth, and carcass traits of feedlot steers; however, previous rate of gain may interact with these responses in finishing cattle.

Key Words: CLA, Immune function, Cattle

M199 Influence of rate of growth and rumen-protected Ca salts of conjugated linoleic acid (CLA) on growth performance, immune function, and lipid metabolism of growing cattle. H. Flórez-Díaz*[1], E. B. Kegley[1], G. F. Erf[1], D. L. Kreider[1], K. P. Coffey[1], N. D. Luchini[2], and S. L. Krumpelman[1], [1]*University of Arkansas, Fayetteville*, [2]*NutriScience Technologies, Inc., Fairlawn, OH*.

Forty-eight crossbred beef calves (initial BW = 350 kg) were used to determine the effects of rate of growth and CLA on immunity, lipid metabolism, and growth performance. Calves were blocked by weight, stratified by gender, and assigned to 16 pens. Pens within each block were assigned randomly to 1 of 4 diets arranged as a 2 × 2 factorial. Main effects were rate of gain (diets formulated to gain 0.68 [L] or 1.36 [H] kg/d), and fatty acid source (4% Ca salts of palm oil [PO] or 4% Ca salts of CLA). Data were analyzed using GLM and MIXED procedures of SAS with pen as the experimental unit. Feeding CLA tended to increase ($P = 0.07$) ADG and G:F in cattle fed L but not H diets, and tended to decrease the percentage of monocytes ($P = 0.09$) and eosinophils ($P = 0.06$) in H but not in L diets during the 56 d trial. Total white blood cell ($P = 0.02$) and lymphocyte concentrations ($P = 0.05$) were greater in L vs. H diets. Feeding CLA decreased the proliferation of cells stimulated with phytohemagglutinin (PHA; $P = 0.04$) or concanavalin A ($P = 0.03$) in H but not in L diets. Responses of cells to PHA were lower ($P = 0.003$) in L than in H diets. On d 56, CLA tended to decrease ($P = 0.08$) the percentage of $CD4^-CD8^+$ T cells, and to increase the percentage of γδ-TCR^+CD8^- T cells ($P = 0.08$), the $CD4^+CD8^-/CD4^-CD8^+$ ratio ($P = 0.07$), and the $CD4^+/CD8^+$ ratio ($P = 0.08$). Lower ($P < 0.05$) $CD4^+CD8^-/CD4^-CD8^+$ and $CD4^+/CD8^+$ ratios were observed in L vs. H diets. Feeding CLA decreased ($P = 0.05$) NEFA on d 28 and 56 in L but not in H diets. Lower insulin concentrations were observed on d 28 ($P = 0.01$) and 56 ($P = 0.002$) in L-CLA but not in L-PO. In conclusion, CLA may increase growth performance, modulate immunity, and affect lipid metabolism in growing cattle but responses depend on time and rate of growth.

Key Words: Cattle, Immune function, CLA

M200 Maternal nutrition effects on lipogenic enzyme messenger RNA in adipose tissue of suckling calves. C. M. Murrieta*[1], S. L. Lake[2], E. J. Scholljegerdes[3], B. W. Hess[1], and D. C. Rule[1], [1]*University of Wyoming, Laramie*, [2]*Purdue University, West Lafayette, IN*, [3]*USDA ARS, Mandan, ND*.

Milk fatty acid composition can be altered through maternal dietary manipulation. We hypothesized that changes in milk fatty acid composition could affect adipose tissue development in the suckling calf. Our objective was to determine the effects of maternal prepartum energy balance and postpartum lipid supplementation on mRNA transcripts of four lipogenic enzymes in adipose tissue of suckling calves. Three-year-old Angus × Gelbvieh beef cows nutritionally managed to achieve a BCS of 4 ± 0.07 (BW = 479.3 ± 36.3 kg) or 6 ± 0.07 (BW 579.6 ± 53.1 kg) at parturition were used in a 2-yr experiment (n = 36/yr). Beginning 3 d postpartum, cows within each BCS were assigned randomly to be fed hay and a low-fat control supplement or supplements with either high-linoleate cracked safflower seeds or high-oleate cracked safflower seeds until d 60 of lactation. Diets fed to cows were formulated to be isonitrogenous and isocaloric, with 5% of DMI as fat. After 61 d of suckling these cows, calf adipose tissue biopsies were taken from the tail head region for determination of mRNA abundance. Maternal BCS did not influence mRNA abundance for lipoprotein lipase (LPL; $P = 0.90$), acetyl-CoA carboxylase (ACC; $P = 0.96$), stearoyl-CoA desaturase (SCD; $P = 0.97$), or fatty acid synthase (FAS; $P = 0.25$). Likewise, mRNA abundance of LPL (*P*

= 0.94), ACC (*P* = 0.93), SCD (*P* = 0.98), and FAS (*P* = 0.86) did not differ in adipose tissue of calves suckling cows fed the various dietary treatments. We conclude that neither maternal BCS nor milk fat compositional changes occurring from 5% of DMI as fat from oil seeds during the first 60 d of lactation in beef cows was great enough to impact lipogenic enzyme mRNA abundance in adipose tissue of their suckling calves.

Key Words: Lipid supplementation, Beef cattle, Milk

Ruminant Nutrition: Metabolism and Immunology

M201 Is OmniGen-AF capable of augmenting markers of immune health when blended into a nutritional block? N. Forsberg*, Y. Wang, and S. Puntenney, *Oregon State University*, *Corvallis*.

Previous studies have shown that addition of OmniGen-AF to diets of ruminant livestock and laboratory animals increases expression of markers of innate immune health. Markers which respond to the presence of OmniGen-AF have included neutrophil L-selectin, interleukin-1-beta (IL1B) and interleukin 8-receptor. The goal of this study was to evaluate whether similar responses in immunity were detected when OmniGen-AF was mixed into a nutritional block. The rationale for completing this experiment was that block formation requires high temperature processing and we were concerned that heat may thereby inactivate the product. Fourteen growing sheep were assigned to two treatments: control block and Omnigen-AF-supplemented block. Concentration of the OmniGen product in the block was 9% which was expected to deliver an approximate daily intake of 4g OmniGen/animal/d. All animals on the study were immunosuppressed via twice daily injection of Azium (0.1 mg/kg twice/day). Duration of the study was 28 d. On day 28, blood samples were taken via the jugular and neutrophils were isolated. The RNA was prepared from neutrophils using Trizol. Concentrations of L-selectin mRNA and beta-actin mRNA were then determined using selectin- and actin-specific primers and quantitative RT-PCR. Animals on the 2 treatments gained similar weight during the study (P>0.05). Control-fed sheep gained 0.17 kg/d and OmniGen-AF-fed sheep gained 0.19 kg/d. Quantitative RT-PCR revealed that feeding OmniGen-AF increased expression of L-selectin in neutrophils of immunosuppressed sheep by 3.75-fold (P<0.05). This increase is similar to effects of OmniGen-AF on L-selectin expression when provided outside of a nutritional block formulation. Therefore, the high temperatures associated with nutritional block formulation do not inactivate OmniGen-AF. OmniGen-AF is capable of enhancing expression of immune genes in immunosuppressed sheep when included in a nutritional block.

Key Words: OmniGen-AF, Immunity, L-selectin

M202 Effect of feeding blends of feedstuffs naturally contaminated with Fusarium mycotoxins on performance, metabolism and immunological parameters of dairy cattle. S. Korosteleva* and T. Smith, *University of Guelph*, *Guelph, Ontario, Canada*.

There is little known about the effect of Fusarium mycotoxins on performance, metabolism and immunity of dairy cattle. A blend of naturally contaminated feedstuffs was fed to 18 mid-lactation Holstein cows with average milk production of 30-35 kg/day. Diets included: (1) control (2) contaminated and (3) contaminated + 0.2% glucomannan mycotoxin adsorbent (GMA) for a period of 56 days. Wheat, corn and hay were the contaminated feedstuffs. Deoxynivalenol (DON) was the major contaminant and was found in TMR at up to 3.6 ppm dry matter. Body weight, body condition score, milk production, milk composition, SCC, blood serum chemistry, hematology, total Ig count and coagulation profile were measured. Data were analyzed by analysis of covariance using the mixed model of SAS as a completely randomized design with repeated measures (P<0.05). Zero point (befor experiment) measurements were used as a covariate. Multiple comparisons at each time point were performed. Experimental groups were compared to control. Milk production, milk composition and SCC were not affected by diet (P>0.05). Globulin (P=0.0016) and total protein (P=0.0130) levels increased significantly in cows fed contaminated TMR compared to controls after 42 days, while albumin:globulin ratio decreased (P=0.0074). Serum urea concentrations were significantly elevated (P=0.0121) throughout the experiment when cows fed the contaminated diet were compared to controls. Serum IgA concentrations decreased significantly in cows fed contaminated TMR after 36 days of feeding (P=0.0095). The feeding of GMA prevented these effects (P>0.05). It was concluded that feed naturally contaminated with Fusarium mycotoxins, even in low concentrations, can affect metabolic parameters and immunity of dairy cows and GMA can prevent some of these effects.

Key Words: Dairy cows, Fusarium mycotoxins, Deoxynivalenol

M203 Effect of feeding whole soybeans on hepatic gene expression in lactating dairy cows. J. D. Sampson*[1], R. P. Rhoads[1], R. J. Tempelman[2], S. S. Sipkovsky[2], P. M. Coussens[2], M. C. Lucy[1], J. N. Spain[1], and D. E. Spiers[1], [1]*University of Missouri*, *Columbia*, [2]*Michigan State University*, *East Lansing*.

The purpose of this study was to determine hepatic gene expression in the dairy cow supplemented with whole soybeans during adaptation to chronic heat stress (HS) using microarray analysis. Twenty-four Holstein dairy cows were randomly assigned to either control diet (LC) or a whole soybean (LSB) diet and acclimated to thermoneutral conditions (TN; 19°C) for 2 weeks prior to exposure to HS conditions (cycling daily temperature; minimum ~24°C, maximum ~32°C). During the study, individual feed intake (FI) and milk production (MP) were measured on a daily basis. Rectal temperature (Tre) and respiration rate (RR) were measured at four hour intervals and milk components were analyzed weekly. Liver biopsies were obtained after one week of TN conditions and again after two weeks of HS exposure. Hepatic total RNA was reverse transcribed to cDNA. LC and LSB paired samples were sequentially labeled with Cy3 or Cy5 prior to hybridization to an 18,263 member NBFGC microarray. Gene expression data were normalized and analyzed using a two-stage mixed effects model in SAS. During HS, the profile of Tre and RR mirrored the cycling temperature, reaching daily maximums of 41°C and 95 breaths per minute, respectively. FI and MY steadily declined and reached stable reductions of 25% and 20%, respectively, for both dietary treatment groups by day 5 of HS. Microarray analysis revealed no diet by temperature interactions. However, there were 11 differentially expressed genes (P≤0.001) due to diet with an approximately equal number of up and down-regulated genes. In conclusion, feeding whole soybeans alters hepatic gene expression.

Key Words: Liver, Microarray, Whole soybeans