T202 Effect of supplementation with sunflower oil (SO) or seeds (SS) combined or not with fish oil (FO) on conjugated linoleic acid (CLA) in milk from grazing dairy cows. G. A. Gagliostro*[1], M. A. Rodríguez[2], P. Pellegrini[2], P. Gatti[2], G. Muset[2], D. Garciarena[1], A. Ferlay[3], and Y. Chilliard[3], [1]*Instituto Nacional de Tecnología Agropecuaria, INTA*, *Balcarce, Buenos Aires, Argentina*, [2]*Instituto Nacional de Tecnología Industrial, INTI*, *Buenos Aires, Argentina*, [3]*Institut National de la Recherche Agronomique, INRA*, *Saint Genès Champanelle, France*.

The effectiveness of C18:2-rich supplements (SS vs SO) combined or not with FO to increase milk CLA (cis-9, trans-11C18:2) was evaluated in 64 Holstein grazing cows. During each milking corn grain (1.3 kg DM/cow) and a mineral-vitamin mix (0.25 kg) were consumed. Between the a.m. and p.m. milkings cows grazed a pasture at 11 kg DM/cow allowance. After the p.m. milking, cows (16/treatment) received four TMR diets over a 5-wk period : 1) SS = 74.7% corn silage (CS); 25.3% SS, 2) SO = 76.7% CS, 12.3 % sunflower meal (SM), 11 % SO; 3) SS-FO = 72.4 % CS, 24.5 % SS, 3.1 % FO and 4) SO-FO = 74.3% CS, 11.9% SM, 10.6% SO, 3.2% FO. TMR intake (kg DM) averaged 7.52, 7.33, 3.45 and 4.63. Every week milk samples were collected and FA composition (GLC) were analyzed in a completely randomized design with repeated measures. A pre-trial period represented basal FA concentrations and used for covariance analysis. The average 5-wk concentrations (g/100g FA) of C12:0 (1.52) and C14:0 (6.39) were similar. Concentration of C16:0 was higher ($P<0.01$) when FO was included in the diet (20.49 vs 17.94). FO supply reduced ($P<0.01$) milk content of C18:0 (13.54 to 6.30) and cis-9 C18:1 (31.39 vs 19.2) and increased total trans-C18:1 (21.8 vs 10.56). Interactions ($P<0.05$) between sources of C18:2n6 (SS and SO) and FO were detected for C18:2n-6 and CLA . Concentration of C18:2n-6 was: SS (2.78), > SS-FO (2.10), >SO (2.04), >SO-FO (1.73). Concentration of C18:3n-3 was higher ($P<0.03$) with treatments including FO (0.68 vs 0.62). Pre-trial CLA concentrations averaged 1.08, 1.15, 1.12, and 1.11 for SS-FO, SS, SO-FO and SO respectively. Milk CLA content was sharply increased after lipid supplementation reaching a maximal value of 8.49 g/100g FA (± 2.25) at wk-5 in SS-FO. The highest average CLA concentration over the 5-wk was observed in SS-FO (6.07) followed by SO-FO (4.37), SS (2.96) and SO (2.36) treatments. Mixing lipid supplements with corn silage represents a feeding-strategy that may be easily carried out by the farmer in order to improve milk CLA and trans-C18:1 concentrations.

Key Words: Conjugated Linoleic Acid, Sunflower, Fish Oil

T203 Effect of dietary vegetable oil and antioxidant supplementation on dairy cattle performance and milk fat depression. M. He[1], H. S. Xin[2] and L. E. Armentano[1], [1]*University of Wisconsin, Madison,* [2]*China Agricultural University, Beijing, China.*

This experiment was conducted to evaluate the effect of dietary supplementation of free vegetable oil with or without a commercial antioxidant (Agrado® plus, Novus International) on dairy cattle performance and milk fat depression. Twenty four multiparous Holstein cows (138±31 DIM) were divided by production into 2 blocks (Hi or Lo) of 12 cows each. Agrado (0 or 0.025% of DM, -A or +A) was randomly assigned to 6 cows per block resulting in a main plot randomized block design with 20 df for error. These 4 groups of 6 cows each (-AHi, -ALo, +AHi and +ALo) were each fed 6 diets in a 6X6 Latin square design that was a split plot with 3wk periods. Dietary treatments were no added oil (CTRL), or 5% DM as free oil from palm (PALM), high-oleic safflower (OSAF), high-linoleic safflower (LSAF), linseed (LNSD) or corn oil (CORN). Diets were formulated to be iso-CP and iso-NDF, and consisted of approximately 40% alfalfa silage, 20% corn silage and 40% grain mix (DM basis). Data reported were analyzed using the mixed model of SAS (Y = agrado + block + block*agrado + oil + oil*agrado + oil*block + period + period*agrado + period*block). There was no main effect of Agrado feeding nor an Agrado by oil interaction for milk production parameters, but Agrado by block interaction was found for milk yield ($P=0.09$) and milk protein yield ($P=0.08$). Negative effects were associated only with the unsaturated fatty acids and linoleic acid appeared to be the most deleterious of the unsaturated fatty acids fed.

Table 1. Effect of vegetable oil on dairy cattle performance

	CTRL	PALM	OSAF	LSAF	LNSD	CORN	SEM
DMI, kg/d	22.44[ab]	22.97[ab]	24.80[a]	22.97[ab]	23.27[ab]	21.13[b]	0.99
Milk, kg/d	33.5[ab]	34.5[a]	33.7[a]	30.5[b]	33.6[ab]	32.2[ab]	1.33
Milk Fat %	3.41[a]	3.43[a]	3.04[b]	2.85[b]	3.07[b]	3.05[b]	0.11
Milk Protein %	3.24[b]	3.24[b]	3.30[ab]	3.45[a]	3.28[b]	3.39[ab]	0.06
Milk Fat, kg/d	1.14[ab]	1.18[a]	1.02[bc]	0.86[d]	1.02[bc]	0.98[cd]	0.05
Milk Protein, kg/d	1.09[a]	1.10[a]	1.10[a]	1.03[a]	1.08[a]	1.08[a]	0.04

[ab]Least square means within a row not sharing a common superscript differ ($P<0.05$). Based on Bonferroni statistical test.

Key Words: Vegetable oil, Antioxidant, Milk fat depression

T204 Effect of close-up fat supplementation on first 90 days milk production of Holstein dairy cows. M. Danesh Mesgaran* and A. R. Heravi Mousavi, *Dept. of Animal Science (Excellence Center for Animal Science), Ferdowsi University of Mashhad*, *Mashhad, Iran*.

Effect of close-up fat supplementation and body condition score on first 90 days milk production was evaluated in high producing lactating Holstein cows. Data of 6 herds with average 112 milking cows were used. Body condition scores were recorded 50 days before and 45 days after the calving. All cows in each herd were dried off 50-70 days before expected calving and moved to a far-off dry herd with dry matter intake of 3 kg alfalfa, 5 kg corn silage, 1.5 kg wheat straw and 3 kg far-off concentrate (CP: 162 g/kg; ME:12.4 MJ/kg). The cows were moved to the close-up dry herd around 25 days before calving. Close-up dry ration (DM basis) was consisted of 2.2 kg alfalfa, 6.1 kg corn silage, 1.9 kg wheat straw, 5.2 kg concentrate (CP: 176 g/kg; ME: 13.2 MJ/kg), and 300 g of anionic salts. In 3 herds, the close-up ration was supplemented with 0.25 kg palm fat prills (99.5% fat). After parturition, all cows were fed a total mixed ration (as DM) based on 24% alfalfa, 14% corn silage and 60% concentrate. This ration met the requirements of high producing cows (CP: 180 g/kg; ME: 12.2 MJ ME/kg DM). Cows were inseminated around 60-85 days in milk after a presynch-ovsynch estrous synchronization program. During the first

90 days of lactation, weekly milk production was recorded. Data were analyzed using GLM procedure of SAS. Retained placenta, metrits and endometrits were lower in cows fed fat supplemented close-up ration compared with the non-supplemented cows. First 90 days milk yield was significantly influenced by close-up fat supplementation ($P< 0.05$). Milk yield of fat supplemented and non-supplemented cows was 41.3.8 and 39.6 kg/d/head, respectively. Milk yield appeared to be depressed in postpartum thin cows (BCS= 2.4) compared with normal cows (BCS= 2.9). Results of the present study indicated that fat cows (BCS more than 4.6 before dry off) resulting in lower milk production. It was concluded that relationship between close-up period fat supplementation and milk production in the first 90 days was a critical point.

Key Words: Close-Up, Fat, Milk

T205 Soybean oil and linseed oil supplementation affect profiles of ruminal microorganisms and fermentation parameters in dairy cows. D. P. Bu[1], S. L. Yang[1], J. Q. Wang*[1], Z. Y. Hu[1], D. Li[1], H. Y. Wei[1], L. Y. Zhou[1], and J. Loor[2], [1]*State Key Laboratory of Animal Nutrition, Institute of Animal Science, Chinese Academy of Agricultural Sciences*, *Beijing, P. R. China*, [2]*University of Illinois*, *Urbana*.

The objectives of this study were to evaluate changes in ruminal microorganisms and fermentation parameters due to dietary supplementation of soybean and linseed oil alone or in combination. Four primiparous Holstein cows with permanent ruminal cannulas were randomly assigned to control (CK, 60:40 forage to concentrate) or CK with 4% soybean oil (LOC1), 4% linseed oil (LOC2), or 2% soybean oil plus 2% linseed oil (LOC3) in a 4 × 4 Latin square with 12-week periods. Forage and concentrate mixtures were fed at 0800 and 2000 h daily. Ruminal fluid was collected every 2 h over a 12 h period on d 19 of each experimental period. Ruminal pH and concentrations of acetate and propionate did not differ but butyrate (10.4 vs. 9.5 mmol/L) and total VFA (109 vs. 104 mmol/L) were lower ($p < 0.05$) with oil supplementation compared with CK. Concentration of ruminal NH_3-N (13.6 vs. 17.4 mg/dL) was greater ($p < 0.05$) due to oil compared with CK. Compared with CK, cows fed oil had lower ($p < 0.05$) cellulolytic bacteria (3.25×10^8 vs. 4.66×10^8 CFU/mL) and protozoa (9.04×10^4 vs. 12.92×10^4 CFU/mlL) colony counts. Proteolytic bacteria (7.01×10^8 vs. 6.08×10^8 CFU/mL) counts, however, were greater ($p < 0.05$) in response to oil compared with CK. Among oil treatments, the amount of *B. fibrisolvens*, *F. succinogenes*, and *R. flavefaciens* in ruminal fluid (measured by real-time PCR) was substantially lower ($p < 0.05$) due to oil supplementation primarily when LOC2 was fed *R. albus* concentration decreased by an average of 40% regardless of oil level or type. Overall, results indicate that some ruminal microorganisms, except proteolytic bacteria, are more susceptible to dietary PUFA supplementation above 2% of DM, particularly when linolenic acid-rich oils are fed. Dietary oil effects on ruminal fermentation parameters seemed associated with the profile of ruminal microorganisms.

Key Words: Soybean Oil, Linseed Oil, Rumen Fermentation

T206 Effects of soybean oil and linseed oil supplementation on digestibility of nutrient and milk composition in dairy cows. D. P. Bu, Z. Y. Hu, J. Q. Wang*, S. L. Yang, D. Li, H. Y. Wei, and L. Y. Zhou, *State Key Laboratory of Animal Nutrition, Institute of Animal Science, Chinese Academy of Agricultural Sciences*, *Beijing, P. R. China*.

The objectives were to examine the effects of dietary supplementation of soybean and linseed oil alone or in combination on intake, apparent ruminal digestibility, and total tract digestibility of DM, OM, NDF, ADF, milk production and composition in dairy cows. Four primiparous Holstein cows with permanent ruminal cannulas were randomly assigned to control (CK, 60:40 forage to concentrate) or CK with 4% soybean oil (LOC1), 4% linseed oil (LOC2), or 2% soybean oil plus 2% linseed oil (LOC3) in a 4 × 4 Latin square with 12-week periods. Forage and concentrate mixtures were fed at 0800 and 2000 h daily. The results indicated that intake, apparent ruminal digestibility, and total tract digestibility of DM, OM, NDF, ADF were not affected by the oil supplementation ($P>0.05$）,however the fat supplement tended to reduce the digestibility of DM, OM, NDF, ADF on rumen and total tract ($P>0.05$). Cows fed diets with fat supplementation did not alter milk production, milk Lactose and milk protein percentage or production ($P > 0.05$). Milk fat percentage, however, numerically decreased for cows fed diets supplemented with fat compared with that for cows fed the control diet (3.45% vs. 3.21%; $P < 0.01$). Cows fed supplemented fat had lower concentration of C16:0 and C16:1 ($P < 0.01$), but higher concentration of C18:0, trans-18:1, cis-18:1, C18:2, and C18:3 ($P < 0.01$) than did cows fed the control diet. The proportions of cis9, trans11 CLA were increased by 236%, 156% and 176% in LOC1, LOC2 and LOC3 treatments compared with cows fed control diet, respectively. Results showed fat supplementation (4% of diet DM) in dairy cows appeared to have a negative influence on rumen and total tract digestibility, but did not affect milk production, milk Lactose and milk protein percentage or production

Key Words: Soybean Oil, Linseed Oil, Digestibility

T207 Effect of dietary linoleic acid and forage level on conjugated linoleic acid content in plasma and milk. D. P. Bu, J. Q. Wang*, S. J. Liu, H. Y. Wei, and L. Y. Zhou, *State Key Laboratory of Animal Nutrition, Institute of Animal Science, Chinese Academy of Agricultural Sciences*, *Beijing, P. R. China*.

The objective of the study was to examine the effect of dietary linoleic acid (LA) and forage level on conjugated linoleic acid (CLA) content in plasma and milk. Twenty-four Chinese Holstein dairy cows, 117.6 ± 52 d in milk and 23.6 ± 4.63 kg/d milk were allocated to four treatments arranged in a 2 × 2 factorial design. Four treatments were a high forage (60% of dry matter basis) diet without LA (HFC), a high forage (60%) diet with LA (HFLA), a low forage (40%) diet without LA (LFC), or a low forage (40%) diet with LA (LFLA). LA was added through sunflower oil (contained 59% LA) by replacing the corn in the diet. Diets were isonitrogenous (average of 16.5%) and were fed as a total mixed ration 3 times a day. Milk yields were recorded twice a week and milk samples were collected weekly. Measurements were made during the last 6 wk of the 9 wk experimental period. Blood samples were taken from coccygeal vein or artery at 4h postfeeding at the end of the 9 wk experimental period. Data were analyzed with animal, period, LA level, forage level and two-way interaction between LA and forage level in the model. LA intake was increased when cows were fed either LA (140.2 vs. 446.6 g/d, $p<0.001$) or low forage diet (284.0 vs. 302.8 g/d, $P<0.001$). Milk fat content was 3.81[a], 3.11[ab], 3.60[a] and 2.66[b] in HFC, HFLA, LFC and LFLA respectively. Percentages of 8:0 to14:0 and 16:0 in milk fat were decreased with LA addition ($p<0.05$) Dietary forage

level did not alter de novo fatty acids (8:0 to 12:0), 14:0 and 16:0. Percentage of t11-C18:1 in plasma (1.50 vs. 3.69 %, p>0.05) and milk fat (1.12 vs. 5.67 %, p<0.001) were greater when cows fed LA. Despite a lack of difference in plasma percentage of c9t11 CLA, cows fed LA had greater c9t11 CLA (0.69 vs. 4.08 %, p<0.001) in milk fat. Overall, increasing dietary LA level decreased short and medium-chain fatty acids (P < 0.05) and increased (P < 0.001) t11-C18:1 or c9t11 CLA in milk fat. However, there was no interaction between forage level and LA addition on percentage of t11-C18:1 or c9t11 CLA in plasma and milk fat under present experiment condition.

Key Words: Forage Level, Linoleic Acid, Conjugated Linoleic Acid

T208 Milk fatty acid composition of dairy cows fed increasing amounts of linseed oil. C. Benchaar*[1], M. Eugène[1], C. Côrtes[1], A. V. Chaves[1], H. V. Petit[1], T. A. McAllister[2], A. D. Iwaasa[3], and P. Y. Chouinard[4], [1]*Agriculture and Agri-Food Canada*, *Dairy and Swine Research and Development Centre, Sherbrooke, Quebec, Canada*, [2]*Agriculture and Agri-Food Canada*, *Lethbridge, Alberta, Canada*, [3]*Agriculture and Agri-Food Canada*, *Semiarid Prairie Agricultural Research Centre, Swift Current, Saskatchewan, Canada*, [4]*Laval University*, *Quebec, Quebec, Canada*.

The objective of this study was to examine the effects of increasing dietary concentrations of linseed oil (LO) on milk fatty acid (FA) composition of dairy cows. Four primiparous cows (BW=566 kg, DIM=52 d) used in a 4×4 Latin square design (28-d periods) were fed a control TMR (**CTL**) or a TMR supplemented (DM basis) with LO at 2% (**LO2**), 3% (**LO3**), or 4% (**LO4**). Milk samples were collected during the last week of each experimental period. Preplanned contrasts (PROC MIXED, SAS) were: LO vs. CTL, linear and quadratic effects of LO supplementation. Significance was declared at $P < 0.05$. Milk fat content (g/100 g of FA) of C16:0 linearly decreased (27.0, 21.0, 19.1, and 17.4% for CTL, LO2, LO3, and LO4; respectively), whereas the concentrations of C18:0 (8.11, 10.2, 11.1, and 11.3%) and *cis*-9 C18:1 (14.2, 16.8, 17.1, and 17.6%) linearly increased with LO addition. The concentrations of several intermediates of ruminal biohydrogenation of polyunsaturated FA were also higher for the CTL vs. LO and linearly decreased with LO addition; including *trans*-10 C18:1 (0.25, 0.43, 0.51, and 0.76%), *trans*-11 C18:1 (0.78, 1.54, 2.05, and 2.86%), *cis*-9- *trans*-11 C18:2 (0.36, 0.68, 0,87, and 1.22%), *trans*-11 *cis*-15 C18:2 (0.050, 0.56, 1.03, and 1.68%), and *cis*-9 *trans*-11 *cis*-15 C18:3 (0.01, 0.07, 0.10, and 0.12%). The concentration of *cis*-9- *cis*-12 C18:2 linearly decreased with LO addition (2.06, 1.99, 1.91, and 1.83% for CTL, LO2, LO3, and LO4; respectively). Milk fat concentration of *cis*-9 *cis*-12 *cis*-15 C18:3 increased as the level of LO in the diet increased up to 3% but no further increase was observed when 4% of LO was fed (0.33, 0.79, 0.86, and 0.86% for CTL to LO4; respectively). Milk fat contents of *cis*-5 *cis*-8 *cis*-11 *cis*-14 *cis*-17 C20:5 (0.044, 0.058, 0.055, and 0.051% for CTL to LO4; respectively) and *cis*-5 *cis*-7 *cis*-10 *cis*-13 *cis*-16 C22:5 (0.051%; 0.011, 0.017, 0.014, and 0.012% for CTL to LO4; respectively) were quadratically affected by LO addition. Results of this study showed that adding LO to dairy cow diets can improve the nutritive value of milk fat by enhancing the concentrations of health promoting FA such as conjugated linoleic and omega-3 FA.

Key Words: Linseed, Dairy Cow, Milk Fatty Acids

T209 Digestion, milk production, and milk composition of dairy cows fed increasing amounts of linseed oil. C. Benchaar*[1], M. Eugène[1], C. Côrtes[1], A. V. Chaves[1], H. V. Petit[1], T. A. McAllister[2], A. D. Iwaasa[3], and P. Y. Chouinard[4], [1]*Agriculture and Agri-Food Canada*, *Dairy and Swine Research and Development Centre, Sherbrooke, Quebec, Canada*, [2]*Agriculture and Agri-Food Canada*, *Lethbridge, Alberta, Canada*, [3]*Agriculture and Agri-Food Canada*, *Agriculture and Agri-Food Canada, Semiarid Prairie Agricultural Research Centre, Swift Current, Saskatchewan, Canada*, [4]*Laval University*, *Quebec, Quebec, Canada*.

The objective of this study was to examine the effects of increasing amounts of linseed oil (LO) on digestion, milk production, and milk composition of dairy cows. Four primiparous cows (BW=566 kg, DIM=52 d) used in a 4×4 Latin square design were fed a control TMR (**CTL**) or a TMR supplemented (DM basis) with LO at 2% (**LO2**), 3% (**LO3**), or 4% (**LO4**). Each experimental period consisted of 21 days of adaptation and 7 days for sample collection. Preplanned contrasts (PROC MIXED, SAS) were: LO vs. CTL, linear and quadratic effects of LO supplementation. Significance was declared at $P < 0.05$. Dry matter intake (18.9 kg/d) and total-tract digestibilities of DM (63.5%), OM (65.1%), CP (65.3%), and ADF (46.6%) were not affected by LO addition. Milk production tended (P=0.05) to be higher for LO diets vs. CTL and linearly increased with LO supplementation (26.1, 27.3, 27.4, and 28.4 kg/d for CTL, LO2, LO3, and LO4; respectively). Production of FCM (26.5 kg/d) was not changed by LO supplementation. Feed efficiency (kg of FCM/kg of DMI) was linearly improved by LO addition (1.33, 1.38, 1.45, and 1.46 for CTL, LO2, LO3, and LO4; respectively). Milk contents of fat (3.78%) and lactose (4.70%) were not changed by LO supplementation. However, milk protein content was lower for LO diets vs. CTL and linearly decreased with LO addition (3.41, 3.33, 3.29, and 3.22% for CTL, LO2, LO3, and LO4; respectively). Somatic cell counts were lower with LO diets vs. CTL and tended (P=0.06) to linearly decrease with LO addition (22, 14, 15, and 14 × 10^3/mL for CTL, LO2, LO3, and LO4; respectively). Supplementation with LO had no effect on milk yields of fat (1.04 kg/d) and protein (0.90 kg/d). However, milk yield of lactose was lower with CTL vs. LO diets and linearly increased with LO supplementation (1.20, 1.28, 1.28, 1.39 kg/d for CTL, LO2, LO3, and LO4; respectively). Results from this study showed that supplementing dairy cow diets with LO at 2, 3, or 4% of dietary DM had no effect on nutrient digestibility, milk fat percentage and yield, but decreased milk protein concentration without affecting milk protein yield.

Key Words: Linseed Oil, Nutrients Digestion, Milk Composition

T210 Effects of increasing amounts of linseed oil on ruminal fermentation, protozoa counts, and forage in situ ruminal degradation in dairy cows. C. Benchaar*[1], M. Eugène[1], C. Côrtes[1], A. V. Chaves[1], H. V. Petit[1], T. A. McAllister[2], A. D. Iwaasa[3], and P. Y. Chouinard[4], [1]*Agriculture and Agri-Food Canada*, *Dairy and Swine Research and Development Centre, Sherbrooke, Quebec, Canada*, [2]*Agriculture and Agri-Food Canada*, *Lethbridge, Alberta, Canada*, [3]*Agriculture and Agri-Food Canada*, *Semiarid Prairie Agricultural Research Centre, Swift Current, Saskatchewan, Canada*, [4]*Laval University*, *Quebec, Quebec, Canada*.

The objective of this study was to examine the effects of increasing amounts of linseed oil (LO) supplementation on ruminal fermentation characteristics, protozoa counts and forage in situ ruminal degradation

in dairy cows. Four ruminally cannulated lactating cows (BW=566 kg, DIM= 52 d) used in a 4×4 Latin square design were fed a control TMR (**CTL**) or a TMR supplemented (DM basis) with LO at 2% (**LO2**), 3% (**LO3**), or 4% (**LO4**). Preplanned contrasts (PROC MIXED, SAS) were: LO vs. CTL, and linear and quadratic effects of LO supplementation. Significance was declared at $P < 0.05$. Ruminal pH (6.35), ammonia-N (12.04 m*M*) and total VFA concentrations (139.1 m*M*) were not affected by LO addition. Supplementation with LO caused a quadratic change in acetate (A) proportion (61.9, 61.4, 61.2, and 62.3% for CTL, LO2, LO3, and LO4; respectively) and linearly decreased propionate (P) proportion (21.8, 21.8, 21.2, and 20.4% for CTL, LO2, LO3, and LO4; respectively). However, no change was observed in the proportions of A and P when LO diets were contrasted against CTL. Adding LO caused a quadratic increase in A:P ratio (2.88, 2.84, 2.91, and 3.07 for CTL, LO2, LO3, and LO4; respectively), but no difference in A:P was observed when LO diets were contrasted against CTL. Butyrate proportion was lower with CTL vs. LO diets and linearly increased with LO supplementation (12.2, 12.5, 13.1, and 13.0% for CTL, LO2, LO3, and LO4; respectively). Rate of ruminal degradation of DM of timothy hay was lower with LO diets vs. CTL and linearly decreased with LO addition (4.5, 3.8, 3.7, and 2.8 %/h for CTL, LO2, LO3, and LO4; respectively). Consequently, effective degradability of DM was also lower with LO diets vs. CTL and linearly decreased with the addition of LO to the diet (51.5, 50.3, 51.2, and 48.4% for CTL, LO2, LO3, and LO4; respectively). Total protozoa numbers (10.5×10^5/mL) were not affected by LO addition. This study showed that supplementing dairy cow diets with LO at 2, 3, or 4% of dietary DM resulted in increased A:P ratio, decreased ruminal degradability of DM, but had no effect on total protozoa numbers.

Key Words: Linseed, Dairy Cow, Ruminal Fermentation

T211 The effects of long-term lipid supplementation on milk production traits and metabolic profile in dairy goats. G. Battacone*[1], A. Nudda[1], P. Nicolussi[2], A. H. D. Francesconi[1], P. Bonelli[2], and G. Pulina[1,3], [1]*Dipartimento di Scienze Zootecniche, University of Sassari, Italy*, [2]*Istituto Zooprofilattico Sperimentale della Sardegna, Sassari, Italy*, [3]*AGRIS Sardegna, Olmedo Loc. Bonassai, Sassari, Italy*.

The use of lipid supplements to alter the fatty acid composition of ruminant dairy products has increased lately. Since these supplements have a high net energy value, they can influence the production traits of animals and increase their hepatic activity. This work aimed to evaluate the effects of long-term lipid supplementation on milk yield, milk composition and blood metabolic profile in dairy goats. Forty crossbreed dairy goats were divided into 2 iso-productive groups: one was fed the control diet (CON) and the other group was supplemented with 200 g of extruded linseed (LIN), which supplied 70 g of fat per day per head. The trial lasted 8 weeks. Once a week milk yield was recorded and milk samples were collected. Every two weeks blood samples were collected and analyzed for total bilirubin, creatinine, glutamic oxaloacetic transaminase, glutamic pyruvic transaminase, gamma glutamyl transpeptidase, alkaline phosphatase, total protein and urea nitrogen. Milk yield was about 15% higher in the LIN group than in the CON group (2369 vs. 2049 g/d; P<0.01). LIN supplement increased milk fat content (3.77 vs. 3.33%; P<0.01) and protein content (3.1 vs. 2.9%; P<0.01) content compared to the CON group. The milk fatty acid profile was markedly influenced by lipid supplementation.
The blood parameters evidenced a significantly higher glutamic oxaloacetic transaminase and glutamic pyruvic transaminase activity in goats supplemented with fat than in the control. These data suggest that dairy goats fed the studied dose of lipid supplement for a long-term period might have had their hepatic metabolic activity increased compared with goats fed no lipid.
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Key Words: Dairy Goat, Fat Supplementation, Serum Parameters

T212 Effects of feeding whole linseed to Lacaune dairy ewes on lactational performances and CLA and N3 fatty acids content of the milk. R. Casals, M. V. Pol, E. Albanell, X. Such, M. A. Bouattour*, and G. Caja, *Universitat Autònoma de Barcelona*, *Bellaterra, Spain*.

This study was performed to investigate in dairy ewes the effects of feeding whole linseed (WLS) on dairy performances and milk fatty acids (FA) profile, particularly conjugated linoleic acid (CLA) and n3 FA. A total of 24 Lacaune dairy ewes were blocked in 2 pens of 12 animals, and used in a cross-over design with 2 periods of 21 days each. Treatments were: 1) C (control); 2) WLS (8.0% of total DM). Diets consisted of 52% forage (dehydrated whole plant corn and dehydrated alfalfa, 1/1) and 48% concentrate. Diets were isonitrogenous (16% CP) but with different EE (C: 1.5; WLS 3.5%). The addition of WLS had no effect on dry matter intake (3.6 kg/d) and milk yield (2.26 L/d), but increased (P < 0.001) milk fat content (6.0 vs. 6.9%) and yield (135 vs. 154 g/d). Milk protein (5.7%) and casein (4.4%) contents remained unchanged. Milk fatty acids composition was widely modified by the treatment, since short (19.3 vs. 14.8 mg/100 mg of total FA) and medium chain FA (55.3 vs. 41.1) were decreased, while long chain FA (25.1 vs. 43.8) were increased (P < 0.001). The milk from ewes receiving WLS had less saturated FA (80.3 vs. 68.2) content and more unsaturated fatty acids (19.3 vs. 31.7), being increased (P < 0.001) both MUFA (17.9 vs. 27.9) and PUFA (1.6 vs. 3.8). The enhanced milk fat quality was also evident trough the higher amounts of n3 FA (0.6 vs. 2.1, P < 0.001), trans vaccenic acid (0.8 vs. 1.6, P < 0.01) and CLA (0.6 vs. 1.0, P < 0.01) and the lower atherogenicity index (4.9 vs. 2.3, P < 0.001). In conclusion, feeding WLS to dairy ewes is a useful way to obtain milk with a healthier profile of FA.

Key Words: Dairy Sheep, Linseed, Fatty Acids

T213 Effects of high oil corn (HOC) grain supplementation on milk production and plasma metabolites in grazing dairy cows. F. Luparia, D. A. Garciarena, C. A. Cangiano, and G. A. Gagliostro*, *Instituto Nacional de Tecnología Agropecuaria, INTA*, *Balcarce, Buenos Aires, Argentina*.

The effect of HOC (6.6% ether extract) vs conventional corn (CC, 2.25% ether extract) was evaluated in 44 Holstein cows in early lactation in a 2 x 2 factorial arrangement of two levels (4 and 8 kg/cow/d) and two genotypes of corn grain. During the first 17 days of lactation, cows were fed pasture ad-libitum , 4 kg/d of CC corn grain, 2 kg/d soybean meal and 0.2 kg/d of a mineral-vitamin premix. After a covariate period (8 to 17 DIM), herbage allowance was fixed at 11 and 17 kg pasture DM/cow/d for treatments with 8 and 4 kg of grain respectively. Supplements were thoroughly consumed by cows. Pasture intake averaged 12.2 and 9.1 kg DM/cow/d when cows consumed 4 and 8 kg of grain respectively. After 3 adaptation weeks, milk production was recorded daily and milk composition was measured two days a week during 6 additional weeks. Body weight (BW) and body condition score (BCS) were recorded weekly. Blood was sampled at 10, 40 and 70 days postpartum. Data were analyzed as a completely randomized design with repeated measures adjusted by covariate. Milk yield (22.8 kg/d) and FCM (19.9 kg/d) did not differ (P>0.05). Milk composition was not affected by level of corn grain. HOC increased (P<0.01) milk fat content (32.5 vs 30.3 g/kg). Milk protein content was numerically increased (P<0.18) with HOC feeding (32.1 vs 31.3 g/kg). The efficiency of milk to cheese yield (kg of cheese/100 kg milk) was significantly (P<0.02) improved by HOC (9.04 vs. 8.69). Milk fat (0.715 kg/d) and milk protein yields (0.723 kg/d), changes in BW gain (0.51 Kg/d) and in BCS (-0.025) did not differ. Plasma concentrations of glucose (60.8 mg/dL), urea (22.8 mg/dL), triacylglycerides (214 mg/dl), cholesterol (124 mg/dl), NEFA (606 meq/L), insulin (0.9 ng/ml) and IGF-1 (211.7 ng/ml) where not affected by corn level or genotype. In spring pastures milk production was not affected by corn level or genotype but HOC improved fat and protein concentration and the efficiency of milk to yield cheese.

Key Words: High Oil Corn, Milk Composition, Grazing Dairy Cows

T214 Effects of high oil corn (HOC) on milk fatty acid composition in grazing dairy cows in early lactation. F. Luparia[1], P. Pellegrini[2], A. Rodríguez[1], D. A. Garciarena[2], and G. A. Gagliostro*[1], [1]*Instituto Nacional de Tecnología Agropecuaria, INTA*, *Balcarce, Buenos Aires, Argentina*, [2]*Instituto Nacional de Tecnología Industrial, INTI*, *Buenos Aires, Argentina*.

The effect of high oil corn (HOC, 6.6% ether extract) vs conventional corn (CC, 2.25 % ether extract) on milk fatty acid (FA) composition was evaluated in 44 Holstein cows in early lactation in a 2 × 2 factorial arrangement of two levels (4 and 8 kg/cow/d) and two genotypes of corn grain.

During the first 17 days of lactation, cows were fed pasture ad-libitum, 4 kg/d of CC, 2 kg/d soybean meal and 0.2 kg/d of a mineral-vitamin premix. From day 17 postpartum, herbage allowance was 11 and 17 kg pasture DM/cow/d for treatments with 8 and 4 kg of grain respectively. Supplements were thoroughly consumed by cows. Pasture intake averaged 12.2 and 9.1 kg DM/cow/d when cows consumed 4 and 8 kg of grain respectively. At day 40 postpartum, milk FA composition was determined by GLC. The model used included corn genotype, corn level and interaction. Significant genotype x corn level interaction was not detected. The concentration of short (4.09 g/100g FA), medium (37.81) and long chain (50.26) FAs were not affected. The concentration (g/100g FA) of the hypercholesterolemic fraction of milk fat (C12:0, 2.01; C14:0, 7.84 and C16:0, 22.97) and the atherogenicity index of milk (1.66) were not affected. Concentration of vaccenic acid (VA, trans-11 C18:1) in milk fat resulted higher (P<0.01) when cows consumed 4 kg/d (3.17 g/100g FA) instead of 8 kg/d of corn grain (2.78 g/100g FA). Conjugated linoleic acid (CLA, 9c, 11t C18:2) tended (P<0.08) to be higher when cows consumed 4 kg/d (1.03 g/100g FA) instead of 8 kg/d (0.94 g/100g FA) of corn grain. The higher concentration of VA (+ 0.39 g/100 g FA) and cis-9, trans-11 C18:2 (+ 0.09 g/100 g FA) at the lower level of corn grain were probably explained by the higher pasture intake and pasture/corn grain ratio in the total diet. Supplementary HOC feeding did not induce changes in milk fatty acid profile of grazing dairy cows when pasture intake represented 50.1 to 69.5 % of total DMI.

Key Words: High Oil Corn, Conjugated Linoleic Acid, Grazing Dairy Cows

T215 Effects of dietary docosahexaenoic acid and free linoleic acid supplementation on fatty acid ratio in milk fat from dairy cows. S. J. Liu, J. Q. Wang*, D. P. Bu, S. Liang, L. Liu, H. Y. Wei, and L. Y. Zhou, *State Key Laboratory of Animal Nutrition, Institute of Animal Science, Chinese Academy of Agricultural Sciences*, *Beijing, China*.

The objective of this study was to evaluate fatty acid ratio in milk and milk composition from dairy cows supplemented with dietary docosahexaenoic acid (DHA) and free linoleic acid (LA). Four dairy cows with ruminal, ileac and duodenal fistulas were randomly assigned to control (CK, without additional oil supplement) or basal diet with 2.45% LA (LA), 2.45% LA plus 0.45% DHA (LA + DHA) and 0.45% DHA (DHA) in a 4 × 4 Latin square with 12-wk durational periods. Milk samples were collected on d 20 and d 21 of each experimental period and pooled for each animal. Pooled milk samples were analyzed milk composition and milk fatty acid profiles. Separation of fatty acids was achieved by gas chromatography. All data were analyzed using the MIXED procedure of SAS 8.2. The significance was declared at p < 0.05. Compared with CK, milk yield and milk fat content decreased when DHA was supplemented, but they did not differ among four treatments ($P > 0.05$). Tricosanoic acid content of milk fat in DHA treatment increased, while total saturated fatty acid concentration did not change. In contrast to CK, total polyunsaturated fatty acid was improved by 100% in milk fat from combinational addition of LA and DHA ($P < 0.05$). In addition, saturated fatty acids to unsaturated fatty acids ratio in milk fat decreased (P < 0.05) from 3.18 in CK to 1.24 in LA treatment, while monounsaturated to polyunsaturated fatty acid ratio decreased ($P < 0.05$) from 5.94 in CK to 3.00 in DHA treatment. Taking together, our study indicated that fatty acid ratio was changed by dietary LA and DHA supplementation.

Key Words: Docosahexaenoic Acid, Free Linoleic Acid, Milk Fat

T216 Effects of rumen-protected fat feeding on glucose metabolism in high-yielding dairy cows. H. M. Hammon*, A. K. Langhof, K. Duske, F. Schneider, and C. C. Metges, *Research Institute for the Biology of Farm Animals (FBN)*, *Dummerstorf, Germany*.

In dairy cows, feeding rumen-protected fat (RPF) influences milk production by increasing dietary energy density but at the same time, affects glucose metabolism. As glucose availability is important for milk production, the present study has investigated effects of RPF feeding on glucose metabolism in high-yielding dairy cows. Dairy cows (98 DIM; 2nd lactation) were fed for four weeks either a diet containing 5.6 % RPF with Ca-soaps mainly of C16:0 and C18:1 (F) or a control diet (C) based on corn starch (n=9 per group). Feed intake and milk yield were measured daily. Blood samples were taken once a week to measure plasma triglyceride (TG), NEFA, glucose, insulin, and glucagon concentrations and during a glucose tolerance test (GTT; 1 g/kg $BW^{0.75}$ i.v.) after 12 h without food at the end of the study. Areas under the concentration curves for glucose and insulin were calculated. After slaughtering, liver samples were collected for quantification of mRNA levels of pyruvate carboxylase (EC 6.4.1.1), cytosolic phosphoenolpyruvate carboxykinase (EC 4.1.1.32), and glucose 6-phosphatase (G6-Pase; EC 3.1.3.9) by real-time RT-PCR. Data were analyzed using the Mixed Model or GLM of SAS, respectively, with diet and time or only diet as fixed effects. DMI, but not energy intake was slightly lower (P < 0.05) in F than C and plasma concentrations of TG and NEFA were higher (P < 0.05) in F than C. Plasma insulin concentrations decreased (P < 0.05), but the glucagon to insulin ratio increased with RPF-feeding.

During GTT, basal glucose concentrations were lower ($P < 0.05$) and basal glucagon concentrations tended to be higher ($P < 0.1$) in F than C. Hepatic mRNA levels of G6-Pase mRNA were lower ($P < 0.05$) in F than C and were positively related ($P < 0.01$) to basal plasma glucose. Feeding RPF did not affect milk yield, but reduced basal plasma glucose and hepatic gene expression of G6-Pase that might affect glucose availability for milk production.

Key Words: Dairy Cow, Fat Feeding, Glucose Metabolism

T217 Feeding rumen-protected fat (RPF) during the dry period: Effects on milk production and glucose metabolism in high-yielding dairy cows. H. M. Hammon*, K. Duske, A. K. Langhof, F. Schneider, H. M. Seyfert, and C. C. Metges, *Research Institute for the Biology of Farm Animals (FBN)*, *Dummerstorf, Germany*.

The objective of the study was to determine effects of rumen-protected fat (RPF) in diets during late lactation and dry period on milk production and glucose metabolism after parturition in high-yielding dairy cows. Cows (n=18) were divided into 2 feeding groups 12 wk before expected calving and were fed either starch-based control diets (SD) or diets containing 3 – 5% RPF (FD) during late lactation (wk -12 to -9) and during far-off (wk -8 to -4) and close-up (wk -3 to -1) dry period. Diets were calculated to be isonitrogenous and isoenergetic. After parturition, all cows received a starch-based diet up to 98 DIM. Feed intake and milk yield were recorded daily. Plasma concentrations of glucose, NEFA, insulin, and glucagon were measured in blood samples taken at selected d before and after calving. Liver biopsies were taken 10 d before and at 1, 10, 28, and 95 d after calving to measure glycogen and fat content and mRNA levels of pyruvate carboxylase (PC, EC 6.4.1.1), cytosolic phosphoenolpyruvate carboxykinase (PEPCK; EC 4.1.1.32) and glucose 6-phosphatase (G6-Pase; EC 3.1.3.9). Data were analyzed by the Mixed Model of SAS with diet and time as fixed effects. DMI was higher ($P < 0.05$) during the far-off period in SD than FD. Milk yield was higher ($P < 0.05$) in SD than FD. Plasma glucose concentrations were lower ($P < 0.05$) in FD than SD during transition to lactation. Plasma glucagon tended to be higher ($P < 0.1$) in FD than SD before parturition. In liver, glycogen content decreased and fat content as well as PC, PEPCK and G6-Pase mRNA levels increased with onset of lactation, irrespective of prepartum feeding. PC mRNA levels were positively related to fat, but negatively related to glycogen content ($P < 0.05$, resp.). Feeding RPF during the dry period decreases milk yield and plasma glucose around parturition, but barely affect hormonal levels as well as hepatic glucose and lipid metabolism.

Key Words: Dairy Cow, Prepartum Feeding, Glucose Metabolism

T218 Influence of sunflower oil supplementation on milk conjugated linoleic acid and mammary tissue stearoyl-CoA desaturase, lipoprotein lipase, and acetyl-CoA carboxylase gene expression in Xinong Saanen goats. D. P. Bu[1], J. Q. Wang*[1], H. Y. Wei[1], L. Y. Zhou[1], and J. J. Loor[2], [1]*Institute of Animal Science, Chinese Academy of Agriculture Sciences; State Key Laboratory of Animal Nutrition*, *Beijing, China*, [2]*University of Illinois*, *Urbana*.

This study examined the effect of supplemental sunflower oil (SFO) on milk fat trans-11-18:1 (vaccenic acid; VA) and cis-9 trans-11 conjugated linoleic acid (CLA) concentration and mRNA expression of stearoyl-CoA desaturase (*SCD*), lipoprotein lipase (*LPL*), and acetyl-CoA carboxylase (*ACACA*) in mammary tissue from lactating goats. Twelve Xinong Saanen goats (36 ± 3 DIM) were fed a basal diet (CTL, 50:50 forage:concentrate) or CTL supplemented with 4% SFO in a cross-over design with 4 wk experimental periods. Mammary percutaneous biopsies were collected on d 27 of each experimental period. DMI (1.76 vs 1.84 kg/d) and milk yield (1.35 vs 1.63 kg/d) were greater ($P < 0.05$) with SFO. However, SFO resulted in lower ($P < 0.05$) milk fat % (3.70% vs. 4.33%). Concentrations of VA (1.7% to 5.7% of total fatty acids) and cis-9 trans-11 CLA (0.55% to 1.4%) in milk fat increased by ~3-fold due to feeding SFO. The mRNA abundance of *LPL* and *ACACA* in mammary tissue was 75% and 60% greater ($P < 0.05$) with SFO but *SCD* mRNA was 26% lower ($P < 0.05$). Increased supply of dietary lipid might explain greater *LPL* mRNA in mammary from goats fed SFO. Ruminal biohydrogenation of SFO likely resulted in production of trans-18:1 and/or CLA isomers that might have reduced *SCD* mRNA abundance. Despite the negative effect on *SCD* by supplemental SFO, greater supply of VA ensured that cis-9,trans-11-CLA synthesis in mammary tissue increased.

Key Words: Lactation, Milk Fat, Lipogenesis

T219 Feed intake, apparent digestibility, and milk composition of dairy cows fed whole flaxseed or/and Ca–salts of flaxseed oil. C. Côrtes*[1], D. C. Silva[1,2], R. Kazama[1,2], N. Gagnon[1], C. Benchaar[1], G. T. Santos[2], L. M. Zeoula[2], and H. V. Petit[1], [1]*Agriculture and Agri-Food Canada*, *Sherbrooke, Quebec, Canada*, [2]*Universidade Estadual de Maringá Brazil and CNPq Brazil*, *Maringá, Paraná, Brazil*.

The objective of this study was to examine the effects of dietary whole flaxseed and Ca–salts of flaxseed oil on feed intake, apparent digestibility, and milk composition of dairy cows. Four lactating Holstein cows (BW = 602 kg; DIM = 64 d) fitted with ruminal cannulae were used in a 4 x 4 Latin square. Each experimental period consisted of 21 d of adaptation and 7 d of data collection. Cows were milked twice a day at 0730 and 1930 h. All cows were fed twice daily (0830 and 1530 h) for ad libitum intake (10% refusals). Four total mixed rations were formulated and contained no flaxseed product (CO), 5% (DM basis) whole flaxseed (WF), 2% Ca–salts of flaxseed oil (CF), or a mixture of 2.5% whole flaxseed and 1% Ca–salts of flaxseed oil (MF). Dry matter intake, apparent digestibility of DM, and milk composition were analyzed using the MIXED procedure of SAS. Tukey–Kramer multiple–comparison test was applied to separate means. Significance was declared at $P < 0.05$. Dry matter intake (DMI) and apparent digestibility of DM (DMD) were not affected by treatments. Milk yield and milk concentrations of fat and lactose were similar among treatments. Milk protein percentage tended ($P = 0.09$) to be higher for cows fed WF than for those fed CF (3.32% vs. 3.17%), however milk protein yield was similar ($P = 0.15$). This study suggests that feeding whole flaxseed or/and Ca–salts of flaxseed oil have no negative effect on cow performance.

Table 1.

	CO	WF	CF	MF	SEM	*P–value*
DMI, kg/d	22.1	22.7	21.6	21.5	0.42	0.32
DMD, %	64.7	64.1	65.5	65.2	0.59	0.47
Milk yield, kg/d	31.5	32.6	32.5	32.3	0.45	0.42
Milk fat, %	3.00	2.71	2.32	2.67	0.223	0.37
Milk protein, %	3.32	3.36	3.17	3.26	0.034	0.09
Milk lactose, %	4.74	4.79	4.80	4.80	0.028	0.54

Key Words: Dairy Cows, Flax Product, Milk/Digestibility

T220 Effect of dietary flax products on concentration of the mammalian flax lignan, enterolactone, in ruminal fluid, plasma, milk, and urine of dairy cows. N. Gagnon*[1], C. Côrtes[1], D. C. da Silva[1,2], R. Kazama[1,2], G. T. dos Santos[2], L. M. Zeoula[2], and H. V. Petit[1], [1]*Agriculture and Agri-Food, Sherbrooke, QC, Canada*, [2]*Universidade Estadual de Maringá, Brazil, CNPq Brazil*.

Four rumen fistulated lactating Holstein cows were used in a 4 × 4 Latin square design to study the effects of dietary addition of flax products on concentration of the mammalian lignan, enterolactone (EL) in ruminal fluid, urine, plasma, and milk. All cows were fed the same diet for ad libitum intake. Flax hulls (1800 g/d) and flax oil (400 g/d) were placed in the rumen three times daily and/or infused for 23 h a day in the abomasum. Treatments were: 1) oil and hulls placed in the rumen + abomasal infusion of water (RUM); 2) oil and hulls infused in the abomasum (ABO); 3) oil infused in the abomasum and hulls placed in the rumen (ABORUM); and 4) oil placed in the rumen + hulls infused in the abomasum (RUMABO). Water was the carrier for infusion of hulls (ABO and RUMABO) and the same amount of water was infused in the abomasum when hulls were placed in the rumen (RUM and ABORUM). Experimental periods consisted of 21 d with 15 d of adaptation. Milk samples were collected twice daily from d 16 to 20 and pooled for lignan assay. Blood was withdrawn from the jugular vein 6 h postfeeding on d 20. Rumen contents were sampled on d 21 at 0, 2, 4, and 6 h after the morning meal and urine samples were taken 2 h postfeeding. Concentration of EL in ruminal fluid was determined at 0 h (baseline) and on samples pooled for 2, 4, and 6 h. Concentrations of EL in urine ($p < 0.001$), milk ($p = 0.001$), and plasma ($p = 0.04$) were significantly higher when hulls were placed in the rumen than when they were infused in the abomasum. Adding flax oil in the rumen or abomasum had no effect on EL concentrations in urine, milk, blood, and rumen. This study suggests that the rumen plays an important role in the metabolism of flax lignans and that urine and milk are good indicators of the mammalian lignan, EL, metabolism in dairy cows fed flax products.

Key Words: Enterolactone, Rumen, EIA

T221 Effect of four levels of lauric acid on ruminal protozoa, milk production and composition in dairy cows. A. P. Faciola*[1], G. A. Broderick[2], A. N. Hristov[3], and J. A. Pires[1], [1]*University of Wisconsin, Madison*, [2]*U. S. Dairy Forage Research Center, Madison, WI*, [3]*Penn State University, University Park*.

Ruminal protozoa (RP) are the main contributors to bacterial protein turnover in the rumen; therefore, reducing RP may improve N utilization. Medium-chain saturated fatty acids such as lauric acid (C12:0) have been shown to suppress RP. We tested lauric acid (LA) as a practical defaunating agent and assessed the effects of partial defaunation on N utilization, fermentation patterns, nutrient digestibility, milk production and milk composition. Forty-eight Holstein cows (8 fitted with ruminal cannulae) were blocked by DIM into 12 blocks of four cows (2 blocks of cows with ruminal cannulas) and randomly assigned within blocks to four balanced 4 X 4 Latin square diet sequences. The basal diet contained (DM basis) 29% alfalfa silage, 36% corn silage, 7.5% high-moisture corn, 6% soybean meal, 8% dry molasses, 12% ground corn, vitamin and mineral premix, 15.5% CP and 30% NDF. Diets differed in LA content: A) zero, B) 240, C) 480, and D) 720g/d. Each experimental period consisted of 21d for adaptation plus 7d for data collection. Data were analyzed using proc mixed in SAS. The results are reported in the table below. LA was effective in reducing RP; however, it also decreased DMI. LA fed at 240 g/d did not reduce yield of milk or FCM; however, higher levels were detrimental to milk production and composition.

Table 1.

Item	A	B	C	D	SEM	P>F
DMI, kg/d	24.4a	22.7b	20.7c	18.6d	0.5	<0.01
Milk yield, kg/d	33.6a	32.7ab	31.3b	28.8c	1.0	<0.01
3.5% FCM, kg/d	34.7a	33.5a	29.8b	26.6c	1.0	<0.01
Fat, %	3.7a	3.7a	3.2b	3.2b	0.1	<0.01
Fat yield, kg/d	1.2a	1.2a	1.0b	0.9c	0.04	<0.01
Protein yield, kg/d	1.02a	0.95b	0.94b	0.84c	0.03	<0.01
Lactose, %	4.85a	4.75b	4.65c	4.56d	0.04	<0.01
SNF, %	8.84a	8.68b	8.62bc	8.55c	0.06	<0.01
SNF yield, kg/d	2.92a	2.75b	2.66b	2.34c	0.08	<0.01
MUN, mg/dL	13.79c	14.68b	16.01a	16.69a	0.29	<0.01
Protozoa, x 10^6 cells/ml	7.1a	5.1b	3.6c	2.5d	0.2	<0.01

Key Words: Lauric Acid, Protozoa, Dairy Cows

T222 Effects of differential supplementation of calcium salts of fatty acids (CSFAs) on dairy cows. F. T. Silvestre*, T. S. M. Carvalho, J. E. P. Santos, C. R. Staples, and W. W. Thatcher, *University of Florida*, *Gainesville*.

Effects of CSFAs (Virtus Nutrition) on milk yield (MY), cervical discharge (CD), metabolic status, pregnancy rates (PR) and losses (PL) at 1st and 2nd AI were evaluated. Cows were randomly allocated to diets at -27 days postpartum (dpp; PO [Palm oil, 47% C16:0] vs SO [Safflower oil, 64% C18:2n-6]) and fed until 30dpp when within each diet further allocated to either PO or FO (Fish oil, 11% of C20:5n-3 + C22:6n-3) and fed until 160dpp. CSFAs were fed at 1.5% of the diet. Contrasts were PO vs SO, PO vs FO and interaction. CD (clear/flacks, mucupurulent and purulent) was evaluated at 8dpp (n=1118). Plasma samples were collected 3x/weekly from 0 to 35dpp for metabolite measurements (n=32). At 43dpp cows initiated a presynch comprised of $PGF_{2\alpha}$ 14d apart, followed by Ovsynch 14d later for 1st AI. All cows received a CIDR device at 18d after 1st AI, followed in 7d by CIDR removal and GnRH injection. At 32d after 1st AI, cows were ultrasounded (US) for pregnancy. Non-pregnant cows received $PGF_{2\alpha}$, GnRH 56h later, a 2nd AI at 72h, and US at 32d after 2nd AI. PL was evaluated at 60d of pregnancy. Plasma progesterone at 2nd $PGF_{2\alpha}$ and

start of Ovsynch determined cyclicity. Plasma NEFAs, BHBA, glucose, BUN, and frequency of CD did not differ between PO and SO cows. Cyclicity was not affected by diets (80%, n=1117). PR for 1st AI at 32d (37.4%, n=1055) and 60d (33.3%, n=1048) was not affected by diets, but PL was lesser (P<0.05) in FO (6.3%, n=190) vs. PO (13.6%, n=198). PR for 2nd AI was higher at 32d (P<0.05) and 60d (P<0.05) in FO (36.9% [n=295], 34.4% [n=293]) vs. PO (27% [n=309], 23.7% [n=303]), respectively; PL was not affected by diets (6.5%, n=185). Overall PR was 54.5% (n=1084) at 32d and higher (P<0.05) at 60d in the FO (52.8%, n=528) vs. PO (45.4%, n=541). Overall PL was lesser (P<0.05) in FO (6%, n=297) vs. PO (12%, n=279). Monthly MY was greater (P<0.02) in SO (41.9kg, n=532) vs. PO (41.2kg, n=534). Feeding differential CSFAs during transition and breeding periods can benefit fertility and milk production of dairy cows.

Key Words: Fatty Acids, Reproduction, Milk Yield

T223 Effects of rumen protected CLA supplemented to dairy cows in late pregnancy and early lactation on milk yield and some milk features. G. Bertoni*, E. Trevisi, M. G. Maianti, and A. Gubbiotti, *Istituto Di Zootecnica, Universita' Cattolica Del Sacro Cuore, Piacenza, Italy*.

Dairy cows in the transition period suffer for the negative energy balance (NEB), which causes some metabolic diseases, as well as lower fertility. Conjugated linoleic acid (CLA) is quoted to reduce milk fat content and therefore the energy output that could alleviate the NEB. Nevertheless, the great change of milk composition could have some consequences on the creaming activity and overall on the cheese making traits, both of great importance in Italy. To evaluate the effects of CLA on milk traits, 8 dry cows (kept in a tied barn) were divided in two homogeneous groups receiving 20 g/d of rumen protected CLA (equivalent to 100 g of Luta-CLA® 20P, BASF, Germany) or 100 g/d of a mixture of rumen protected fats. Supplementation began approximately 30 days before calving and lasted 28 days after it. Besides daily milk yield, morning milk samples were taken two times a week for the first 3 months of lactation. Milk yield was numerically lower (45 vs 47 kg/d at 28th DIM) in the CLA cows, but the main results during the first month of lactation are those regarding milk composition and its technological traits: CLA has reduced milk fat content (2.8 vs 3.6%, P<0.05 at 28th DIM) and its creaming activity (61 vs 68%, N.S., average of 3rd and 4th week). On the contrary, the milk protein content of CLA supplemented cows was slightly higher and the curd firmness was increased (26 vs 21 mm, N.S., average of 3rd and 4th week) despite a similar clotting time. It is worthwhile that one-two weeks after the end of CLA supplementation, the above differences disappeared. The overall results suggest that CLA feeding at the end of pregnancy and in first month of lactation can contribute to lower the milk energy output. Nevertheless, the reduction of milk fat content could impair the fat creaming activity, which is essential for some typical cheeses (i.e. parmesan), although the short period of CLA use could minimize the risk.

Key Words: Conjugated Linoleic Acid, Milk Traits, Transition Period

T224 Energy balance indexes and blood changes of dairy cows supplemented with rumen protected CLA in late pregnancy and early lactation. E. Trevisi*, A. Ferrari, F. Piccioli-Cappelli, and G. Bertoni, *Istituto Di Zootecnica, Universita' Cattolica Del Sacro Cuore, Piacenza, Italy*.

Transition dairy cows suffer for the negative energy balance (NEB) and for inflammatory-like conditions. Both can negatively affect DMI and incidence of metabolic diseases as well as fertility. Conjugated linoleic acid (CLA) is quoted to reduce milk fat content and hence the severity of NEB, but also to attenuate inflammatory phenomena. To evaluate the effects of CLA on DMI, BCS and metabolic profile in the transition period, 8 dry cows (kept in a tied barn) were divided in two homogeneous groups receiving 20 g/d of rumen protected CLA (equivalent to 100 g of Luta-CLA® 20P, BASF, Germany) or 100 g/d of a mixture of rumen protected fats (CTR). Supplementation began approximately 30 days before calving and lasted 28 days after it. Besides health status, daily DMI and milk yield, cows were checked weekly for body weight and BCS. Moreover, blood samples were taken two times a week when dry and for the first 90 days in milk (DIM), but daily 10 days before and after calving. The results suggest that a supplement of CLA improves the blood indexes of energy metabolism: glucose, NEFA and BHB (0.8 vs 1.6 mmol/l of CTR at 1-5 DIM; P<0.01). Moreover, it reduce the urea level, lower at 23-27 DIM (4.0 vs 5.2 mmol/l; P<0.1). The consequences of inflammatory conditions, that typically occur at calving time, appear also smaller after calving: e.g. CLA cows have showed higher levels of some negative acute phase proteins like lipoprotein as cholesterol (5.0 vs 4.3 mmol/l, P<0.05 at 20-30 DIM), albumin (36.3 vs 34.4 g/l, P<0.1 in the first 28 DIM) and thiol groups (less important reduction after calving). These changes agree with some other results: slightly lower rectal temperature around calving, higher DMI (19.3 vs 18.2 kg/d on average in first 28 DIM) and slightly lower reduction of body weight and BCS (0.29 vs 0.37 points). Thus CLA supplementation seems to improve some aspects of dairy cows transition: e.g. energy balance and inflammatory conditions.

Key Words: Conjugated Linoleic Acid, Blood Indexes, Transition Period

T225 Effect of different levels of fish oil and canola oil on milk production and composition of high producing Holstein dairy cows in early lactation. T. Vafa*, A. Naserian, A. Heravi Moussavi, M. Danesh Mesgaran, and R. Valizadeh, *Ferdowsi University of Mashhad, Mashhad, Khorasan Razavi, Iran*.

The aim of this study was to evaluate the effect of different levels of canola oil or/and fish oil supplementation on dry matter intake (DMI), and milk production and composition in early lactating Holstein dairy cows. Eight multiparous early lactation Holstein cows (42±12 DIM, 40±6 kg daily milk yield) were fed a total mixed ration supplemented with either 0% oil (Control), 2% canola oil (CO), 2% fish oil (FO), or 1% canola oil + 1% fish oil (CoFo), according to a double 4 × 4 Latin square design. Each period lasted 3 wk; experimental analyses were restricted to the last week of each period. Diets were formulated to be isonitrogenous using NRC 2001. Cows were housed in tie stalls and fed the TMR two times a day to allow 5 to 10% orts (as-fed basis). Cows were milked 3 times per day and yields were recorded. Milk samples were collected from each milking on 1 d per wk and composited for analysis of fat, protein, and lactose. Data were analyzed as a replicated 4 × 4 Latin square using the GLM procedure of SAS (2001). The model included effects caused by diet, period, and cow. Least squares means are reported throughout, and significance was declared at $P < 0.05$. Diet had no effect on DMI (24.92, 25.60, 23.70, and 25.84 ± 0.79 kg/d; for control, CO, FO, and CoFo, respectively). Milk production was similar among the groups (34.41, 34.15, 32.93, and 34.55 ± 0.84 kg/d, respectively). Milk fat content (2.87, 2.70, 2.45, and 2.89 ± 0.21%, respectively), milk protein content (2.88, 2.86,2.92, and 2.89 ± 0.07%, respectively), and milk lactose content were all similar among the diets. The results of this study demonstrated that the canola oil or/and fish oil supplementation in the diet of early lactation cows had no apparent effect on the DMI, and milk production and composition.

Key Words: Dairy Cow, Canola Oil, Fish Oil

T226 Effects of degree of unsaturation of supplemental dietary fat on ruminal fermentation, nitrogen metabolism, and urea nitrogen recycling in dairy cows. T. Mutsvangwa*, G. N. Gozho, and D. Kiran, *University of Saskatchewan, Saskatoon, Saskatchewan, Canada*.

The objective of this study was to evaluate the effects of degree of unsaturation of supplemental dietary fat on ruminal fermentation, nitrogen metabolism, and urea-N recycling. Four Holstein cows (693 kg BW; 92 DIM) with ruminal cannulae were used in a 4 x 4 Latin square design with 21-d periods. Dietary treatments contained 0% supplemental fat (control), 3.52% canola oil, 3.52% tallow, and 1.76% canola oil + 1.76% tallow. Diets were offered twice per day as TMR made up of 55% forage and 45% barley-based concentrate. Nitrogen balance was measured from d 16 to d 20, with concurrent measurements of urea-N kinetics using a single dose intra-jugular infusion of [$^{15}N^{15}N$]-urea on d 16. Dry matter intake, milk yield and milk composition were not affected by fat supplementation; however, milk fat content tended to be lower (P = 0.10) for cows fed canola oil. Ruminal protozoa were 2.63 x 10^5, 2.75 x 10^5, 3.72 x 10^5, and 2.82 x 10^5 counts/ml for control, canola oil, tallow, and canola + tallow mixture, respectively. Protozoal counts were higher (P = 0.03) in cows receiving supplemental tallow compared to those fed the control diet. Ruminal pH, and concentrations of NH_3-N, and individual and total VFA were not affected by source of supplemental fat. Urea-N production (189.9, 178.4, 182.8, 182.3 g/d), and urea-N entering the GIT (185.3, 174.6, 180.0 177.8 g/d) were similar for the control, canola oil, tallow, and canola + tallow diets, respectively. Fractional urea-N transfers were unaffected by treatment. Results show that the source of supplemental fat did not affect protozoa counts or change ruminal fermentation patterns and, consequently, had no impact on urea-N recycling.

Key Words: Dairy Cow, Urea Kinetics, Nitrogen Metabolism

T227 Influence of dietary fats on hepatic gene expression in transition dairy goats. A. Agazzi[1], G. Invernizzi*[1], A. Campagnoli[1], M. Ferroni[1], A. Galmozzi[2], M. Crestani[2], and G. Savoini[1], [1]*Department of Veterinary Science and Technology for Food Safety, Milan, Italy*, [2]*Department of Pharmacological Sciences, Milan, Italy*.

The aim of the study was to evaluate the dietary fats influence on hepatic gene expression in transition dairy goats. Eighteen second parity alpine goats from wk 2 before to wk 3 after kidding were assigned to 1 of 3 dietary treatments: C (n=6) basal diet, FO (n=6) basal diet plus 47g/d of protected fish oil, PO (n=6) basal diet plus 47g/d of hydrogenated palm oil. Feed consumption, live body weight (BW), milk yield and composition were assessed weekly. Blood samples were collected on 15, 7, and 2d before, and 2, 7, 15, and 21d after kidding for ALAT, ASAT, NEFA, glucose, BHBA, and cholesterol content. Bioptic samples were obtained 7d before and 21d after kidding and analyzed for mRNA content of peroxisome proliferator-activated receptor-α (PPARα), carnitine palmitoyltransferase I (CPT1), long chain acyl-CoA synthetase (ACSL), very-long-chain acyl-CoA dehydrogenase (ACADVL), acetyl-CoA carboxylase (ACC1) and malonyl-CoA decarboxylase (MCD) by real time Q-PCR. Data were analyzed by a mixed procedure of SAS. No effects were observed on BW, plasma metabolites and milk composition. Milk yield was increased in PO vs. C (3.65kg/d, 2.42kg/d; P<0.05). Higher expression of CPT1 and ACADVL were detected in C vs. PO goats before kidding (P<0.05), while on day 21 PO increased PPARα expression as compared to C (P<0.05), and increased ACSL values as compared to C and FO animals (P<0.01). Hepatic gene expression in an intra-group analysis evidenced decreased values in C from pre to post kidding for ACADVL and ACSL (P<0.05), while ACSL was significantly decreased after kidding in FO subjects (P<0.05). No variations were evidenced in PO animals from dry period to lactation. Correlation analysis evidenced a negative feedback of PPARα on cholesterol plasma content by 42% (P=0.03). Results suggest different mechanism of action of dietary saturated and unsaturated fatty acids in transition goat on hepatic gene expression.

Key Words: Goat, Nutrigenomics, Liver

T228 Reproductive performance of cows fed rolled flaxseed on two commercial dairies. N. R. Bork*[1], G. P. Lardy[1], J. W. Schroeder[1], K. A. Vonnahme[1], P. M. Fricke[3], K. B. Koch[2], M. L. Bauer[1], and K. G. Odde[1], [1]*North Dakota State University, Fargo*, [2]*Northern Crops Institute, Fargo, ND, USA*, [3]*University of Wisconsin, Madison*.

The objective of this field trial was to study the effects of supplementing early lactation dairy cows with rolled flaxseed on reproduction. We hypothesized that fatty acids in flaxseed, namely C18:3n-3, may improve reproductive performance of dairy cows. Conducted on 2 commercial dairies with cows naive to flaxseed, treatments consisted of either their existing early lactation ration (CON; n = 252) or a similar ration, equal in protein, energy and fat, re-formulated with rolled flaxseed (FLX; n = 339; 0.85 kg DM/d). Cows were assigned randomly to treatment upon leaving the fresh pen (approximately 10 d postpartum) within parity (primiparous, P or multiparous, M; P-CON, M-CON, P-FLX, M-FLX). Statistical analysis for conception rate data included all cows in the study, and was performed using a mixed model. Cow was the experimental unit and data were analyzed as a split plot with pen being the whole plot error term (random term was treatment by parity by farm). Statistical analysis for other reproductive parameters including all pregnant cows was performed with a categorical model using logistical regression. First and second-service analysis included 1422 AI services. First-service conception rates did not differ (P = 0.27) among treatments (P-CON = 46.8 ± 4.0%; M-CON = 34.3 ± 3.1%; P-FLX = 41.1 ± 3.1%; M-FLX = 30.0 ± 2.8%). Treatment did not interact (P ≥ 0.27) with season of the year, breeding method (AI at estrus vs. Ovsynch and timed AI), or farm. Analysis of services per conception for pregnant cows (CON = 1.92 ± 0.12; FLX = 1.95 ± 0.12; P = 0.87), days to first insemination (CON = 76.6 ± 0.8; FLX = 73.9 ± 0.7; P = 0.11), and days open (CON = 113.5 ± 3.7; FLX = 109.9 ± 3.2; P = 0.53) included 591 cows and did not differ between treatments. We conclude that feeding 0.85 kg/d (DM basis) of flaxseed during early lactation does not affect reproductive performance of dairy cows.

Key Words: Flaxseed, Reproduction, Dairy Cows