trials to increased chop length. Crop processing of 19 mm TLC silage reduced eating time and mean particle size of silage and masticates.

Key Words: corn silage, mean particle size

1452 N-alkanes as markers for estimation of dry matter intake and diet composition in steers consuming all-forage or forage-concentrate diets. S.A. Moshtagh Nia*[1], K.M. Wittenberg[1], and W. Chen[2], [1]*University of Manitoba, Winnipeg, MB,* [2]*Agriculture and Agri-Food Canada, Brandon, MB.*

Eight Holstein steers weighing approximately 208 kg were assigned to four dietary treatments in a three period cross over design to compare the alkane-based and chromium/in vitro-based procedures with the total fecal collection technique relative to estimating of dry matter intake (DMI) and diet composition for forage or forage:concentrate based diets. The four dietary treatments were 1) pure meadow brome grass hay (B); 2) 1/2 B + 1/2 alfalfa hay (BA); 3) 1/2 B + 1/2 barley grain (BB); and 4) 1/4 B + 1/4 alfalfa hay + 1/2 barley grain (BAB). The two types of hay were chosen to achieve a wide range of hydrocarbon intake. Appropriate portions of forages and grain were mixed as a total mixed ration and fed in two equal portions twice daily at 2.5% of body weight. Two controlled release capsules, one containing n-alkanes (C_{32} and C_{36}) and other chromic oxide were placed into the steer reticulo-rumen by oral administration on day 1 of each period (30 days). Total fecal output was collected twice daily from day 8 to 14 of each period to establish the fecal recovery of chromium and the alkanes. Recovery of alkanes was also calculated by in-vitro digestion of individual feed samples. Fecal recovery of the natural alkanes, C_{31} and C_{33}, was low, ranging from 59.5 to 73.3%, whereas the range in fecal recovery of the dosed alkanes, C_{32} and C_{36}, was 83.3 to 95.5%, and of chromium was 82.7 to 95.8 across the diets. The estimated DMI was similar across all diets using the C_{31}/C_{32} and C_{33}/C_{32} alkanes; however, the estimated DMI using C_{31}/C_{32} was significantly ($P < 0.05$) lower compared to total collection or chromium/in-vitro methods. The use of least-squares to estimate ingredient proportions in the diet using n-alkanes is excellent when marker recovery values from total collection are used. Estimates of ingredient proportions in the diet were less reliable when in-vitro digestion was used for n-alkane recovery estimates.

Key Words: Alkanes, Chromium, Dry matter intake

1453 Estimation of forage intake of lactating dairy cows on pasture using n-alkanes. H. M. Froebe*, K. M. Wittenberg, and S. A. Moshtaghi Nia, *University of Manitoba, Winnipeg, Canada.*

The objective of this study was to determine the forage intake of lactating dairy cows on pasture using the n-alkane marker technique when fed at different levels of concentrate supplementation. In two separate trials, fifteen primiparous Holstein cows weighing approximately 552 ± 49 kg were randomly assigned to three dietary treatment groups according to milk production (33.1 ± 5.0 kg/day) and days in milk (168 ± 89). The three dietary treatments consisting of concentrate supplement were fed at 20% (L), 35% (M), and 50% (H) of pre-trial total dry matter intake (DMI). The supplement was fed in equal portions at each milking (AM and PM). Cows grazed a primarily orchardgrass (*Dactylis glomerata*) pasture and were moved to a new section of the pasture daily. A controlled-release capsule containing n-alkane (C_{32} and C_{36}) was placed into the cow reticulo-rumen by oral administration. Fecal grab samples were collected twice daily at milking for a seven day period, starting on the seventh day post administration. Milk production was 21.8, 26.4 and 30.5 ± 1.6 kg/day for the L, M, and H groups respectively. The L group had significantly lower ($P< 0.05$) milk production compared to the M and H groups. The estimated forage DMI was calculated using the C_{31}/C_{32} and C_{33}/C_{32} alkane ratios. The estimated forage DMI using C_{33}/C_{32} had higher intake of 15.1, 13.3, and 11.0 ± 1.0 kg/day compared to using C_{31}/C_{32} with intake of 14.0, 12.2, and 10.0 ± 1.0 kg/day for L, M, and H respectively. However, with both ratios, the L treatment had significantly ($P<0.05$) higher forage DMI estimates than the H treatment. The estimated total DMI using C_{33}/C_{32} was similar across all dietary treatments with an average value of 19.4 ± 1.1 kg/day, reflecting 3.5 ± 0.2% of body weight, whereas, the estimated DMI using C_{31}/C_{32} had an average value of 18.4 ± 1.0 kg/day, reflecting 3.3 ± 0.2% of body weight. Daily fecal output estimates using C_{36} were similar for all dietary treatments averaging 5.9 ± 0.3 kg/day (DM basis). It was concluded that at lower level of concentrate feeding, the cows compensated by higher level of forage intake on pasture.

Key Words: N-alkanes, Pasture intake, Dairy cow

1454 Evaluation of cultivates of alfalfa (Medicago sativa L.) by in situ degradability technique. E. C. J. Sales, A. R. Evangelista*, R. A Santos, and J. C. Teixeira, *Universidade Federal de Lavras, Minas Gerais, Brazil.*

Fifteen cultivates of alfalfa (Medicago sativa L.): Alpha 200, SW 8210, High, Rio, Monarca SP INTA, Victria SP INTA, Semit 711, P 30, P 205, F 208, Florida77, MH 4, Br 1, Br 2 and Creole, were studied with to evaluate the ruminal degradability of the dry matter (DM), crude protein (CD) and neutral detergent fiber (NDF). Samples of each cultivate they were placed in nylon bags and incubated in the rumen of cows for 0, 6, 12, 24, 48, 72 and 96 h. The disappearance of the nutrients data (DM, CB and NDF) in the bags, were submitted to the analysis of non lineal regression of Gauss-Newton, being used the model DP = a + b (1 × exp(-c*t)), to potential degradability and DE = a + ((b x c)/(c+k)), to effective degradability. Assuming rate of passage of 5 %/h, there was not difference ($P>0.05$) between cultivates to dry matter effective degradability. Significant values ($P<0.05$) were found to CP and NDF effective degradability, standing out cultivate Loud, Monarch SP INTA, Victria SP INTA, Semit 711, P 30, P 205, F 208, Florida 77, MH 4, Br 1, Br 2 and Creole. To the degradation rate of CP was not verified significant effect ($P>0.05$). The largest degradation values of CP, they can be attributed to the largest efficiency of degradation of N for the microorganisms, once the animals received balanced diet with the incubated cultivates. To NDF, there were variations ($P<0.05$) in the degradation rate between cultivates. The soluble fraction from CP and NDF differed between cultivates; the difference found in those cultivates can not be attributed to the handle of the samples and consequent bedding of particles, and also due the presence of soluble components (starch, pectin).

Key Words: Alfalfa, Degradability, Cultivate

ASAS/ADSA Ruminant Nutrition: Fat, Protein, Intake, and Feedlot

1455 Effect of Housing and Fat Supplementation on Reproduction and Productivity of Holstein Cows in early Lactation . S.L. Boken*, C.R. Staples, L.E. Sollenberger, W.W. Thatcher, and P.J. Hansen, *University of Florida, Gainesville, FL.*

The objective of this trial was to investigate the effects of feeding a soybean oil refining byproduct (SORB) on estrus behavior and productivity of early postpartum Holstein cows managed in a free stall barn or in an intensive rotational grazing system of cool season rye-ryegrass pasture. Multiparious Holstein cows (n=35) were assigned randomly at calving to one of four treatments arranged in a 2 by 2 factorial design. The SORB was suspended in a molasses slurry (30% of slurry DM). The SORB was mixed into a TMR (2% of diet DM) for cows in the barn and into the grain supplement (3.9% of DM) for cows on pasture. Control cows were fed liquid molasses without SORB. Cows on pasture grazed in groups of three and were fed supplement twice daily at a rate of 1 kg/ 2.5 kg of milk produced. During the first 14 wk of lactation, milk production of cows kept in free stalls peaked higher (41.8 vs. 38.1 kg/d) and was more persistent than cows kept on pasture (housing x time, P = 0.03). Average milk fat content was greater for barn-fed cows (3.39 vs. 3.16%, P = 0.02) but average milk protein content was unchanged (2.98 vs. 2.89%). Fat supplementation did not affect milk production or composition. Cows on pasture relied more on body reserves to help support milk production as plasma NEFA concentrations peaked higher (772 vs. 579 mEq/L) and later postpartum (wk 4 vs. 1) (housing x time, P = 0.002). Production of microbial nitrogen as estimated by allantoin and creatinine analyses of spot samples of urine was unaffected by treatment (326 g/d, SE = 30). Estrus activity was recorded using the HeatWatch® estrus detection system. Cows not detected in estrus (n = 14) were assigned 98 DIM as the number of days to first estrus and this did not differ among treatments (69 DIM, SE = 6). When only

cows that exhibited estrus were analyzed (n = 21), number of days to first estrus was similar (50 DIM, SE = 6) and length of first estrus was similar (291 min, SE = 77); however number of mounts during the first estrus (7.7 vs. 4.7) was greater (P = 0.05) for cows kept on pasture. Cows managed on pasture produced less milk of lower fat content, had higher concentrations of plasma NEFA, and demonstrated more intense estrus activity during the first 14 wk postpartum.

Key Words: pasture, fat, reproduction

1456 Increasing the concentration of beneficial fatty acids in lamb muscle. K Nuernberg[1], S Grumbach[2], K Ender[1], and G Nuernberg[1], [1]*Research Institute for the Biology of Farm Animals,* [2]*State Institute of Agriculture and Fishery M/V.*

The objective of the study was to optimize the production of high quality sheep meat under different production systems and to increase the concentration of n-3 polyunsaturated fatty acids (PUFA) in muscle of lambs. Thirty four male crossbred lambs (Texel x Bleu du Maine) with an initial live weight of 20 kg were used in the experiment. The lambs were randomly divided into three groups (group 1: weaning lambs fed intensively with concentrate, group 2: suckling lambs kept on pasture, group 3: weaning lambs kept on pasture). Animals were slaughtered at an average live weight of 40 kg. The carcass weight, the daily gain and the *longissimus* muscle area were significantly ($P < .05$) lower in weaning lambs kept on pasture (group3) compared to concentrate fed lambs (group 1). The color of lamb meat was not influenced by the feeding systems. There are important effects of production systems on total fatty acid composition of lamb muscle. The concentration of total n-3 fatty acids was significantly ($P < .05$) increased up to 83 mg/100 g muscle in lambs kept on pasture compared to 33 mg/100 g in animals fed concentrate. The elevated biosynthesis of n-3 long chain polyunsaturated fatty acids proved the 2-fold increase of C20:5n-3, C22:5n-3 and C22:6n-3 in muscle. The results of the experiment demonstrated the ability to convert absorbed C18:3n-3 to longer chain n-3 fatty acids. The ratio of n-6 and n-3 fatty acids was beneficially low as well as in concentrate fed lambs (7:1) and in grazing lambs (2:1). The significantly higher ($P < .05$) percentage of stearic acid and the sum of saturated fatty acids in muscle of grazing lambs (group 2 and 3) reflected a higher rumen activity for biohydrogenation of PUFA. Besides the contribution from landscape maintenance as well as nature preservation, a pasture feeding system can be corresponded to the consumer demand for healthier meat because of the increased n-3 fatty acid concentration.

Key Words: fatty acids, muscle, lamb

1457 Modification of essential fatty acids in phospholipids and triglycerides from beef cattle. S Lorenz*[1], K Nuernberg[1], and K Ender[1], [1]*Research Institute for the Biology of Farm Animals.*

Simmental bulls (n = 10) and German Holstein steers (n = 9) were divided in two feeding groups (intensive feeding = semi ad libitum access to a concentrate diet, extensive feeding = maintaining on a pasture). For each group the intramuscular fat content of the *longissimus* muscle and the fatty acid composition of phospholipids (PL) and triglycerides (TG) was determined. The different feeding regimes led to significant changes in the fatty acid profile of the PL and TG. Simmental bulls showed significant [$P < 0.05$] differences for each fatty acid except for C18:0 and CLA isomers *9c11t, 7t9c, 8t10c*. The relative amounts of these two fatty acids were constant in both feeding groups. In contrast to this a significant difference in the C18:0 level for the German Holstein steers was detected. Despite biohydrogenation in the rumen, C18:3 contained in grass was absorbed and deposited into the lipids of the muscle. This led to a significantly [$P < 0.05$] higher percentage of n-3 fatty acids in the PL in the muscle of cattle kept on pasture. The relative amount of total n-3 fatty acids in Simmentals increased from 3.2 % in the intensively fed cattle to 14.4 % in pasture fed cattle. German Holsteins showed a respective increase from 2.5 % to 12.8 %. The n-6/n-3 ratio of extensively kept Simmentals was 1.6 in contrast to 14.8 in stable-kept animals [$P < 0.05$]. However, German Holsteins showed a n-6/n-3 ratio of 1.5 (extensive) in contrast to 15.9 (intensive) [$P < 0.05$]. Differences in the fatty acid composition of TG from both feeding groups were also observed for both breeds. Grass fed Simmentals had a n-3 fatty acid level of 1.2 %; fourfold higher than the value observed in the TG of animals kept in stable. Whereas, German Holstein steers showed only a twofold increase from 0.3 % to 0.6 % [$P < 0.05$]. For both breeds the amount of CLA isomers *9c11t, 7t9c, 8t10c* was constant in both feeding regimes as shown for PL. Maintaining cattle on pasture resulted in an enrichment of n-3 fatty acids in beef. The total n-3 fatty acid content in beef muscle increased from 23.2 mg to 97.8 mg/100 g muscle (Simmentals) and from 20.4 mg to 72.1 mg/100 g muscle (German Holsteins).

Key Words: fatty acids, muscle, beef

1458 Effect of L-carnitine on lamb growth and metabolites. T. W. White*[1], J. M. Fernandez[1], G. D. Harding[1], R. L. Walker[1], C. C. Williams[1], H.G. Bateman[1], and M. A. Froetschel[2], [1]*Louisiana State University Agricultural Center, Baton Rouge,* [2]*University of Georgia, Athens.*

Two experiments were conducted to study the effect of L-carnitine (LC) on performance and ruminal and plasma metabolites of individually fed lambs. Weights were taken after a 16-h shrink and ruminal (84 d) and blood samples (28 and 84 d) collected 3 h post feeding after a 16-h shrink. In Exp. 1, 32 Katahdin wethers (BW=26 kg) were blocked by weight into four groups. Lambs in each group were assigned to eight treatments in a 2 x 4 arrangement of four levels (0, 50, 100, or 200 ppm) of ruminally unprotected (UP) or protected (P) LC. Lambs were slaughtered after 98 and 126 d when blocks averaged 47 kg. Ruminally PLC improved (P<0.06) ADG when compared with UPLC (199 vs 184 $\pm$ 5.1 g/d). A quadratic (P<0.05) response on ADG suggests 100 ppm as optimum. Carcass composition was not affected by LC. Ruminal ammonia N levels responded (P<0.02) in a linear, quadratic, and cubic manner to LC. Plasma ammonia N at 84 d was lower (P<0.01) when PLC was fed than when UPLC was fed (46.1 vs 52.2 $\pm$ 1.45 μM). Ruminal butyrate increased (P<0.05) linearly with increases in LC. In Exp. 2, 16 Suffolk wether (BW=33kg) and 16 Suffolk ewe lambs (BW=32 kg) were assigned as in Exp. 1 to corn-based or soyhull-based diets with 0 or 100 ppm PLC. Lambs were slaughtered after 84, 112, or 140 d averaging 50 kg. Lamb fed corn diets gained faster, were more efficent (P<0.01) and graded higher (P<0.06) than lambs fed soyhull diets. Feeding corn diets increased ruminal propionate, reduced ruminal acetate, pH, ammonia N, and plasma urea N and glucose (P<0.01). Feeding PLC improved (P<0.09) DMI and ADG (P<0.06). Ruminal pH, ammonia N, and plasma ammonia N were reduced (P<0.05) on d 84 by PLC. Individual VFA were not affected by PLC. Protected LC appears beneficial in improving ADG and reducing ruminal and plasma ammonia N levels.

Key Words: Lambs, Carnitine, Growth

1459 Effect of fat source on plasma fatty acids in sheep. H. Febel[1], F. Husveth[2], and T. Veresegyhazy*[3], [1]*Research Institute of Animal Breeding and Nutrition, Herceghalom,* [2]*University of Veszprem, Keszthely,* [3]*Szent Istvan University, Faculty of Veterinary Science, Budapest, Hungary.*

This study was designed to determine whether dietary butylsoyamide and hydroxyethylsoyamide made from soybean oil escape ruminal biohydrogenation and increase unsaturated fatty acids in plasma of sheep. The effect of oleamides was compared with other fat supplements containing Ca soap or soybean oil. Five mature wethers (BW 72 kg) were fed five diets in a 5x5 latin square experiment. The control diet consisted of 50% meadow hay and 50% concentrate with no added fat. The control diet was supplemented with Ca soap (CS), hydroxyethylsoyamide (HA), butylsoyamide (BA), or soybean oil (SO). Fat was added at 3.5% of dietary DM. Each period lasted 18 days. Blood samples were taken by jugular venipuncture during the final 2 days of each period at 3h postfeeding, for determination of total cholesterol, triglyceride, total lipid and fatty acids. All fat supplements increased (P<0.05) plasma triglyceride, cholesterol and total lipid. Plasma concentration of cholesterol and total lipid was highest (P<0.001) with SO. Highest (P<0.001) blood triglyceride was observed for the sheep fed CS supplemented diet. Plasma 16:0 decreased (P<0.05) when either HA or SO was added to the diet. The inclusion of CS in the control diet increased (P<0.001) 16:0. All fat supplements increased (P<0.05) plasma 18:0 and decreased (P<0.05) 16:1 and 18:1. Plasma 18:2n-6 was not changed (P>0.05) by feeding CS and SO. However, compared to the control diet, 18:2n-6 increased 12 (P<0.05) and 41% (P<0.001) in plasma fatty acids when sheep were fed HA and BA, respectively. The ratio of 18:2n-6 to saturated fatty acids in plasma for the control, CS, HA, BA, and SO diets were 1.15, 0.76, 1.25, 1.5 and 1.03, respectively. The results of the current study showed that plasma concentration of unsaturated fatty acids

was enhanced more when the amide was synthesised from butylamine than when from ethanolamine. Further work is needed to determine the effect of fat supplements on ruminal fermentation and digestion.

Key Words: Oleamide, Calcium Soap, Fatty Acid

1460 The feeding of fish oil as fish meal with linoleic acid sources enhances milk CLA content. A. A. Abu-Ghazaleh*, D. J. Schingoethe, A. R. Hippen, and L. A. Whitlock, [1] *South Dakota State University*.

Twelve multiparous Holstein cows at 65 (33-122) DIM were used in a 4 x 4 Latin square with 4 wk periods to study the effect of feeding fish meal (FM) and /or extruded soybeans (ESB) on feed intake, milk yield and composition, and milk fatty acids with emphasis on conjugated linoleic acid (cis-9,t-11 C18:2, CLA) and trans-vaccenic acid (t-11 C18:1, TVA). Treatment diets were 1) Control; 2) 0.5 % fish oil from FM; 3) 2.5% soybean oil from ESB; and 4) 0.5% fish oil from FM and 2% soybean oil from ESB. Diets formulated to contain 18% crude protein and were composed of 50% (dry basis) concentrate mix, 25% corn silage, and 25% alfalfa hay. Intake of DM (29.4, 29.8, 29.0, and 28.8 kg/d for diet 1 to 4, respectively) was not affected ($P = 0.26$) by diet. Milk production (33.3, 34.6, 36.9, and 38.0 kg/d) was increased ($P < 0.05$) by all treatments compared with control. Milk fat percentages (3.74, 3.46, 3.19, and 3.07), and milk protein percentages (3.27, 3.26, 3.07, and 3.10) were decreased ($P < 0.05$) with ESB and FM+ESB diets. Milk fat yield (1.24, 1.18, 1.17, and 1.17 kg/d) was not affected by treatments ($P > 0.05$), but yield of milk protein (1.08, 1.12, 1.13, and 1.18 kg/d) was increased ($P < 0.05$) with supplemental FM and ESB or their blend. When FM, ESB, or their blend were fed, concentrations of CLA in milk fat increased ($P < 0.01$) by 0.4, 1.4, and 3.2, fold and TVA concentrations in milk fat increased ($P < 0.01$) by 0.4, 1.8 and 3.5 fold compared with control. The increases in CLA and TVA were much higher when a blend of FM and ESB was fed than the additive effect of FM and ESB. This indicated that fish oil caused increased production of CLA and TVA from other dietary sources of linoleic acid such as ESB.

Key Words: Conjugated linoleic acid, Fish oil, Extruded soybeans

1461 Validation of a model for the digestion of fat in dairy cows. P. J. Moate*, R. C. Boston, and W. Chalupa, *University of Pennsylvania, Kennett Square, PA.*.

Our objective is development of a model of fat digestion within the structure of CPM-Dairy. Data from 36 diets in eight published experiments that reported intakes and flows (g/d) of long chain fatty acids (LCFA) to the duodenum and to feces were used to develop equations that described lipolysis of fat and biohydrogenation of LCFA in the rumen, ruminal production of LCFA and intestinal digestion of LCFA (J. Dairy Sci. 83(Supple1):279-280). The model has now been validated for prediction of absorption of LCFA from the intestine using similar in vivo data from another 38 diets in eight published papers. In the table, the mean and range of the measured (X) absorbed LCFA (g/cow/d) is tabulated and the relationship between the predicted absorbed LCFA (Y) and X is given by A (Y intercept) and B (slope). Despite the fact that validation diets covered a wide range in LCFA intakes as well as diverse fat sources, there was good concordance between measured and predicted absorption of total LCFA and acceptable concordance for most individual LCFA.

LCFA	Xmean	X range	A	B	n	R^2	Bias %
Total LCFA	331	86 - 667	0*	1.02	36	0.88	2
C12:0	5	0 - 29	0.5	0.99	19	0.99	10
C14:0	7	0 - 85	1.0	0.78	26	0.99	8
C16:0	71	17 - 182	0*	0.91	36	0.96	-9
C16:1	1	0 - 4	0*	1.00	18	0.83	0
C18:0	175	36 - 375	0*	1.05	36	0.97	5
C18:1t	18	1 - 44	9.0	0.54	15	0.52	4
C18:1c	29	14 - 54	0*	0.73	15	0.90	-27
C18:2	20	2 - 87	0*	0.87	34	0.91	-13
C18:3	3	0 - 21	-0.7	1.01	31	0.91	-20
Cother	23	11 - 45	11.4	0.19	26	0.10	-32

* Intercept not significantly ($P > 0.05$) different from 0, regression forced through origin.

Key Words: Cattle , Fatty acids, Digestion model

1462 *Trans* fatty acids in milk of Holstein cows fed soybean oil or two forms of conjugated linoleic acid. T. C. Jenkins*, S. A. Mosley, and J. A. Bertrand, *Clemson University, Clemson, SC*.

The extent that milk *trans* fatty acids can be altered by fat supplements was examined by feeding lactating Holstein cows either a control diet with no added fat or three diets containing 3% added fat as either soybean oil (SBO), unprotected conjugated linoleic acid (CLA-U), or conjugated linoleic acid protected as simple amides (CLA-P). The diets were fed in a 4 x 4 Latin square design with 2-wk periods. The CLA supplement was a mixture of several conjugated dienes including the *cis*-9, *trans*-11 (22.1% of total fatty acids), *trans*-10, *cis*-12 (18.4%), and *trans*-9, *trans*-11 (6.0%) isomers. Converting the CLA supplement to amides reduced the loss of the *cis*-9, *trans*-11 isomer over 48 h from 100 to 57% in ruminal in vitro cultures. The SBO supplement had no effect on dry matter intake, milk yield, or milk protein concentration. Feeding SBO reduced milk fat from 3.2 to 2.9% with an increase ($P < 0.05$) in total *trans* monoenes from 1.89 to 5.42% of total milk fatty acids, an increase ($P < 0.05$) in the *cis*-9, *trans*-11 diene from 0.38 to 0.63% of milk fatty acids, but a decrease ($P < 0.05$) in the ratio of *trans*-11/*trans*-10 monoenes from 2.54 to 1.00. Both CLA supplements reduced ($P < 0.05$) milk fat percentage from 2.9% for SBO to 1.8%, but had no effect on milk yield or intake. Compared to SBO, the CLA-U and CLA-P supplements increased ($P < 0.05$) total *trans* monoenes from 5.42 to 10.68 and 10.71% of milk fatty acids, increased ($P < 0.05$) the concentration of all conjugated dienes, but reduced ($P < 0.05$) the ratio of *trans*-11/*trans*-10 monoenes in milk from 1.00 to 0.56 and 0.50, respectively. The CLA-P diet had higher ($P < 0.05$) *trans*-6/8 monoenes in milk, but lower ($P < 0.05$) *trans*-10, *cis*-12 and *trans*-9, *trans*-11 dienes in milk compared to CLA-U. The results show that feeding conjugated dienes, as either the free acids or amide, to lactating dairy cows increases the concentration of *trans* fatty acids (both *trans* monoenes and dienes) in milk more than feeding an equal quantity of soybean oil.

Key Words: Milk Fatty Acids, Conjugated Linoleic Acid, Milk Fat

1463 Effects of prepartum intake, postpartum induction of primary ketosis, and periparturient disorders on carnitine palmitoyltransferase I activity in dairy cows. H. M. Dann*, J. K. Drackley, and D. E. Morin, *University of Illinois, Urbana*.

Thirty-five multiparous Holstein cows were used to determine the role of mitochondrial carnitine palmitoyltransferase I (CPT I) in liver on peripartal adaptations of fatty acid metabolism. Cows were fed a diet (1.54 Mcal NE_L/kg, 14.1% CP) from dry-off to parturition at either ad libitum (A; n=17) or restricted (R; 80% of calculated NE_L requirements; n=18) intake. After parturition, all cows were fed a lactation diet (1.58 Mcal NE_L/kg, 16.8% CP). At 4 d in milk (DIM), cows were assigned to three groups: healthy-control (HC; n=6), healthy-ketosis induction (HK; n=9), and periparturient disorder (PD; n=17), based on a physical examination. Cows in HC and PD were fed for ad libitum intake. Cows in HK were fed at 50% of intake at d 4 postpartum from 5 DIM to signs of clinical ketosis or until 14 DIM, and then were returned to ad libitum intake. Liver was biopsied at -30, 1, 14, and 28 d relative to parturition. Mitochondria were isolated by differential centrifugation. Activity of CPT I (nmol palmitoyl-[^{3}H]-carnitine formed$\cdot$min$^{-1}\cdot$mg protein^{-1}) was 5.6 and 6.9 for A and R, respectively ($P < 0.05$) at -30 DIM. Sensitivity of CPT I to its inhibitor, malonyl CoA, did not differ ($P > 0.05$) between A and R; mean IC_{50} was 1.03 μM. Postpartum CPT I activity and malonyl CoA sensitivity were not affected ($P > 0.05$) by prepartum intake (A vs. R), postpartum group (HC vs. HK vs. PD), or time. Mean postpartum CPT I activity was 8.25 and IC_{50} was 1.48 μM. Prepartum serum nonesterified fatty acids were correlated ($P < 0.05$) with CPT I activity at -30 (Spearman rho = 0.47) and 1 (Spearman rho = 0.48) DIM but not at 14 and 28 DIM. Prepartum intake affected prepartum CPT I activity but not malonyl CoA sensitivity. Neither induction of primary ketosis nor periparturient disorders affected CPT I activity or sensitivity, which indicates that alterations of CPT I may not be involved in the etiology of primary ketosis or other periparturient disorders.

Key Words: Carnitine Palmitoyltransferase I, Ketosis, Transition Cow

1464 Influence of feeding canola seed on lactation performance and conjugated linoleic acid concentration in milk fat of lactating Holstein cows. J.D. Handegard*[1], D.B. Carlson[1], M.S. Laubach[1], D.E. Schimek[1], W.L. Keller[1], J.W. Schroeder[1], C.S. Park[1], G.D. Marx[2], and J.H. Herbein[3], [1]*North Dakota State University, Fargo,* [2]*University of Minnesota-Crookston,* [3]*Virginia Polytechnic and State University, Blacksburg.*

The objective of this study was to determine the optimum level of dietary canola seed supplementation to cause maximum increases in conjugated linoleic acid (CLA) content in milk fat. Twelve lactating Holstein cows were randomly assigned to one of three dietary treatments (0, 6, and 12% of the total diet as crushed canola seeds). Crushed canola seeds were blended into total mixed rations. Cows were housed in tiestalls and fed individually for a period of 12 wk. Feed intake and milk weights were monitored daily. Blood and milk samples were collected every three wk. Body weight and a body condition score (BCS) were also determined at this time. Fatty acid profiles on milk were determined by gas chromatography. Analysis has shown an increase in CLA concentration in milk fat of cows on the 12% canola seed diet compared with cows on the 0 and 6% diets ($P < 0.05$). Milk production, dry matter intake, body weight, milk fat, and BCS were not significantly different between treatments. Plasma glucose and insulin were not affected by treatment. However, plasma non-esterified fatty acids of cows on the 12% canola seed diet were decreased (ca. 30%) compared to the control group ($P < 0.05$). Dietary supplementation of crushed canola seed up to 2.5 kg/d can increase CLA concentration in milk fat of lactating cows without negatively affecting lactation performance.

Key Words: Conjugated linoleic acid, Canola, Fat supplementation

1465 Conjugated linoleic acids in duodenal and milk lipids of lactating dairy cows fed different diets. L. S. Piperova*[1], J. Sampugna[1], B. B. Teter[1], K. F. Kalscheur[1], R. A. Erdman[1], M. P. Yurawecz[2], K. Ku[2], and K. Morehouse[2], [1]*University of Maryland, College Park.,* [2]*U.S. Food and Drug Administration, Washington, D.C..*

Duodenal and milk samples of lactating dairy cows obtained from a previous study (Kalscheur et al, 1997, J. Dairy Sci. 80:2104) were examined to determine the effect of diet on the conjugated linoleic acids (CLA) content. Four lactating Holstein cows, fitted with duodenal cannulas, were fed 4 diets in a 2x2 factorial, 4x4 Latin square design with 3 week treatment periods. The diets had two levels of forage 25% or 60% (LF or HF) with (B) or without (NB) added buffer (1.5% $NaHCO_3$ and 0.5% MgO). Fatty acid methyl esters were prepared using 0.7N H_2S0_4 in methanol, at room temperature, and analyzed by GLC (100m SP2560 column) and HPLC (triple Ag+- column). The total duodenal CLA were highest (1.7 g/d) in cows fed the LFNB diet, compared to both HF diets and the LFB diet. In contrast, the milk CLA yield was similar among treatments (7.1 g/d - 9.5 g/d). Regardless of the diet c-9, t-11 was the major isomer, greater than t-7,c-9 >t/c-c/t-11,13 >c-8,t-10. The difference between the milk CLA yields and duodenal flow of CLA can be accounted for by the action of the delta-9-desaturase on the t-11- and t-7-18:1 fatty acids absorbed from the duodenum. The LFNB diet produced the greatest amount of t-10, c-12 CLA in milk fat. Although it has been reported that the t-10, c-12 isomer inhibits delta-9-desaturase, the levels of c-9, t-11 and t-7, c-9 were similar in spite of the level of the t-10, c-12 CLA in milk. The results suggest that the majority of milk CLA were formed by post-absorptive synthesis from *trans*-18:1 fatty acids.

	Diets					Effects ($P<$)		
Item	HFNB	HFB	LFNB	LFB	SED	F	B	F x B
Duodenal CLA, g/d	1.09	1.05	1.7	0.97	0.28	0.21	0.06	0.09
Milk CLA, g/d								
Total	9.06	7.99	9.46	7.06	1.35	0.52	0.11	0.37
t-7,c-9-18:2	0.72	0.63	0.81	0.52	0.13	0.77	0.16	0.55
c-8,t-10-18:2	0.04	0.06	0.02	0.03	0.02	0.03	0.14	0.31
c-9,t-11-18:2	7.43	6.72	7.21	5.86	1.12	0.31	0.12	0.33
t-10,c-12-18:2	0.05	0.01	0.1	0.03	0.005	0.07	0.04	0.84
t/c,c/t-11, 13-18:2	0.07	0.08	0.04	0.04	0.03	0.44	0.17	0.19

Key Words: Milk, CLA, CLA isomers

1466 Metabolic fate of long chain fatty acids by ruminant hepatocytes. D.G. Mashek*, S.J. Bertics, and R.R. Grummer, *University of Wisconsin, Madison.*

The objective was to determine the metabolism of long chain unsaturated fatty acids to oxidation or cellular lipid products. Hepatocytes were isolated from four ruminating calves and exposed for 3 hours in suspension to one of the following treatments: 1 mM palmitic acid (1C16), 2 mM palmitic acid (2C16), or 1 mM of palmitic acid plus 1 mM of oleic (C18:1), linoleic (C18:2), linolenic (C18:3), eicosapentaenoic (C20:5), or docosahexaenoic (C22:6) acid. For treatments 1C16 and 2C16, metabolism of [1-^{14}C]palmitic acid was measured. For all other treatments, the fatty acid other than palmitic acid contained the radiolabel. Oxidation of [1-^{14}C]fatty acids to CO_2 or incorporation into cellular triglyceride (TG), phospholipid (PL), cholesterol (C), and cholesterol ester (CE) were measured. Rates of oxidation to CO_2 were 3 to 4-fold higher for C22:6 compared to other treatment fatty acids, with the exception of C20:5, which had intermediate rates of oxidation to CO_2. Treatments 2C16 and C18:1 yielded the highest rates of incorporation into most cellular lipids, whereas the polyunsaturated fatty acids were poor substrates for incorporation into cellular lipids. The most pronounced change was a reduction of polyunsaturated fatty acid incorporation into cellular TG compared to 1C16, 2C16, and C18:1. All polyunsaturated fatty acids were incorporated into cellular TG at rates less than 25% of those observed for 2C16 and C18:1. Therefore, long chain fatty acids vary in their routes of metabolism by bovine hepatocytes. Values in the table below represent incorporation of [1-^{14}C]fatty acids into metabolic products ($p$mol/ug DNA/3 h).

Product	1C16	2C16	C18:1	C18:2	C18:3	C20:5	C22:6
CO_2	77.4^{c}	69.9^{c}	99.8^{c}	50.4^{c}	56.6^{c}	155.0^{b}	$28\ 3.2^{a}$
TG	202.0^{b}	307.8^{a}	287.5^{a}	19.4^{c}	60.1^{c}	21.7^{c}	46.9^{c}
PL	104.9^{bcd}	128.6^{ab}	144.6^{a}	81.2^{d}	117.9^{abc}	78.1^{d}	90.5^{cd}
C	31.0^{bcd}	36.4^{bc}	84.5^{a}	42.9^{b}	40.8^{b}	24.6^{cd}	22.9^{d}
CE	36.2^{b}	58.2^{a}	74.4^{a}	20.2^{b}	36.5^{b}	25.4^{b}	29.5^{b}
TCL[1]	373.9^{b}	530.6^{a}	565.4^{a}	158.7^{cd}	226.0^{c}	$145.0\ ^{d}$	188.6^{cd}

^{abcd}Means within a row with unlike superscripts differ ($P<0.05$). [1]Total Cellular Lipids (TCL) = TG + PL + C + CE.

Key Words: fatty acids, hepatic metabolism, bovine

1467 Effects of feeding whole linseed on milk production and composition of dairy ewes. M. V. Pol, R. Casals*, E. Albanell, and X. Such, *Universitat Autonoma de Barcelona.*

Forty eight multiparous Manchega dairy ewes (45 days in milk) were used in a cross-over design to study the effects of supplementing diets with whole linseed on lactational performance. Animals were blocked into two groups according to previous milk yield and assigned to one of two diets: control (C) and whole linseed (L). After a first 3-wk experimental period, ewes were switched to the alternate diet for a second 3-wk period. Measurements and samplings were done during the last week of each period. Diets were offered as total mixed rations, containing (dry matter basis) 26% dehydrated whole-plant corn, 26% dehydrated alfalfa, 8% alfalfa pellets and 40% concentrate, where barley and soybean meal were the main ingredients. Since whole linseed was included (8%) in the L diet, proportions of barley and soybean meal were reduced to obtain isonitrogenous diets (16% CP). Ether extract of the diets varied from 1.5% (C) to 3.5% (L). Milk fat content (C, 6.88; L, 7.88%) and yield (C, 80.7; L, 91.0 g/d) increased ($P < 0.01$) due to fat supplementation. In contrast, dry matter intake (DMI: C, 2.87; L, 2.85 kg MS/d), milk yield (C, 1.20; L, 1.16 kg/d), and milk protein (C, 6.06; L, 6.11%) and casein contents (C, 4.76; L, 4.77%) were not affected. However, if expressed as percentage of milk protein, casein (C, 78.56; L, 78.08% of CP) tended to decrease ($P < 0.14$). Provisional results suggest changes in the fatty acid profile of milk, with an increase of unsaturated fatty acids in the L group. Blood serum concentrations of nonesterified fatty acids (C, 0.16; L, 0.26 mmol/L), triglycerides (C, 23.6; L, 36.6 mg/dL) and cholesterol (C, 116.5; L, 153.8 mg/dl) were increased ($P < 0.001$) by the use of linseed, but glucose and β-hydroxybutyrate were not modified. In conclusion, whole linseed may be used at moderate doses in rations of dairy ewes as a natural mean to modify milk fat content without negative effects on DMI and milk protein content. Acknowledgments: CICYT-Spain (Project AGF99-0773) and Agribrands Europe-Espaa.

Key Words: Dairy Ewes, Whole Linseed, Milk

1468 Effect of supplementing Solin, a high linoleic acid oilseed, to a TMR containing fresh grass, on bovine plasma and milk conjugated linoleic acid (CLA) and fatty acid levels. A.T. Ward* and K.M. Wittenberg, *University of Manitoba, Winnipeg, Canada*.

The objective of the trial was to compare the CLA and other fatty acids levels in plasma and milk of cows fed three dietary treatments. The diets were fed as TMR's with forage to concentrate ratios of 60:40. The diets contained either conserved or fresh grass cut from the same field, supplemented with tallow, and fresh grass supplemented with solin crushed oilseed. Twelve multiparous Holstein cows were assigned to one of the three diets in a 3 x 3 Latin square design. Average feed intakes and milk yields of the cows fed the grass diets were significantly lower than feed intakes and milk yields of cows fed the hay-tallow diet. Per cent milk fat, however, was similar for the cows fed the three diets. The grass-solin diet lipid contained 54% linoleic acid as compared to 10% linoleic acid in the grass-tallow and hay-tallow diets. The proportion of the short and medium chain fatty acids were lower in the plasma and milk lipid of the cows fed the grass-solin diet compared to the grass-tallow and hay-tallow diets whereas the C18 fatty acids, except for linolenic acid, were higher in the plasma and milk lipid of the cows supplemented with the grass-solin diet. Vaccenic acid and the CLA isomer C18:2 cis-9, trans-11 were significantly higher in the plasma and milk lipid of the grass-solin fed cows compared to the cows fed the grass-tallow and hay-tallow diets. The cows fed the grass-tallow diet had a significantly higher level of C18:2 cis-9, trans-11 in plasma and milk compared to the hay-tallow diet. The milk lipid C18:2 cis-9, trans-11 CLA isomer levels in the grass-solin, grass-tallow and hay-tallow fed cows were 1.3, 1.07 and 0.93% (SEM=0.04), respectively. The cows fed the grass-tallow and hay-tallow diets had significantly higher plasma levels of the C18:2 trans-9, cis-11 CLA isomer than the cows fed the grass-solin diet, which resulted in total plasma CLA levels to be higher in the cows fed the grass-tallow and hay-tallow diets compared to the grass-solin diet. The C18:2 trans-9, cis-11 isomer, however, was not detected in the milk of the cow's fed the three diets.

Key Words: Conjugated linoleic acid, Oilseed, Fatty acids

1469 Effect of feeding frequency and dietary sunflower oil on conjugated linoleic acid (CLA) concentrations in milk from dairy cows. N.W. Lafond[1], V. Girard[2], and P.Y. Chouinard[1], [1]*Universite Laval, QC, Canada,* [2]*Institut de recherche et de developpement en agroenvironnement, QC, Canada*.

Previous work (Kelly et al., 1998; J. Nutr. 128:881) showed that CLA content of milk can be enhanced by dietary addition of sunflower oil (SO), which is rich in C18:2. However, large variation has been observed between cows receiving the same treatment indicating that additional factors must be affecting the CLA content of milk. The objective of the present study was to evaluate if feeding behaviour can explain part of this variation. Eight multiparous Holstein cows in mid-lactation were used in a replicated 4 x 4 Latin square design with three weeks periods. Treatments were: 1) basal diet fed in 1 meal; 2) basal diet fed in 12 meals; 3) basal diet + 5% SO fed in one meal; 4) basal diet + 5% SO fed in 12 meals. Diets were fed as TMR. Treatments had no effect on milk yield but administration of SO reduced DMI ($P<0.05$). Rumination time, number of chews and ruminal pH were increased by the addition of SO in the diet ($P<0.05$). Increasing the feeding frequency tended to decrease the number of chews ($P<0.07$), and reduced diurnal variations of ruminal VFA, NH_3-N and pH ($P<0.01$). Milk fat content was increased, and milk protein content and yield were decreased when feeding frequency was increased ($P<0.05$). Dietary SO also reduced milk protein content and yield ($P<0.05$). Addition of SO enhanced the proportions (mg/100 g DM) of C16:0, C18:0, trans-C18:1, cis-C18:1, C18:2 and CLA in ruminal content ($P<0.01$). Increasing the feeding frequency decreased the proportion of C18:2, but had no effect on the concentration of CLA in ruminal content. Feeding SO decreased the content and yield of milk fatty acids from C6 to C17, and reduced the yield of C18:2 and C18:3 ($P<0.05$). Moreover, dietary SO increased milk fat content and yield of C18:0, trans-C18:1, cis-C18:1 and CLA (5.6 vs. 24.6 mg/g) ($P<0.01$). Feeding frequency had no effect on CLA content of milk fat. Concentrations of CLA in milk fat can be increased with the addition of SO in the diet, but feeding frequency has no effect on ruminal production and subsequent milk concentration of CLA. Supported by Dairy Farmers of Canada, NSERC, and FCAR fund.

Key Words: CLA, sunflower oil, feeding behaviour

1470 Comparison of prilled tallow and free fatty acids from tallow as fat supplements for dairy cows. S. T. Franklin*[1], D. M. Amaral-Phillips[1], J. A. Jackson[1], K. J. Touchette[2], and J. A. Coalson[2], [1]*University of Kentucky,* [2]*Merrick's, Inc.*.

Twenty-six Holstein cows were used in a 2 X 2 Latin square design to compare production achieved by supplementing diets with fat as prilled tallow (PT) or free fatty acids from tallow (FF). The study was conducted during July and August of 2000 which subjected the cows to heat stress. Cows were in mid to late lactation and were assigned to treatments based on lactation number (first parity = 12 and multiparous = 14), days in milk, and production. Cows were housed in a tie-stall barn to allow for individual feed intake. Diets were fed as TMR and contained 2.8% alfalfa hay, 42.1% alfalfa silage, 18.0% corn silage, 3.5% whole cottonseed, and 32.6% concentrate, DM basis. After 1 wk of acclimation to the tie-stalls, fat supplements were gradually incorporated into the diets to provide approximately 0.45 kg of supplemental fat as PT or FF per cow daily. Each period lasted 5 wk with 2 wk to acclimate to the fat supplements and 3 wk for data collection. Milk weights were recorded at each milking, a.m. and p.m. milk samples were obtained twice weekly, and feed fed and refused were recorded daily. Feed samples were obtained weekly and pooled by period for analysis. Diets were formulated to be isonitrogenous, averaging 18.5% CP, 1.64 Mcal NEL/kg, and 7.6% ether extract. Treatment did not affect ($P > 0.05$) DMI and averaged 23.5 kg/cow daily. During period 1, energy corrected milk from cows fed PT and FF averaged 28.5 and 30.1 kg/d, respectively, and during period 2 averaged 27.8 and 26.6 kg/d, respectively. Overall means for energy corrected milk did not differ ($P > 0.05$) and were 28.1 kg/d for PT and 28.4 kg/d for FF. Percent fat, fat yield, percent protein, and protein yield did not differ ($P > 0.05$) by treatment. Percent fat was 3.63% and yield was 1.0 kg/d for PT whereas percent fat was 3.70% and yield was 1.0 kg/d for FF. Similarly, percent protein was 3.25% and yield was 0.9 kg/d for PT whereas percent protein was 3.24% and yield was 0.9 kg/d for FF. As expected, milk production, fat yield, and protein yield were lower ($P < 0.05$) for first parity cows compared to multiparous cows, but there were no interactions ($P > 0.05$) between lactation number and production. In conclusion, milk yield and composition did not differ for cows fed fat supplements of prilled tallow or free fatty acids from tallow.

Key Words: Supplemental fat, Prilled fat, Free fatty acids from tallow

1471 Short-term feeding strategies for altering conjugated linoleic acid (CLA) content of meat. R. A. Robinson*, K. E. Griswold, G. A. Apgar, B. N. Jacobson, D. Johnson, and H. D. Woody, *Southern Illinois University, Carbondale, IL*.

Short-term (6-week) feeding strategies to alter conjugated linoleic acid (CLA) levels in meat were evaluated in a feedlot trial. The trial was designed as an incomplete 3x2 factorial with level of soy oil and level of forage as the factors. Forty Angus x Hereford steers were randomly assigned to one of four treatments (ten animals per treatment) for the last six weeks of a normal finishing period. The treatments were: 1) control standard 80:20 concentrate:forage finishing diet (C), 2) control + 4% soy oil (C4), 3) 60:40 concentrate:forage finishing diet + 4% soy oil (F4), 4) 60:40 concentrate:forage finishing diet + 8% soy oil (F8). Animals were housed in a slatted floor facility with five animals per pen (two pens per treatment), fed ad libitum, and orts were weighed daily to determine intake. Animals were weighed on a weekly basis, and average daily gain (ADG) was calculated. At termination, carcasses were yield graded, and tissue samples were collected from the longisimus dorsi for determination of fatty acid composition by GC analysis. Data were analyzed using the GLM procedures of SAS with pen as the experimental unit for ADG and animal as the experimental unit for carcass and CLA data. ADG was 3.2, 3.1, 3.4, and 3.0 for C, C4, F4, and F8, respectively, and was unaffected by treatment ($P>.05$). Dressing percentage, kidney, heart and pelvic fat, and quality grade were all significantly lower when oil was added to the diet ($P<.05$). There was a trend for backfat to be reduced with the addition of soy oil to the diet ($P=.07$). Increasing forage in the diet significantly increased ribeye area ($P<.05$), but had no effect on other carcass quality parameters. For CLA analyses, only the cis-9, trans-11 isomer was detectable in the tissue samples. The levels of CLA (mg per g of total fatty acids) found in the tissues were 2.3, 2.2, 2.7, and 3.1 for C, C4, F4, and F8, respectively. There was a significant oil effect ($P<.03$), and a significant oil by forage interaction ($P<.03$). There was a trend for a forage effect ($P=.10$). Short-term finishing period feeding strategies can be utilized to alter meat CLA levels.

Key Words: CLA, Beef, Short-term Feeding

1472 Conjugated linoleic acid (CLA) must be protected from rumen hydrogenation for the greatest impact on milk composition. M.M. Hawley*[1], M.A. McGuire[1], T.W. Hanson[1], and A.F. Kertz[2], [1]*University of Idaho, Moscow,* [2]*Agribrands International, St. Louis, MO.*

Conjugated linoleic acids (CLA) are fatty acids found in milk that possess beneficial properties for human health. Efforts to increase the content of CLA in milk have focused on alterations of the rumen environment to promote greater production of CLA during biohydrogenation. Certain CLA isomers also cause milk fat depression (MFD), an effect that may improve the economics of marketing milk. Calcium salts of fatty acids are commercial means to protect lipids from alterations in the rumen. The hypotheses tested included: 1) feeding of Ca salts of CLA was required to enrich milk with CLA; and 2) MFD would only occur when rumen protected CLA was fed. Eight lactating Holstein cows were randomly assigned to one of three treatment sequences in a 3 x 3 Latin square design. Periods lasted 7 d with treatments fed d 3 to 7 of each period. A 7 d rest occurred between every period to minimize any treatment carryover effect. Treatments were safflower oil, CLA as a free oil, and Ca salts of CLA. The CLA used was CLA-60, a mixture of CLA isomers. Supplements were fed to provide 100 g of total CLA per day; safflower oil was fed at 333 g/d equal to the total lipid in the Ca salts of CLA. Supplements were offered once a day before the morning feeding. No effect of treatment on DM intake (29.0 kg/d, SEM = 1.9) or milk yield (33.6 kg/d, SEM = 1.9) was detected. On d 5 of supplementation, feeding of safflower oil, CLA oil, and Ca salts of CLA increased ($P<0.001$) concentrations of cis-9, trans-11 CLA in milk similarly compared to the first 2 d of each period (3.9 vs. 6.8 mg/g fat). The trans-10, cis-12 CLA isomer was increased ($P<0.001$) during supplementation with CLA oil (0.8 mg/g) or Ca salts of CLA (1.9 mg/g) compared to pretreatment (0.2 mg/g). Milk fat depression was most evident for the Ca salt supplementation (30.5%) but was also detected for the CLA oil treatment (15.1%) on d 5 of supplementation. Conjugated linoleic acid can be enriched in milk without the utilization of a rumen inert form, however the extent of enrichment and MFD is less than when Ca salts are utilized.

Key Words: Milk Fat, Rumen Inert Fat, Dietary Fat

1473 Feeding Calcium Salts of Oleic Acid on Dry Matter Intake, Milk Yield, and Milk Fatty Acid Content. J.E. Delahoy*, L.D. Muller, R.F. Roberts, L.A. Kalwasinski, and F. Bargo, *The Pennsylvania State University, University Park, PA.*

The objective of this study was to evaluate the effects of feeding increasing amounts of calcium salts of oleic acid (CaOleate) on dry matter intake, milk yield, and milk fatty acid content. Ten cows (108 DIM) were paired according to milk yield, DIM, and parity, and used in a repeated measures design with four sampling periods (seven days in length). All cows were fed a basal TMR containing 17% CP, 34.4% NDF, 37% NFC, and 4% lipid. Five cows were fed increasing amounts of CaOleate mixed into the TMR at a rate of 0, 340, 680, and 1020 g/cow/d. A control group of five cows was fed the basal TMR. Milk samples were taken at the end of each period and analyzed for milk fat, milk protein, and milk fatty acids. Milk yield and DMI were determined daily. Fatty acids were measured to determine saturated fatty acid content (C4:0 to C18:0), unsaturated fatty acid content (C14:1 to 18:3), and CLA. Mean milk yield (33.9 kg), DMI (22.5 kg), milk protein (2.92%), and milk fat (3.36%) were not affected by CaOleate supplementation. Milk fat content of saturated fatty acids decreased linearly (71.2 to 59.9%; $P > 0.05$) with increased amounts of CaOleate. Milk fat content of unsaturated fatty acids (28.8 to 40.1%; $P < 0.05$) and CLA (7.1 to 15.5 mg/g of fat; $P < 0.05$) increased linearly with increased supplementation of CaOleate. Milk from cows fed 1020 g of CaOleate was processed into 2% milk and compared in a triangle test to milk from the Penn State dairy herd. Consumers detected no significant differences between the 2% milks. In summary, milk yield, DMI, milk protein, and milk fat did not differ when cows were fed increasing amounts of CaOleate. Milk fat content of saturated fatty acids were decreased and unsaturated fatty acids and CLA were increased with increasing levels of CaOleate supplementation.

Key Words: Saturated fatty acids, Oleic acid, Milk fat

1474 Effect of processing methods on the utilization of corn grain by ruminants. S.Y. Lee* and J.K. Ha, [1]*Seoul National University, Suwon, Korea.*

To evaluate the effect of processing methods on the utilization of corn grain by ruminants two experiments were carried out. In the in vitro experiment, DM digestibility and fermentation characteristics were investigated with using differently processed corns (whole, 4mm-ground, finely-ground, flake, and flake-ground corn). In the in situ experiment, DM disappearance was measured and observation of corn incubated in the rumen by scanning electron microscopy was made. In vitro DM digestibility was influenced by corn processing($P<0.01$). Whole corn was poorly digested even after 48 h incubation. Finely-ground and flake-ground corn were more digested than the other corns. 4mm-ground corn was more digested than flake corn. Therefore, it is likely that ground corns have more effect on improving the DM digestion than flaked corns. The extent of pH reduction differed between processing methods($P<0.01$). pH for whole corn was reduced a little, that for flake and 4mm-ground corn were reduced slowly to 6.2-6.3. And pH for finely-ground and flake-ground corn were reduced rapidly to 6.18-6.19. The highest gas production was obtained in finely-ground and flake-ground corn, followed by 4mm-ground, flake and whole corn. NH3-N concentration was influenced by processing method after 6 h incubation ($P<0.01$). After 48 h incubation total VFA was the highest in finely-ground corns, followed by flake-ground, flake, 4mm-ground, and whole corn. Processed corn grains had higher acetate, propionate and butyrate concentration than whole corn. The result of in situ disappearance was similar with that of in vitro digestibility. That is, finely-ground corn grains were digested to the most extent, followed by 4mm-ground, flake and whole corn. Examination by SEM showed that the endosperm of processed corn grains, except for whole corn, was colonized by a variety of rumen bacteria, and showed extensive pitting as a result of bacterial amylolysis. It can be concluded that cattle need some kind of processing to have an improved utilization of corns from the result of in vitro, in situ experiment.

Key Words: Corn, Processing, Ruminants

1475 Effect of two protein sources on ADG, reproductive performance, ruminal fermentation and digestion kinetics in beef cattle. O. Ruiz-Barrera[1], J. Mejia-Haro[2], J.A. Jimenez-Castro[1], J.A. Ramirez-Godinez[1], I. Mejia-Haro*[3], and A. Flores-Marielarena[1], [1]*Universidad Autonoma de Chihuahua, Mexico,* [2]*Universidad de Guanajuato, Mexico,* [3]*CIGA-ITA de Aguascalientes, Mexico.*

To evaluate the chemical composition of a rye grass-oat pasture and the effect of supplementation of ruminal undegradable protein on performance, 100 bulls and 62 heifers were fed for 112d. Cattle were randomly assigned to one of two treatments: 1) rye grass-oat pasture, oat hay and a ruminal degradable protein supplement (PDR) based on poultry manure and urea; and 2) rye grass-oat pasture, oat hay and a ruminal undegradable protein supplement (PNDR) based on blood meal and cottonseed meal. One month before the end of the experiment SyncroMate-B was applied to all cycling heifers. Blood samples were taken from the jugular vein at implant insertion, implant removal (before feeding) and 8 h after feeding (after implant removal). A cervical mucus sample was taken at estrus to determine pH, and 15 h after the beginning of the estrus, heifers were inseminated. One month before the end of the experiment, the semen quality was evaluated and blood samples were taken from the jugular vein to determine blood pH and urea. Dry matter, OM, CP, ADF, NDF, ME and in vitro digestibility was determined in feed and fecal samples. Data were analyzed by ANOVA using the GLM of SAS (1993). Average daily gain of bulls and heifers was not affected ($P > .05$) by treatments. Values of blood urea were not different ($P>.05$) between treatments. The pH in cervical mucus and blood serum samples taken at implant insertion, implant removal (before feeding) and 8 h after feeding (after implant removal) did not show differences ($P>.05$) between PDR and PNDR. The pregnancy rate was 46 and 77 % for PDR and PNDR, respectively ($P<.05$). Blood urea values were similar ($P>.05$) between bulls of PDR and PNDR. No differences were observed in sperm concentration, percentage of live and dead cells, masal motility, progressive motility, and abnormalities. With maturity of the pasture, a tendency to increase the content of DM, ADF and NDF and decrease CP, DM and OM digestibility, and ME was observed. No differences ($P > .05$) were observed in ADG and values of blood urea, blood pH and pH of cervical mucus samples. The decrease in fertility in heifers fed PDR could be due to the high values of blood urea found 8 h after feeding. Kind of protein did not affect ADG, blood urea and semen quality.

Key Words: Protein, Undegradable, Fertility