when variation in kd was taken into account. For the NRC model, the ranking of critical inputs was, for diet 1, SBM kd (r=-0.5), CS A fraction (r=-0.34), and dried corn kd (r=-0.25), for diet 2, SBM kd (r=-0.55), grass hay CP (r=0.32), and dried corn kd (r=-0.31). For the CNCPS, the ranking was, for diet 1, SBM kd of B2 pool (r=-0.5), dried corn kd (r=-0.26), and WB CP (r=0.26), for diet 2, SBM kd (r=-0.52), grass hay CP (r=0.36), and dried corn kd (r=-0.35). One SD increase (1.5 %/h) in SBM kd resulted in a 0.5 SD decrease in MP from RUP (Diet 1 SD= 153 g, Diet 2 SD=208 g), while for the CNCPS model, 1 SD increase (4 %/h) in kd for SBM B2 kd resulted in a > 0.5 SD decrease (Diet 1 SD=136 g, Diet 2 SD=177 g). Because of the intrinsic variation in kd measurements and the sensitivity of the current models, research is needed to improve the methodology used to obtain kd.

	Diet 1			Diet 2		
	CNCPS1	CNCPS2	NRC	CNCPS1	CNCPS2	NRC
MP milk from RUP	1.9	2.8	3.1	2.2	3.6	4.2
MP milk from Met in RUP	2.2	2.9	1.8	2.3	3.0	4.2
MP milk from Lys in RUP	1.4	2.2	2.4	1.3	2.6	2.7

Key Words: Nutritional Models, Monte Carlo, Digestion Rates

Ruminant Nutrition: Dairy - Fats

622 Effect of rumen protected conjugated linoleic acid on energy metabolism of dairy cows during early to mid-lactation.

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Trans-10, cis-12 conjugated linoleic acid (CLA) inhibits milk fat synthesis and reduces milk energy content. Controlled decreases in milk energy secretion could be used to improve energy balance of the dairy cow during early lactation. Twelve multi-parous Holstein-British Friesian cows were used in a randomized block study to evaluate the effects of rumen protected CLA (RCLA) on energy metabolism in early lactation. Supplements were prepared by casein-formaldehyde treatment of CLA methyl esters containing equal amounts of cis-9, trans-11 and trans-10, cis-12. At calving, cows were paired and allocated at random to a control diet (C) or the same diet supplemented with 110 g of RCLA that supplied 14.3 g trans-10, cis-12 CLA/d. Energy balance (MJ/d) was estimated during weeks 3, 7, 11 and 15 of lactation using 6d excreta collection and respiration calorimetry. On average, RCLA reduced milk fat content (34.9 vs. 19.2 g/kg; P<0.001) and milk fat yield (1395 vs. 901 g/d; P<0.001), increased (P<0.05) milk yield (40.3 vs. 47.4 kg/d) and milk protein output (1.25 vs. 1.42 kg/d) and tended to increase DMI (22.2 vs. 24.6 kg/d; P=0.06) and BW (614 vs. 661 kg; P=0.11). The effects on DMI and production occurred within one week of lactation. RCLA increased (P=0.08) energy intake (389 vs. 434, for C vs. RCLA, respectively), but had no effect (P>0.10) on estimated heat energy (155 vs. 169), milk energy (112 vs. 103) or energy excreted in methane (25.0 vs. 26.0), urine (11.1 vs. 11.0) or feces (108 vs. 119). However, RCLA improved (P<0.05) tissue energy balance (-17.1, 8.5, 6.6 and 24.4 at weeks 3, 7, 11 and 15 of lactation, respectively) compared with C (-53.1, -19.3, -8.2 and -6.5). In conclusion, RCLA decreased milk fat content, increased milk production and improved tissue energy balance of dairy cows during the first 15 weeks of lactation, with evidence of improved tissue N retention (19 vs. 42 g/d; P = 0.05). In contrast to the effects in growing mice, heat energy/BW.75 was not affected (1.26 vs. 1.30).

Key Words: Conjugated Linoleic Acid, Energy Metabolism, Dairy Cows

623 Effects of dietary CLA on production parameters and milk fatty acid variables in Holstein and Brown Swiss cows during heat stress.

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Heat stressed dairy cattle are bioenergetically similar to transition cows in that dietary intake may be inadequate to support maximum milk and component synthesis. Objectives were to evaluate whether CLA induced milk fat depression (MFD) during heat stress would allow for increased milk production and component synthesis. In addition, CLA effects on production variables, MFD and milk composition were compared between Holstein and Brown Swiss cows. Multiparous cows (n = 8, Holstein; n = 5, Brown Swiss) averaging 97 ± 17 DIM were used in a crossover design during the summer (mean THI = 75.7). Treatment period lengths were 21 d with a 7 d acclimation period prior to and between periods. During acclimation periods all cows received EnerGII® (a supplement of palm fatty acid distilla; Bioproducts Inc., Fairlawn, OH). Dietary treatment consisted of either 250 g/d of CLA (Bioproducts Inc.) or EnerGII. The CLA supplement contained a variety of CLA isomers (5.4% trans-8, cis-10; 6.3% cis-9, trans-11; 7.9% trans-10, cis-12; and 8.2% cis-11, trans-13 CLA). Treatment was applied 2x/d with half of the supplement top dressed at 0600 h and the remaining at 1800 h. There was no overall treatment effect on DMI (23.9 kg/d), milk yield (40.0 kg/d), SCC (305,000), protein% (2.86) or lactose% (4.52) or yield of these milk components. CLA supplementation decreased (P < 0.01) overall milk fat content and yield by 21 and 24%, irrespective of breed. The reduction of milk fat content and yield was greater on d 21 (28 and 37%, respectively). Energy balance was improved (P < 0.01) by 3.1 Mcal/d for the CLA group (-1.1 vs. 2.03 Mcal/d, respectively). Respiration rate (78 breaths/min) and skin temperature (35.4°C) were not affected by treatment. The CLA supplemented group had higher total milk fat CLA concentrations (8.3 vs. 4.8 mg/g). CLA supplementation caused MFD similarly between breeds and improved energy balance during heat stress, but had no effect on production parameters under these conditions.

Key Words: CLA, Milk Fat, Heat Stress

624 Effects of source and level of dietary lipid on in vitro production of conjugated linoleic acid and trans vaccenic acid.

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Two in vitro experiments were conducted to investigate the effects of source and level of lipid on biohydrogenation (BH) and the production of conjugated linoleic acid (CLA) and trans vaccenic acid (TVA). Exp. 1 examined the effect of partial (50%) or complete replacement of 4% yellow grease with each of the following three plant oils: soybean oil, corn oil, and sunflower oil (SUO), respectively. Based on the results of Exp 1, Exp 2 with a total of six treatments was designed to investigate the effect of four other plant oil sources, olive oil, peanut oil, canola oil, and safflower oil (SAO), as compared to yellow grease and SUO at 4% of dietary DM. Diets were composed of corn silage, alfalfa hay, soybean meal, and contained 18.4% CP and 32.4% NDF on average. The incubation periods were 0, 8, 12, or 16 h for Exp 1 and 0, 12, 18, and 24 h for Exp. 2. Three samples were incubated per treatment per time point. Fatty acid data were analyzed using the MIXED procedure of SAS with repeated measures. Rate of BH was estimated by linear regression. In Exp. 1, source of lipid did not affect the production of TVA but affected (P < 0.05) the production of CLA isomers and total CLA, with SUO producing the largest increase in TVA and CLA yields; elevated level of plant oil increased the production of TVA (P < 0.05), total CLA (P < 0.01) and CLA isomers (P < 0.01). In Exp. 2, SUO and SAO were similarly effective (P < 0.01) in increasing TVA production compared to other plant oils. However, SAO was more effective (P < 0.01) than SUO in increasing CLA production and SUO (P < 0.01) was more effective than the other oils. In addition, combined information from both experiments showed that, within the range of 4% of dietary DM, rate of BH was not affected by lipid source but slightly increased as oil level increased; production of CLA peaked between 12 and 18 h, whereas the peak for TVA occurred later, around 24 h.

Key Words: Conjugated Linoleic Acid, Vaccenic Acid, In Vitro

625 Concentration of cis-12 C18:1 in milk is more closely related to milk fat depression (MFD) than trans-10 C18:1 in cows fed fish oil. M. A. S. Gama[1], J. M. Griinari[2], P. C. Garnsworthy[3], P. H. M. Rodrigues[4], P. R. Leme[4], L. W. O. Souza[4], and D. P. D. Lanna*[1], [1]*Esalq-USP, Piracicaba, Brazil,* [2]*University of Helsinki, Finland,* [3]*University of Nottingham, UK,* [4]*Campus Pirassununga-USP, Brazil.*

Diets producing MFD alter pathways of rumen biohydrogenation, resulting in formation of intermediates which inhibit milk fat synthesis. Increased trans-10 C18:1 formation is a consistent observation. Furthermore, trans-10 C18:1 is often associated with formation of trans-10, cis-12 CLA, a precursor of trans-10 C18:1. Fish oil (FO)-induced MFD represents a notable deviation since it is associated with increased formation of trans-10 C18:1 without any increase in milk trans-10, cis-12 CLA content. This study evaluated temporal changes in secretion and fatty acid profile of milk fat in response to FO and low dietary fibre. Mid-lactation Holstein cows were used. The study was conducted in three periods: 1) Baseline: all cows (n=12) received high fibre diet (HF) without FO (baseline diet, BD) for 12 d; 2) Supplementation: cows (n=4) received three treatments for 21 d: a) HF+FO, b) Low fibre diet (LF) and c) LF+FO; 3) Post-supplementation: all cows returned to BD on 12 d. NDF contents of HF and LF were 40 and 25%, respectively. Roughage was corn silage and FO was included at 1.6% of DM. Milk fat content was progressively reduced for the first two weeks of FO supplementation, after which it reached a plateau. Co-variate adjusted LS-means for milk fat yield and content were 0.74a, 0.45b and 0.44b kg/d and 3.88a, 2.83b and 2.60b% for LF, HF+FO and LF+FO, respectively (different superscripts, $P<0.05$). Milk trans-10, cis-12 CLA content was unchanged by dietary treatments. However, trans-10 C18:1 and cis-12 C18:1 contents increased in FO supplemented diets ($P<0.05$). Temporal change in milk fat content was more closely associated with cis-12 C18:1 than trans-10 C18:1. We conclude that formation of cis-12 C18:1 is characteristic of the altered rumen biohydrogenation and a putative product of linoleic acid associated with FO-induced MFD.

Key Words: Fish Oil, Conjugated Linoleic Acid, Milk Fat Depression

626 Increasing dietary starch fermentability causes milk fat depression in low-producing, but not high-producing cows. B. J. Bradford* and M. S. Allen, *Michigan State University, East Lansing.*

The effects of dietary starch fermentability on milk production and fatty acid profile were evaluated in a crossover study. Thirty-two multiparous Holstein cows (121 ± 48 DIM, 41 ± 9 kg 3.5% fat-corrected milk; mean ± SD) were randomly assigned to treatment sequence and were fed a diet intermediate to the treatments during an initial 21-d period. Treatments were dry ground corn grain (DG) and high moisture corn (HM) from the same field. Treatment periods were 14 d, with the final 4 d used for data and sample collection. Diets included corn silage and alfalfa haylage at a 1:1 ratio and were ∼26% NDF, 16.5% CP, 32% starch, and ∼3% crude fat. Treatments had no consistent effect on production of milk, FCM, or milk components. HM decreased the concentration of C18:0 ($P < 0.001$) and increased concentrations of *trans*-9 C18:1 ($P < 0.001$), *trans*-10 C18:1 ($P < 0.01$), and *cis*- 9, *trans*-11 CLA ($P < 0.01$), but not *trans*-10, *cis*-12 CLA ($P = 0.18$) in milk fat. HM increased *trans* C18:1 concentrations at an increasing rate as production level decreased (quadratic regression, $P < 0.001$), and milk fat depression was evident in cows below approximately 40 kg/d FCM production. In contrast, production level had little influence on milk *trans* C18:1 concentration for DG (slope = -0.023, $P = 0.03$). Milk *trans* C18:1 concentration was negatively correlated with milk fat concentration (r = -0.75), as was *trans*-9 C18:1 (r = -0.60), *trans*-10 C18:1 (r = -0.61), and *cis*-9, *trans*-11 CLA (r = -0.61, all $P < 0.001$). Concentration of *trans*-10, *cis*-12 CLA was not correlated with milk fat concentration (r = -0.11, $P = 0.40$). Production level may influence biohydrogenation patterns and *trans* C18:1 production because of differences in rumen environment; rumen pH and dilution rate can alter metabolism and populations of rumen microbes. Diets with highly fermentable starch sources and without supplemental dietary PUFA can induce milk fat depression in lower-producing cows, possibly because of increased production of *trans* C18 fatty acids.

Key Words: Milk Fat Depression, Trans Fatty acids, Starch Fermentability

627 Effect of timing of initiation of fat supplementation on milk production, plasma hormones and metabolites, and conception rates of Holstein cows in summer. F. M. Cullens*, C. R. Staples, T. R. Bilby, F. Silvestre, J. Bartolome, A. Sozzi, L. Badinga, W. W. Thatcher, and J. D. Arthington, *University of Florida, Gainesville.*

Primiparous (n=22) and multiparous (n=25) Holstein cows were used in a completely randomized block design to determine the effects of timing of the initiation of fat supplementation (Megalac-R, Church and Dwight Co. Inc., Princeton, N. J.) on cow performance the first 14 wk postpartum (PP). Four treatments were as follows: 1) control (no supplemental fat source) and 2-4) Megalac-R supplementation (2% of dietary DM) beginning at 28 d prior to expected calving date, at day of parturition, or at 28 d PP. Blood samples were collected 3x weekly from calving through wk 10 PP. An Ovsynch protocol was begun between d 5 to 10 of an estrous cycle (d 62 PP) with AI occurring at d 72 PP. Orthogonal contrasts tested for treatments were 1 vs. (2+3+4), 2 vs. (3+4), and 3 vs. 4. Mean milk production was 38.1, 41.5, 36.5, and 37.1 kg/d, tending to be greater ($P = 0.06$) for cows fed fat starting in the prepartum compared to the PP period. Pattern of plasma progesterone concentrations accumulated from calving to 79 d PP did not differ among treatments. Of cows that ovulated to the Ovsynch protocol, cows fed fat tended ($P = 0.09$) to have better first service conception rates than controls (27.8 [3/11], 40.0 [4/10], 70 [7/10], and 63.6% [7/11]). Mean plasma concentration of total bilirubin through 4 wk PP was greater ($P= 0.05$) in cows fed fat starting prepartum compared to those starting PP (0.36 vs. 0.22 mg/dl). Plasma gamma-glutamyl transferase of cows fed fat starting prepartum increased from wk 1 to 4 PP (25.5 to 41.6 U/L) compared to controls (25.2 to 30.2 U/L) and those fed fat starting at calving (30.4 to 25.4 U/L) (treatment by wk interaction, $P = 0.01$). Cows fed fat had lower mean concentrations of plasma fibrinogen compared to controls (97.7 vs. 123.0 mg/dl) the first 4 wk PP. Plasma concentrations of BHBA, albumin, alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase, and ceruloplasmin were not affected by treatments.

Key Words: Fat, Milk Production, Reproduction

628 Kinetic model of rumen biohydrogenation: effects of rumen-protected fatty acid saturation on fractional rate of biohydrogenation and duodenal fatty acid flow in lactating dairy cows. K. J. Harvatine* and M. S. Allen, *Michigan State University, East Lansing.*

A simple model of rumen fatty acid (FA) metabolism is proposed that allows calculation of first order fractional rate of FA biohydrogenation and FA passage after determination of ruminal FA pool size and duodenal flux. Saturated and unsaturated rumen-protected fatty acid sources were evaluated for effects on fractional rate and extent of rumen biohydrogenation and duodenal FA flow. Eight ruminally and duodenally cannulated multiparous Holstein cows (77± 12 DIM, mean± SD) were used in a replicated 4x4 Latin square design with 21 d periods. Treatments were control and a linear titration of 2.5% added rumen-protected FA varying in saturation: saturated (SAT; prilled hydrogenated free FA, Energy Booster 100®), intermediate mix of SAT and unsaturated (UNS; calcium soaps of long-chain FA, Megalac-R®), and UNS FA. Experimental diets were 40% forage and contained 27.5% NDF, 30% starch, and 2.5% rumen available vegetable oil (13.5% cottonseed). Rumen-protected FA increased rumen FA turnover rate. Passage rates of C16:0, C18:0 and total C18 were linearly decreased with increasing UNS and trans-C18:1 fractional passage rate was quadratically affected with a maximum for the intermediate treatment. Increasing UNS increased extent of C18:2 and C18:3 biohydrogenation and decreased extent of 18:1 and trans-18:1 biohydrogenation, resulting in increased duodenal flow of trans-C18:1. Calcium salts failed to protect polyunsaturated FA from rumen biohydrogenation despite a mean ruminal pH of 6.0. This model allows a mechanistic description of rumen biohydrogenation and determination of extent of C18:1 biohydrogenation.

Key Words: Biohydrogenation, Kinetic, Fatty Acid

629 Effect of rumen-protected fatty acid saturation on feed intake and feeding and chewing behavior of lactating dairy cows. K. J. Harvatine* and M. S. Allen, *Michigan State University, East Lansing*.

Saturated and unsaturated rumen-protected fat sources were evaluated for effects on feed intake, meal patterns and chewing behavior. Eight ruminally and duodenally cannulated cows (77± 12 DIM, mean± SD)were used in a replicated 4x4 Latin square design with 21 d periods. Treatments were control and a linear titration of 2.5% added rumen-protected fatty acids (RPF) varying in unsaturation: saturated (SAT; prilled hydrogenated free FA, Energy Booster 100®), 50:50 ratio of SAT and unsaturated (UNS; calcium soaps of long-chain FA, Megalac-R®), and UNS. Experimental diets were 40% forage and contained 27.5% NDF, 30% starch, and 2.5% rumen available vegetable oil (13.5% cottonseed). Dry matter intake for SAT was not different from control while UNS linearly decreased DMI 3.2 kg. Wet weight of ruminal digesta decreased linearly up to 11.3 kg (13 %) with increasing UNS. Adding RPF did not change meal number, meal length or time between meals compared to control, but increasing UNS decreased meal size 0.22 kg (9 %) within RPF. SAT increased time spent ruminating 56 (10 %) and 42 (7 %) minutes/d compared to CON and UNS respectively. Increasing SAT did not change rumination bout frequency or interval between bouts, but increased rumination bout length 5.6 min compared to UNS. Water intake was not affected by treatment, but increasing SAT linearly decreased the number of drinking bouts per day up to 2.9 (23 %) bouts. Increased unsaturated FA flow to the duodenum decreased feed intake by decreasing meal size, and increased saturated FA flow to the duodenum increased rumination time per day by increasing rumination bout length.

Key Words: Rumination, Feeding Behavior, Fatty Acid

630 Abomasal infusion of L-carnitine alters hepatic fatty acid metabolism and decreases liver lipid in lactating Holstein cows. D. B. Carlson*[1], H. M. Dann[1], N. B. Litherland[1], J. C. Woodworth[2], and J. K. Drackley[1], [1]*University of Illinois, Urbana*, [2]*Lonza, Inc., Fair Lawn, NJ.*

Eight lactating, multiparous Holstein cows with ruminal cannulas were blocked by DIM (block 1, 162 ± 20 DIM; block 2, 101 ± 16 DIM) in a replicated 4 x 4 Latin square design. A 2 x 2 factorial arrangement of treatments was used to determine the effect of abomasal infusion of L-carnitine (20 g/d). During each 14-d period, treatments consisted of: 1) water infusion, ad libitum DMI (WA), 2) water infusion, restricted DMI (WR), 3) carnitine infusion, ad libitum DMI (CA), and 4) carnitine infusion, restricted DMI (CR). All cows received water infusion (1.2 L/d) on d 1-4 and either water or carnitine infusion on d 5-14. Infusions occurred at 0600, 1200, 1800, and 2400 h. Feed restriction (50% of previous 5-d DMI) was implemented on d 10. Cows were fed a TMR (16.6% CP, 1.68 Mcal/kg NE_L), and bST was injected on d 6 of each 14-d period. Liver was biopsied on d 14 of each period. Liver slices were incubated with [1-14C] palmitate (PALM) to determine conversion to CO_2, acid-soluble products (ASP), and esterified products (EP). Abomasal infusion of carnitine tended to increase conversion of PALM to CO_2 ($P = 0.06$) and increased conversion to ASP ($P < 0.01$) regardless of DMI. As a percent of total PALM metabolism, carnitine increased conversion to CO_2 ($P = 0.05$) and ASP ($P < 0.01$), while decreasing EP ($P < 0.01$). Total liver lipid content (% wet tissue) was greater (infusion x DMI; $P = 0.05$) for WR (5.14%) than for WA (4.33%), CA (4.43%), or CR (4.42%). Carnitine infusion reduced ($P = 0.04$) liver triglyceride (TG) concentration (0.30 %) compared with cows infused with water (0.65%). Infusion of carnitine increased ($P < 0.01$) free carnitine as well as long- and short-chain carnitine esters in liver tissue. Supplemental carnitine supplied postruminally increased oxidation of PALM by liver slices in vitro and decreased hepatic concentration of total lipid and TG in vivo, which may be of particular benefit to periparturient dairy cows.

Key Words: L-carnitine, Liver, Fatty Acid Metabolism

631 Abomasal infusion of L-carnitine affects metabolic and production responses to feed restriction in lactating Holstein cows. D. B. Carlson*[1], H. M. Dann[1], N. B. Litherland[1], J. C. Woodworth[2], and J. K. Drackley[1], [1]*University of Illinois, Urbana*, [2]*Lonza, Inc., Fair Lawn, NJ.*

A 2 x 2 factorial arrangement of treatments was used to determine the effect of abomasal infusion of L-carnitine (20 g/d) during negative energy balance. Eight lactating, multiparous Holstein cows with ruminal cannulas were blocked by DIM (block 1, 162 ± 20 DIM; block 2, 101 ± 16 DIM) in a replicated 4 x 4 Latin square design. During each 14-d period, treatments consisted of: 1) water infusion, ad libitum DMI (WA), 2) water infusion, restricted DMI (WR), 3) carnitine infusion, ad libitum DMI (CA), and 4) carnitine infusion, restricted DMI (CR). All cows received water infusion (1.2 L/d) during d 1-4 and either water or carnitine infusion during d 5-14. Infusions occurred at 0600, 1200, 1800, and 2400 h. Feed restriction (50% of previous 5-d DMI) began on d 10. Cows were fed a TMR (16.6% CP, 1.68 Mcal/kg NE_L), and bST was injected on d 6 of each 14-d period. Milk was sampled on d 7, 8, and 9 and d 12, 13, and 14. Blood was drawn at 0, 3, and 6 h relative to feeding on d 4, 8, and 12. Carnitine did not affect milk yield or milk composition prior to d 10, except for tending to decrease ($P = 0.08$) milk protein content. Restricted DMI decreased milk yield, milk fat yield, and milk protein content and yield compared with ad libitum DMI ($P < 0.01$). During feed restriction, CR (30.0 kg/d) tended to maintain 3.5% FCM (infusion x DMI; $P = 0.07$) relative to WR (27.6 kg/d). Feed restriction increased plasma NEFA (DMI x d; $P < 0.01$), while CR decreased NEFA compared to WR (infusion x DMI x d x h; $P < 0.01$). Serum BHBA was higher for CR than WR, but similar between CR and CA (infusion x DMI x d; $P = 0.01$) on d 12. Serum insulin was lower on d 12 due to DMI restriction (DMI x d; $P = 0.01$). Carnitine infusion increased ($P < 0.01$) the concentration of total carnitine in plasma compared with water infusion. Carnitine supplied postruminally improved metabolic responses to negative energy and nutrient balances induced by DMI restriction.

Key Words: L-carnitine, Metabolism, Milk Yield

632 Cholesystokinin mediates intake regulation of high fat diets in ruminants by acting on the reticulo-omasal sphincter. D. Kumar[1], M. A. Froetschel*[1], T. D. Pringle[1], and D. H. Keisler[2], [1]*The University of Georgia, Athens*, [2]*University of Missouri, Colubia*.

Four yearling (320 kg) and four mature (650 kg) ruminally-fistulated Holstein steers were used in two, simultaneously run 4X4 Latin square designed trials to investigate the role of CCK and leptin in intake regulation of cattle fed high fat diets. Steers were fed diets containing 0, 3, 6, or 9% supplemental fat. Megalac was substituted for corn in high fat diets. All diets were formulated to contain 16.5% CP and 38.5% RUP. Diets contained concentrate and chopped Bermudagrass hay in the ratio of 2:1 and were fed once daily. Experimental periods were 10 days in length. On d 9, rumens were evacuated before feeding and again 6 h afterwards. Rumen contents were weighed, sampled and immediately replaced to provide estimates of rumen particulate disappearance rates. Reticulorumen motility was measured 1-3 h after feeding. Reticulo-omasal orifice opening time was measured only in yearling steers. Jugular blood samples were collected every 30 min, 1 h before and 3 h after feeding. Blood samples were analyzed for leptin, insulin, and glucose. On d 10, all procedures on d 9 were repeated except devazepide (70ug/kg BW), a CCK-A receptor antagonist, was injected into the jugular vein 1 h after feeding. Dietary fat decreased DMI 10.6 -13.1% (Linear, P<.05) in both yearling and mature steers. Yearling steers ate more as a percent of body weight as compared to mature steers (2.94 % VS 2.14%). Devazepide did not influence DMI. Dietary fat had no effect on reticulorumen motility, but devazepide increased motility irrespective of dietary treatment. Dietary fat decreased reticulo-omasal orifice opening time by 7.3 to 33.6% (Linear, P<.05) in yearling steers and this effect was blocked by devazepide. Dietary fat decreased disappearance of ruminal digesta in yearling steers and this effect was blocked by devazepide. Neither dietary fat, devazepide or steer maturity affected leptin, insulin, or glucose. This data suggests that CCK-A is involved in regulating activity of the reticulo-omasal sphincter, thereby influencing reticulo-ruminal passage and mediating intake of ruminants fed dietary fat.

Key Words: Intake, Fat, Cholecystokinin

633 Effect of feeding Ca salts of palm oil (PO) or a blend of linoleic and monoenoic trans fatty acids (LTFA) on uterine involution and reproductive performance in Holstein cows. S. O. Juchem*[1], R. L. A. Cerri[1], R. Bruno[1], K. N. Galvao[1], E. W. Lemos[1], M. Villasenor[1], A. C. Coscioni[1], H. M. Rutgliano[1], W. W. Thatcher[2], D. Luchini[3], and J. E. P. Santos[1], [1]*University of California Davis,* [2]*University of Florida, Gainesville,* [3]*Bioproducts, Inc.*.

Objectives were to evaluate the effects of Ca salts differing in fatty acid profile on uterine involution and reproduction of dairy cows. After blocking according to parity, BCS at dry off and previous lactation milk production, 397 Holstein cows were randomly assigned to one of the two treatments consisting of Ca salts (2% diet DM) of either PO or LTFA from 23 d prepartum to 70 DIM. Body condition of all cows was scored at -43, -23, calving, and at 40, 70, 100 and 140 DIM. Blood was sampled during the first 21d postpartum four times weekly from a subset of 60 cows and plasma was analyzed for PGF metabolite. Ultrasound evaluation was performed weekly from 14 to 42 DIM to determine uterine diameter, thickness of the uterine wall, presence of fluid and interval to first ovulation. Cows were timed inseminated following the Ovsynch protocol at 72 DIM. Continuous and binomial data were analyzed by the MIXED and LOGISTIC procedures of the SAS (2001) program. Source of fatty acids had no effect on BCS either pre- or postpartum (P<0.40). Incidence of retained placenta (6.5 vs 6.7 %) and interval from calving to first postpartum CL (27.9 vs 28.3 d) did not differ (P>0.15) between PO and LTFA, respectively. Interval from calving to disappearance of uterine fluid was reduced in cows fed LTFA compared to PO (27.6 vs 25.8 d; P=0.04). Pregnancy rate after first postpartum AI tended to be higher for LTFA than PO at 27 (36.1 vs 28.1%; P=0.09) and 41 (33.5 vs 25.6%; P=0.09) d after AI, but pregnancy losses were similar (P=0.74) and averaged 7.9%. Ca salts differing in fatty acid profile affected reproduction of dairy cows.
Supported by NRI/USDA Grant 2003-02742.

Key Words: Reproduction, Fatty Acids, Dairy Cows

634 Responses of milk fat composition to dietary non-fiber carbohydrates in Sarda dairy sheep. A. Nudda*, S. Fancellu, F. Porcu, F. Boe, and A. Cannas, *Dipartimento di Scienze Zootecniche, University of Sassari, Italy.*

Diets with high concentration of non-fiber carbohydrates (NFC) often induce milk fat depression (MFD) and changes in the fatty acid (FA) composition of milk in cows. In sheep MFD is less common, even when high NFC diets are fed at very high levels of intake or when they are supplemented with unsaturated oil. However, there are very few studies on sheep milk fatty acid composition for these diets. For this reason, an experiment was carried out to study the effect of diets with high (43% of DM) and low (28% of DM) NFC concentration on fat content and FA composition in sheep milk. Ten Sarda dairy sheep in midlactation were individually fed ad libitum diets that contained 56% of finely chopped alfalfa hay and 44% concentrate. The concentrate was mainly corn and barley in the high NFC diet (H-NFC), while soybean hulls were used in the low NFC diet (L-NFC). Both diets had similar fat content but the H-NSC diet contained higher concentration of C18:1 (+28%) and C18:2 (+25%) than L-NFC diet. DMI was affected by dietary treatments (H-NFC = 2501 g/d; L-NFC = 2891 g/d; P < 0.005). The ewes fed the H-NFC diet consumed more C18:1 and C18:2 and less C18:3. Milk yield was not affected by the treatments (H-NFC = 1674 g/d; L-NFC = 1765 g/d). Milk fat content (7.1% vs. 7.0%) and milk fat yield (116 vs. 122 g/d) did not differ between H-NFC and L-NFC diets. Sheep fed H-NFC diets had higher milk C6 to C12 FA and lower C18:0 and cis-C18:1 FA. All trans-C18:1 positional isomers were significantly higher for sheep fed H-NFC diet. The t10 C18:1 content was more than doubled in H-NFC (P<0.01). Total trans-C18:1 acids and individual isomers did not affect milk fat content. The c9,t11 CLA isomer was significantly higher for sheep fed H-NFC. The desaturase index, calculated as c9,t11 CLA/(t11-C18:1 + c9,t11 CLA), was lower in H-NSC group (P<0.01). Overall, the higher trans-C18:1 and CLA and lower C18:0 and desaturase index in milk fat of sheep fed H-NFC diets suggest that rumen biohydrogenation of unsaturated FA is slower and thus more unsaturated FA escapes from rumen. The high NFC diet used in this study did not decrease fat synthesis in sheep milk. (Research supported by MiPAF).

Key Words: Dairy Sheep, Non-Fiber Carbohydrates, Milk Fatty Acids

635 Nutritional properties and use of rumen protected oilseed /conjugated linoleic acid (CLA) supplements. S. K. Gulati*[1], S. W. McGregor[2], and T. W. Scott[2], [1]*Sydney University,* [2]*Rumentek Pty Ltd.*

FDA (2003) has recently approved the use of formaldehyde as a feed additive for dairy and beef dietary supplements derived from oilseeds/meals. The practical significance of this is that the same diet containing rumen undegraded protein (RUP), rumen undegraded fat (RUF) and designer n-3, n-6 fatty acids can be included in the rations of lactating and non-lactating ruminants. The proportions of RUP and RUF in the supplements made by emulsification and formaldehyde treatment of soybean/canola oilseeds are approximately 90% and 80% respectively; the intestinal digestibility of the C18 unsaturated fatty acids and essential amino acids is 90% and 82%. Oilseeds supplements can be designed in terms of fat content and composition for specific production goals eg, improving reproductive performance, enhancing the physical and nutritional properties of milk and meat. In the current experiment our aim was to determine if the CLA induced suppression of milk fat could be reversed by feeding rumen protected (RP) oilseed supplements. Five Holstein cows in mid-lactation, grazing a predominantly kikuyu based pasture, were fed RP-CLA alone (61.5g/d equivalent to 10.3g/d *trans*10, *cis*12 and 10.2g/d of *cis*9, *trans*11) for 4 days followed by a combination of RP-CLA and RP-soybean/canola oilseed, the latter providing 656g of additional fat per day. RP-CLA alone reduced milk fat by 30% (from 3.4% to 2.4%; P<0.001) and fat yield by 28% (from 826g/d to 594g/d; P<0.001). In combination with RP-soybean/canola oilseed, milk fat increased from 2.4% to 3.4% (P<0.001) and fat secretion was enhanced from 594g/d to 858g/d (P<0.001). This result indicates that the mechanism of CLA induced milk fat depression occurs primarily in the lipogenic pathways within the mammary gland and not on the uptake and transfer of circulating fatty acids. From a dairy industry perspective, it is now practical to design and feed RP fat/protein supplements that produce beneficial effects on performance and product quality.

Key Words: Rumen Protected Oilseeds, CLA

Sheep Species

636 Effect of GnRH in conjunction with ram introduction on the induction of fertile estrus during the nonbreeding season. K.M. Jordan*, A.K. Wurst, E.K. Inskeep, and M. Knights, *Division of Animal and Veterinary Sciences, West Virginia University, Morgantown.*

Introduction of novel rams to anestrous ewes, the ram effect, can be used as a tool for out-of-season breeding but produces a variable response. A single injection of progesterone at ram introduction (RI) and treatment with PG on d 12-16 improved the proportion of pregnant ewes. Maintenance of the ram-induced corpus luteum (CL) up to PG treatment is probably crucial to success of this procedure. Therefore, the effect of a GnRH injection in conjunction with RI was evaluated in anestrous ewes. In addition, the effect of presence of a CL prior to PG injection on fertility of anestrous ewes was tested. In early July, ewes (n = 28-32/group) were exposed to intact rams for 35d and given an ovulatory dose of GnRH (100μg) on d2, d7 or both days following RI. The presence of a CL was determined by transrectal ultrasonography on d7 and d14 at which time an injection of 20 mg PG (Lutalyse) was given. Pregnancy was diagnosed on d52 and d67 relative to RI. Mean estrous response (56%), pregnancy rate to the first (PR1; 29%) and second (PR2; 65%) service periods did not differ among groups. Because of potential for a CL induced by RI or GnRH to be short-lived, the effect of presence of a CL on d7 and/or d14 on fertility variables was examined. Ewes were reclassified as having: no CL on d7 or 14 (CL 0; n=14), a CL on d7 only (CL 7; n=10), a CL on d14 only (CL 14; n=16), or a CL on both days (CL 7,14; n=16). More ewes (P<0.01) in CL 7 (70%), CL 14 (81%) and CL 7,14 (81%) were marked by rams than in CL 0 (14%). PR1 and PR2 were greater in ewes in CL 7,14 (53 and 81%) and CL 14 (38 and 93%) than in CL 0 (7 and 38%). PR1 tended to be higher (P = 0.06)