

service rate were the number of lactating cows per breeding technician, use of a resynchronization program, utilization of soakers in the holding area during the summer, and bunk space per cow in the breeding pen. The aforementioned models explained 35% and 40% of the observed variation in conception rate and service rate, respectively.

Key Words: reproductive performance, management, machine learning

350 Pregnancy rates and herd turnover proportions after using a hormonal synchronization protocol in primiparous dairy cows in a California dairy. K. G. Gohary^{*1}, S. S. Aly², D. C. Wagner¹, B. R. Hoar², V. M. Lane³, and J. D. Rowe³, ¹*William R. Pritchard Veterinary Medical Teaching Hospital, School of Veterinary Medicine, University of California, Davis*, ²*Department of Veterinary Medicine and Epidemiology, School of Veterinary Medicine, University of California, Davis*, ³*Department of Population Health and Reproduction, School of Veterinary Medicine, University of California, Davis*.

The objective of this trial was to evaluate the effect of hormonal synchronization on pregnancy rate (PR) and herd turnover (HT) proportions in primiparous dairy cows. To accomplish this goal a clinical trial was designed to estimate the pregnancy incidence density (PID) rate after up to 3 inseminations, median time to pregnancy and herd turnover proportions in the current and subsequent 2 lactations. A cohort of primiparous Holstein cows (n=333) housed in a freestall dairy in the central valley of California was selected. Cows were systematically enrolled into 2 groups. Cows in the treatment group (n=178) received 100µg of gonadotropin-releasing hormone (GnRH) on day 0, 25mg of prostaglandin F_{2α} (PGF_{2α}) on day 7 and a second GnRH treatment (100µg) on day 9 and were artificially inseminated after 16 hours regardless of heat signs. Cows in the control group (n=155) were inseminated upon heat detection or observation of rubbed tail chalk without receiving hormonal treatments unless warranted for pathological reasons. Veterinarians were unaware of cow group allocation during herd checks. Median time to pregnancy was less for the treatment group than the control group (53 days versus 87 days, *P*=0.023). Although not significant, the PID ratio of the treatment group to the control group was 1.13 (*P*=0.46) indicating a 13% higher PR among synchronized cows than controls. In contrast, PID ratio for cows enrolled with a body condition score (BCS)<2.5 was 1.55 indicating that under-conditioned cows had a 55% higher PR when synchronized compared to control cows of similar BCS (*P*=0.34). However, synchronized cows with 2.5 to 3.5 BCS had only a 4% greater PR than controls of similar BCS (*P*=0.82). Proportion of HT after the first, second and third lactations and overall after 3

lactations did not differ among treatment and control groups (*P*=0.14). In summary, hormonal synchronization in primiparous cows reduced the median time to pregnancy, may be of benefit to under-conditioned cows, and had no significant effect on herd turnover in current and subsequent lactations

Key Words: primiparous dairy cows, hormonal synchronization, pregnancy rates

351 Effect of days open in the previous lactation on the risk of culling or death around calving. P. J. Pinedo^{*} and A. De Vries, *University of Florida, Gainesville*.

The objective was to evaluate the effect of days open (days to conception) on the risk of culling and death in the proximity of a subsequent calving in Holstein cows enrolled in the DHI program. After edits, 6,974,152 observations of cows calving between 2000 and 2006 in herds located in 38 states in the Eastern US were available. The period at risk included the time between 14 d before expected calving and 60 d after calving. Days open were categorized in 6 periods; 0 to 45 d, 46 to 90 d, 91 to 150 d, 151 to 210 d, 211 to 300 d, and 301 to 600 d. Other variables of interest included parity, last test day milk yield prior to dry off, last test day milk yield by 60 d after calving, season of calving, and 305-d milk production. Control variables were calving year, herd size, and herd milk production. All variables were categorized. Generalized mixed models were used and included herd as random effect. Interactions between days open and the variables of interest were included in the final model if *P* < 0.10. Least square means (LSM) for the risk of death were 1.01, 1.00, 1.13, 1.27, 1.58, and 2.00%, for increasing categories of days open. Similarly, for the same categories, LSM for the risk of culling (excluding death) were 2.07, 2.19, 2.31, 2.50, 2.69, and 3.07%. Least square means for the risk of culling and death combined (CD) were 2.78, 3.70, and 5.11% for parity 2, 3 and 4, respectively. For the risk of CD, LSM were 4.52, 3.54, and 3.29% for low, medium or high test day milk yield prior to dry off, and were 10.2, 2.66 and 1.87% for low, medium or high test day milk yield by 60 d after calving. The effect of days open on the risk of culling was slightly greater for lower parity cows, for cows with greater test milk yield prior to dry off, for lower test milk yield by 60 d after calving, for winter calvings, and for lower 305-d milk production in the previous lactation. Similar trends for these interactions were found for the risk of death. It is concluded that increased days open in the previous lactation were associated with a greater risk of culling and death around calving.

Key Words: culling risk, death risk, days open

Ruminant Nutrition: Fat Supplementation

352 Effective use of safflower seeds in early lactation diets with alfalfa hay and corn silage. A. Alizadeh¹, G. R. Ghorbani¹, M. Alikhani¹, H. R. Rahmani¹, and A. Nikkhah^{*2}, ¹*Isfahan University of Technology, Isfahan, Iran*, ²*Zanjan University, Zanjan, Iran*.

Safflower seed (SS), *Carthamus tinctorius* L., has the highest concentration of linoleic acid among 80 oilseeds. We hypothesized that SS can be effectively fed with cottonseeds (CS) in diets with dry hay and ensiled forage to maintain feed intake, energy metabolism and productivity of early lactation cows under negative energy balance. Our objective was to determine the effects of feeding diets containing 1) 10% whole CS with no SS (SS0), 2) 7.5% CS + 2.5% SS (SS2.5), and 3) 5% CS + 5%

SS (SS5), on a DM basis, on feed intake, rumen fermentation, blood metabolites and lipids, and milk production. Nine multiparous early lactation Holstein cows (46 ± 7 days in milk) were used in a replicated 3 × 3 Latin square design study with 21-d periods. Each period had 14-d of adaptation followed by 7-d of data collection. Cows were fed isoenergetic and isonitrogenous total mixed rations, based on alfalfa hay, corn silage, and barley and corn grains, twice daily at 0900 h and 1600 h. Data were analyzed using mixed models with the fixed treatment effect and random period and cow effects. Feeding SS0, SS2.5 and SS5 diets did not respectively affect dry matter intake (23.3, 24.1, 22.8 kg/d, *P*=0.42), rumen pH (6.58, 6.49, 6.55, *P*=0.86) and ammonia (9.4, 8.5, 8.5 mg/dl, *P*=0.24) and VFA concentrations, blood levels of

insulin (6.6, 7.0, 7.0 μ IU/ml), NEFA (161, 165, 156 μ Eq/l, $P=0.20$), urea (19.3, 20, 20.7 mg/dl, $P=0.22$) and triglycerides (13.0, 14.8, 14.5 mg/dl, $P=0.32$), as well as milk yield (36.0, 36.8, 35.4 kg/d, $P=0.44$) and energy-corrected milk yield (36.3, 36.5, 35.3 kg/d, $P=0.13$). Adding SS to the ration linearly reduced blood glucose (54.8, 52.3, 50.7 mg/dl, $P=0.05$) and BHBA (5.05, 5.13, 3.95 mg/dl, $P=0.03$) and increased blood total cholesterol (241, 247, 257 mg/dl, $P<0.01$) and low-density lipoproteins (193, 194, 203 mg/dl, $P=0.02$). Results demonstrate that SS as an economical and rich source of essential fatty acids can be included up to 5% of diet DM alongside CS for early lactation cows without affecting feed intake while maintaining rumen fermentation, peripheral energy supply and milk production.

Key Words: safflower seed, early lactation, palatability

353 Effect of flaxseed oil supplementation on *in vitro* ruminal fermentation in the rumen simulating fermenter (RUSITEC). K. J. Hart*, F. Wurlod, D. A. Kenny, and T. M. Boland. *University College Dublin, Lyons Research Farm, Newcastle, Co. Dublin, Ireland.*

Flaxseed oil has a high content of the essential dietary poly unsaturated fatty acids (PUFA) linolenic and linoleic acid. Supplementation of ruminant diets with PUFA may provide an alternative hydrogen sink within the rumen and as a result may reduce enteric methane production. The aim of this experiment was to investigate the effect of increasing flaxseed oil inclusion level on fermentation products and methane production using a rumen simulating fermenter (RUSITEC) system. Sixteen RUSITEC fermentation vessels were used in this study, each with a volume of 0.85 L. Rumen fluid was collected from four fistulated lactating dairy cows grazing grass supplemented with 6 kg/d concentrate. Artificial saliva was infused at a constant rate of 0.7 L/d using a peristaltic pump. Vessels were fed 16 g/d of a 70:30 dried grass:dairy concentrate on a DM basis. Raw flaxseed oil was added directly to the feed bags prior to incubation at 0, 20, 40 or 60 g/kg DM. Treatments were assessed in quadruplicate. Following a 10 d stabilization period daily methane production was recorded and subsamples of outflow liquor were collected for VFA and ammonia analysis for the following 4 d. Data were analyzed using the MIXED procedure of SAS with terms for oil level and machine included in the statistical model. There was no effect of level of oil inclusion ($P > 0.05$) on any of the variables measured. Results from this experiment show that the addition of flaxseed oil does not affect *in vitro* rumen production of VFAs, ammonia or methane at least at the forage to concentrate ratio used here.

Key Words: methane, dairy, flaxseed oil

354 Effect of prepartum feed restriction and oilseed supplementation on peripartum cow metabolism. A. Hayirli*¹ and L. Doepel², ¹Atatürk University, Erzurum, Turkey, ²University of Alberta, Edmonton, AB, Canada.

This experiment was conducted to determine if feed restriction and supplementation of unsaturated fatty acids (UFA) during the close-up dry period would improve metabolic status and alleviate the severity of negative energy balance (EB) and hepatic lipidosis (HL) in early lactation. Holstein cows ($n=77$) were assigned randomly to 1 of 2 feeding schemes (FS): ad libitum (AL) and 30% feed restriction (FR) and 3 oilseeds (OS): canola (C), linola (L), and flax (F) for 4 wks before expected calving. During the first 63 DIM cows were fed a common lactation diet. Blood samples were collected 19 times between d -34

and d 63 relative to calving and liver samples were obtained on d -34, 1 and 21. Data were subjected to ANCOVA for main effects of FS and OS and their interactions by time. There were no FS by OS interaction effects on the response variables. FR was associated with a lower EB prepartum but a less negative EB in early lactation. FS did not alter plasma glucose (mg/dl), BHBA (mg/dl), IGF-1 (ng/ml), and CCK (pmol/l) concentrations that averaged 67.1, 6.8, 69.9, and 1.2 prepartum and 58.9, 11.5, 35.7, and 1.8 postpartum, respectively. Liver TG was not affected by FS or OS. Overall, OS type did not affect response variables. In conclusion, feed restriction but not UFA provision during the close-up dry period improved EB without altering the severity of HL in early lactation.

Table 1. Energy balance and metabolic profile of peripartum cows

| Variables | FS | | | OS | |
|--------------------------------------|-------|-------|-------|-------|-------|
| | AL | FR | C | L | F |
| Prepartum | | | | | |
| EB, Mcal/d ^a | 4.63 | -0.33 | 1.97 | 2.52 | 1.97 |
| Insulin, μ IU/ml ^a | 6.8 | 4.4 | 5.6 | 5.9 | 5.3 |
| NEFA, mEq/ml ^a | 436 | 572 | 541 | 491 | 480 |
| Leptin, ng/ml ^a | 14.2 | 10.8 | 12.8 | 12.5 | 12.0 |
| Postpartum | | | | | |
| EB, Mcal/d ^a | -6.99 | -4.49 | -5.25 | -5.87 | -6.08 |
| Insulin, μ IU/ml | 3.5 | 4.3 | 3.9 | 4.8 | 3.0 |
| NEFA, mEq/ml | 810 | 727 | 774 | 759 | 773 |
| Leptin, ng/ml | 8.6 | 8.9 | 8.8 | 9.2 | 8.3 |
| Liver TG, μ g/g DM | 13.7 | 12.4 | 12.9 | 14.5 | 11.9 |
| Liver Gly, μ g/g DM ^b | 2.9 | 4.4 | 3.1 | 3.3 | 4.5 |

^aFS effect: $P<0.01$; ^bOS effect: $0.05\leq P<0.10$

Key Words: feed restriction, fatty acid supplementation, liver metabolism

355 Effects of duodenal infusion of linolenic acid on milk fatty acid composition in dairy cows. D. P. Bu¹, Khas-Erdene¹, J. Q. Wang*¹, H. Y. Wei¹, L. Y. Zhou¹, and J. K. Drackley², ¹State Key Laboratory of Animal Nutrition, Institute of Animal Science, Chinese Academy of Agricultural Sciences, Beijing, P. R. China, ²Department of Animal Sciences, University of Illinois, Urbana.

Increasing the linolenic acid content of milk fat might be desirable to meet consumer preference. Our objective was to determine the potential to alter the content of C18:3 in milk by duodenal infusion of a high C18:3 free fatty acid mixture. Four multiparous Chinese Holstein cows (BW = 556 ± 19 kg, DIM = 93 ± 9 d) fitted with duodenal cannulas were administered 2 treatments in a crossover design. Treatments were homogenized aqueous mixtures of α -linolenic acid (LNA; 82.4% *cis*-9, *cis*-12, *cis*-15 18:3; 14.7% *cis*-9, *cis*-12 18:2; 2.8% *cis*-9 18:1) or control containing only the emulsifying ingredients. The control infusate consisted of 15 g/d of xanthan gum, 5 g/d sodium alginate, and 25 g/d of Tween 80 in 10 L of water. Each period lasted 5 wk, in which 2 cows received each amount (0, 40, 80, 120, and 160 g/d) of LNA for 1 wk each, and the other 2 cows received only the carrier infusate. Measurements were made during the last 3 d of each infusion amount. Data were analyzed statistically by using PROC MIXED of SAS. Polynomial contrasts were constructed of linear, quadratic, and cubic effects of amount by treatment. Significance was declared at $P < 0.05$. Increasing the amount of LNA infused into the duodenum linearly increased concentrations of

cis-9, *cis*-12, *cis*-15 C18:3 (0.16, 6.49, 12.42, 18.75, and 25.38% for LNA infused at 0, 40, 80, 120, 160 g/d, respectively) and *cis*-9, *cis*-12 C18:2 (2.38, 2.94, 3.19, 3.77, and 4.16%). Increasing LNA decreased percentages of short-chain fatty acids, C14:0, and C16:0 so that total FA \leq 16C (65.2, 60.7, 57.8, 51.4, 46.0%) decreased linearly. Increasing LNA linearly decreased percentages of *cis*-9 C18:1 (17.4, 16.6, 13.7, 11.7, 11.5%) and *cis*-9, *trans*-11 C18:2 (0.37, 0.37, 0.28, 0.26, 0.18%) in milk fat. Milk fat content of *cis*-5, *cis*-8, *cis*-11, *cis*-14, *cis*-17 C20:5 (0.09, 0.18, 0.22, 0.21, 0.22%) was quadratically affected, whereas concentrations of C18:0, *trans*-9 C18:1, *trans*-11 C18:1, and *trans*-10, *cis*-12 C18:2 were not affected. Increasing the supply of linolenic acid to the small intestine linearly increased linolenic acid in milk fat and markedly altered milk fat composition.

Key Words: linolenic acid, milk fatty acids, supplemental fat

356 Milk fatty acid and protein profiles of grazing cows fed high-fat protein supplements. R. Nyoka*, A. R. Hippen, K. F. Kalscheur, and D. J. Schingoethe, *South Dakota State University, Brookings.*

To determine the effect of supplementing grazing cows with various protein and fat supplements, 27 multiparous cows (9 Brown Swiss and 18 Holsteins, 144 \pm 83 DIM) were allowed to graze alfalfa pasture and fed partial Total Mixed Rations (pTMR) containing: 1) dried distillers grains with solubles (DDGS), 2) soybean meal (SBM), or 3) fishmeal (FM). The pTMR were fed to supply 50% of estimated energy requirements (NRC 2001) and were formulated to have similar crude protein and fat content. Cows had *ad lib* access to alfalfa pasture during the 8-week experimental period. Intakes of pTMR (DM basis) were 23.8, 22.3 and 23.3 kg/day for DDGS, FM and SBM supplemented groups respectively. There were no dietary effects on milk yield with 31.7, 31.4 and 31.5 kg/cow/day for DDG, FM, and SBM. Milk fat percent was greatest for FM followed by DDG and SBM (3.61, 3.53, 3.23%, $P \leq 0.01$). Cows fed DDGS and SBM had lesser ($P \leq 0.05$) concentrations of C12:0, C14:0 and C16:0 in milk fat compared with FM. Dietary treatments did not affect the CLA concentrations in milk (1.10%, 1.14% and 1.04% for DDGS, FM and SBM). Milk from cows fed DDGS and SBM had greater ($P \leq 0.04$) concentrations of long chain fatty acids (58.6% and 58.5%, respectively) and polyunsaturated fatty acids (8.7% and 9.6%) compared with 56.3% and 8.2% from FM. Milk total protein, casein, and casein/protein ratio were not affected by the dietary treatments. A significant breed \times diet interaction was observed in both milk total protein and casein ($P \leq 0.01$). Holstein cows produced greater protein and casein concentrations in milk when fed FM (3.0% and 2.7%) followed by DDGS (2.8% and 2.4%) and SBM (2.6% and 2.2%). Brown Swiss cows produced greater protein and casein when fed DDGS (3.2% and 2.7%) and SBM (3.2% and 2.6%) compared with FM (2.6% and 2.2%). Supplementing grazing cows with high-fat protein supplements can increase the levels of the more desirable long chain and polyunsaturated fatty acids in milk without compromising on milk yield and components.

Key Words: high-fat protein, grazing, milk fatty acids

357 Production response to fat supplementation of corn silage based diets in dairy goats. C. Montes de Oca G. L. Olivares R, J. G. Estrada F, and M. Gonzalez-Ronquillo*, *Universidad Autonoma del Estado de Mexico, Toluca, Mexico.*

High quality milk and dairy products are nutritious and healthy foods that are frequently consumed by people which desire healthy products.

Recently the ruminant fats are the major source of CLA in the human diet, the available evidence suggests that increases in 18: 2n-6 intake on high-forage diets could be used as a nutritional strategy for enhancing the supply of *cis*-9,*trans*-11-CLA available for absorption. The objective of the present study was to determine the milk yield and milk composition in dairy goats, supplemented with different fat sources, sunflower seeds oil rich in 18:2n-6, linaza seeds or Megalac R. Six lactating dairy French alpine goats were used, BW 52.5 Kg, The experimental design was a 3x 3 Latin square 3, 9-wk periods. Goats were housed in a metabolism unit in individual stalls, and feeded at 0800 and 1600 h, with free water access and milked in situ at 0800 h. Diets (14% CP, 2.8 Mcal EM) were formulated with rye grass silage and hay and supplemented cereal based concentrated with sorghum grain, canola meal and minerals plus one fat source, T1: Megalac-R, T2: Sunflower seed oil, T3: Linaza seeds oil. Experimental takes 20 days, the first 14 days were for adaptation period and the last 6 days for taking samples. Individual intake and daily milk production were recorded daily. Milk fat, true protein, SNF, were determined by near-IR spectroscopy (Milko-Scan 133B analyzer; Foss Electric, Hillerød, Denmark). Data from the last 6-day of each period were analyzed using proc glm in SAS; LS means are reported in the table. With the exception of milk fat content, there were not significant effects of diet ($P > 0.05$), on all production traits. However, yield of milk and true protein were not different between diets. Results indicated that Megalac-R increase milk fat content.

Table 1.

| Item | Dietary fat source | Megalac-R | Linaza seed | Sunflower seed | SE | Diet |
|--------------------|--------------------|-----------|-------------|----------------|------------|------|
| Milk yield (Kg/d) | 0.743 | 0.772 | 0.782 | 0.004 | NS | |
| Fat (g/d) | 39.9 | 38.5 | 40.5 | 0.27 | NS | |
| Fat (%) | 5.35a | 4.98b | 5.14ab | 0.10 | $P < 0.05$ | |
| True Protein (g/d) | 33.6 | 35.2 | 35.6 | 0.21 | NS | |
| True Protein (%) | 4.5 | 4.6 | 4.6 | 0.02 | NS | |
| SNF (g/d) | 71.8 | 75.1 | 76.0 | 0.44 | NS | |
| SNF (%) | 9.7 | 9.7 | 9.7 | 0.03 | NS | |

ab in the same row $P < 0.05$

Key Words: goats, milk composition, fat sources

358 Tracer studies in cultures of ruminal microorganisms reveal the formation of conjugated double bonds originating from biohydrogenation of ^{13}C -labeled linolenic acid. Y. J. Lee, C. M. Klein, and T. C. Jenkins*, *Clemson University, Clemson, SC.*

Conjugated linoleic acid (CLA) isomers accumulate in ruminal contents of cattle and are believed to arise exclusively from the microbial biohydrogenation of linoleic acid. Yet, the addition of linolenic acid to ruminal cultures causes shifts in CLA production. To test the possibility of direct conversion of linolenic acid to CLA, two separate *in vitro* experiments were run that each included 24 culture tubes containing ground dairy feed, buffer, and strained rumen fluid from a continuous culture fermenter. Substrate in half of the cultures contained unlabelled linoleic acid and the remaining cultures contained the same quantity of either $1\text{-}^{13}\text{C}$ -linolenic acid in Exp. 1 or $U\text{-}^{13}\text{C}$ -linolenic acid in Expt. 2. Samples were taken from each flask at 0, 3, 24, and 48 hours. Methyl esters of fatty acids were separated on a 100-m CP-Sil 88 column and abundances of the quasimolecular ion (M) and M+1 or M+18 ions were determined by mass spectroscopy in positive chemical ionization mode using methane reagent gas. Geometry and double bond posi-

tion of CLA isomers was verified by acetonitrile chemical ionization tandem mass spectrometry. Enrichment for each peak was calculated as $[(M+1(18)/M) * 100]$ in labeled minus unlabelled cultures and tested for their difference from zero by t-test ($P < 0.05$). From 0 to 48 h of incubation, linolenic acid quantity declined ($P < 0.05$) from 2.19 to 0.06 mg/culture, t11 18:1 increased ($P < 0.05$) from 0.06 to 0.82 mg/culture, and stearic acid increased ($P < 0.05$) from 0.42 to 1.90 mg/culture indicating active biohydrogenation. Enrichment of linolenic acid remained constant over all incubation times ranging from 33.3 to 35.5%. The t11 18:1 was enriched ($P < 0.05$) by 3 h through 48 h incubation, and stearic acid was enriched ($P < 0.05$) by 24 and 48 h incubation. At 48 h of incubation, enrichment was observed in all CLA isomers identified including c9t11, t10c12, and t9t11. The results of this study verified the formation of a multitude of CLA isomers originating from linolenic acid biohydrogenation, including c9t11 and t10c12 CLA.

Key Words: linolenic acid, biohydrogenation, conjugated linoleic acid

359 Effect of linolenic acid, fish oil and dietary vitamin E supplementation on sustained conjugated linoleic acid production in milk fat from dairy cows. A. M. O'Donnell*, K. P. Spatny, J. C. Alishauskas, and D. E. Bauman, *Cornell University, Ithaca, NY.*

Dairy products are increasingly recognized for the beneficial health effects provided by their bioactive components, among which is ruminic acid (*c*-9, *t*-11 CLA; RA). RA is found predominantly in ruminant products and can be enhanced through manipulation of the cow's diet with inclusion of oils rich in polyunsaturated fatty acids. However, the addition of these oils to a ruminant diet often causes a shift in biohydrogenation pathways that results in milk fat depression (MFD). The objective of this study was to examine if vitamin E supplements together with linseed oil and low levels of fish oil would improve sustainability of enhanced RA content in milk fat while minimizing the risk of MFD. Holstein cows ($n=48$) were assigned to a randomized complete design with repeated measures into four treatments for 28d: 1) control (C), 2) 2.5% linseed oil (L), 3) 2.5% linseed oil plus 0.5% fish oil (LF), and 4) 2.5% linseed oil plus 0.5% fish oil plus 10,000 IU vitamin E/d (LFE). A 2 wk pre-treatment period served as the covariate. Cows were individually fed a corn-based TMR; oil supplementation was incorporated in the mixed diet and vitamin E top-dressed daily. Milk fat percent and yield (wk 4) were reduced incrementally with increased oil supplementation (3.69, 3.21, 2.09 and 2.24% for C, L, LF, and LFE, respectively; $P < 0.05$). Vitamin E was ineffective in preventing MFD. Milk fatty acid profiles for LF and LFE treatments were indicative of classical MFD with increased content of *t*-10 18:1 and *t*-10, *c*-12 18:2 CLA, as well as increased *t*-9, *c*-11 18:2 CLA. RA also increased significantly (0.38, 0.94, 2.70, and 2.62 for C, L, LF and LFE), as well as its endogenous precursor, *t*-11 18:1 (0.91, 2.43, 6.71 and 6.46 for C, L, LF and LFE, respectively). In conclusion, dietary supplementation of fish and linseed oil markedly increased milk fat content of RA, but also shifted biohydrogenation pathways to produce fatty acid intermediates known to induce MFD, and this effect was not altered by vitamin E supplementation.

Key Words: conjugated linoleic acid, milk fat

360 Lactation performance of dairy cows supplemented with different oil sources. J. A. Ye¹, C. Wang*¹, H. F. Wang², H. W. Ye³, B. X. Wang¹, H. Y. Liu¹, Y. M. Wang¹, Z. Q. Yang¹, and J. X. Liu¹, ¹*Institute of Dairy Science, Zhejiang University, Hangzhou, P.R. China,* ²*School*

of Forestry and Biotechnology, Zhejiang Forestry University, Hangzhou, P.R. China, ³*Hangzhou Zhengxing Animal Industries, Hangzhou, P.R. China.*

The objective of the study was to investigate the effects of supplemented oils on milk yield, milk composition and fatty acid profiles in lactating dairy cows. Forty-eight Chinese Holstein dairy cows were used in a completely randomized block design. The animals were allocated to four dietary treatments according to DIM and milk yield, and supplemented with none (control), 2% flaxseed oil (FSO), 2% soybean oil (SBO), or 2% oil from extruded soybeans (ESB). The experiment lasted 9 weeks including the first week for adaptation. Milk yield was recorded daily, and milk compositions and fatty acid profiles were analyzed weekly. Feeding FSO, SBO and ESB resulted in higher milk yield vs. the control (27.0, 27.0, and 26.5 vs. 25.4 kg/d), but decreased milk fat content (3.29, 3.31, 3.20 vs. 3.60%), with little difference in fat-corrected milk yield and content of milk protein and total solids among all the treatments. The fatty acid profile of milk was improved by fat supplementation. Feeding oil reduced the proportion of both short-chain ($C_{8:0}$ to $C_{12:0}$) and medium-chain ($C_{14:0}$ to $C_{16:1}$) fatty acids, and increased the proportion of long-chain fatty acids in milk fat. *Cis*-9, *trans*-11 CLA in milk fat was increased from 0.38% for the control to 0.79, 1.51, and 1.56% for the cows supplemented with FSO, SBO, and ESB, respectively. Feeding oils rich in linoleic acid (SBO and ESB) was more effective in enhancing *cis*-9, *trans*-11 CLA in milk fat than oils containing linolenic (FSO). There was a linear relationship between transvaccenic acid and *cis*-9, *trans*-11 CLA content in milk. Over all, oil supplementation increased milk yield and improved fatty acid profile in milk fat.

Key Words: conjugated linoleic acid, dairy cows, milk performance

361 Milk production and composition from cows with different levels of cashew nut in the diet. P. G. Pimentel¹, L. A. Leite², I. R. F. M. Veiga², and R. B. Reis*², ¹*Animal Science Department, Federal University of Ceara, Brazil,* ²*Veterinary School, Federal University of Minas Gerais, Brazil.*

The objective of this research was to evaluate the milk production and composition of dairy cows fed diets containing increasing levels of cashew nut. The cashew nut is produced and processed in the Northeast of Brazil and primarily used as human food. It has an average 22.0% of crude protein and 44.10% of ether extract, and it is rich in long chain unsaturated fatty acids ($C_{18:1}$ and $C_{18:2}$) and has a 3.68 unsaturated:saturated ratio. Although, its low cost compared to corn and soybean it is poorly explored as animal feed. Treatments consisted of replacement of corn and soybean meal in the diet by 0, 4, 8 or 12% of cashew nut in dry matter of the diet. Eight multiparous Holstein cows, between 50 and 74 days in milk and 28 ± 4 kg milk/day were allocated in a 4 x 4 double Latin Square Design. Corn silage was used as main forage in a 50:50 forage to concentrate ratio. The PROC GLM of SAS was used for the statistical analysis. Analysis for linear and quadratic contrasts were performed. The milk production varied between 29.9 to 30.7 kg/day and was not affected by increasing levels of cashew nut in the diet. The milk fat yield (1.09 to 0.79 kg/day) and content (3.68 to 2.66%) decreased linearly with greater proportions of cashew nut in the diet. The decrease in milk fat was followed by lower proportions of short chain fatty acids and higher proportions of long chain fatty acids. The diet contained 12% of cashew nut in the dry matter was responsible for a 38.32% reduction in short chain fatty acids and 38.21% of increase in long chain fatty acids in the milk fat. The milk protein percentage and production were not affected by high levels of cashew nut in the diet. The maintenance of the milk production, protein content and production

and fat reduction content, along with the milk fatty acids profile made the cashew nut utilization a good alternative for obtaining milk with a better nutraceutical value.

Key Words: fatty acids, by-product

362 Effect of dietary n-3 polyunsaturated fatty acids (PUFA) on gene expression of the insulin-like growth factor (IGF) system in the bovine uterus. G. S. Coyne^{*1,2}, D. A. Kenny², and S. M. Waters¹, ¹*Animal Bioscience Centre, Teagasc, Grange Beef Research Centre, Dunsany, Co. Meath, Ireland*, ²*School of Agriculture, Food Science & Veterinary Medicine, University College Dublin, Belfield, Dublin, Ireland*.

Nutrition plays a key role in reproduction and there is evidence to suggest that dietary long chain n-3 PUFA may improve reproductive performance in cattle. Furthermore, localised IGF signalling in the uterine endometrium may play a role in influencing the initiation and maintenance of pregnancy. The objective of this study was to examine the effects of dietary supplementation of n-3 PUFA on the expression of genes involved in the GH-IGF signalling system in the bovine uterine endometrium. Reproductively normal crossbred beef heifers were fed a straw and barley/beet pulp based concentrate diet supplemented with a

rumen protected source of either saturated fat or high n-3 PUFA, for 45 days. Animals were slaughtered on day 18 of the estrous cycle. Endometrial tissue was harvested and total RNA extracted from animals on the high (n=7) and low PUFA (n=7) diets. RNA was reverse transcribed into cDNA. Primers were designed to amplify specific fragments of genes involved in the GH-IGF signalling axis. The relative expression of each gene was analyzed using real time RT-PCR. Animals supplemented with the high PUFA diet showed a 6 fold decrease in IGF-1 ($P < 0.05$) and a 1.5 fold increase in IGF-2 gene expression compared with the low PUFA diet ($P < 0.05$). Animals offered the high PUFA diet also showed an 11 fold decrease in IGFBP-3 and a 4 fold decrease in IGFBP-6 compared to the low PUFA diet ($P < 0.05$). IGF-1 and IGF-2 are both associated with key reproductive events such as preimplantation and placental development. IGFBPs can have an inhibitory effect by competing with IGF-1R for IGF binding; thus down-regulation of IGFBPs could indicate an increase in available IGF-1 for IGF-1R binding. IGFBP-3 is suggested to regulate local IGF bioavailability and transport of IGFs across the endometrium while IGFBP-6 has a higher affinity for IGF-2, inhibiting its effects, including cellular proliferation and differentiation. Differential gene expression of IGF-1, IGF-2 and the IGFBPs in the endometrium may positively influence reproductive efficiency by providing a more suitable environment for embryo survival.

Key Words: PUFA, IGF, uterus

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363 Oats grain as an alternative to corn in beef cattle diets. J. A. Marceñac¹, H. M. Arelovich^{*1,2}, M. F. Martínez¹, M. I. Amela¹, and R. D. Bravo^{1,2}, ¹*Dto. Agronomía-Universidad Nacional del Sur*, ²*Comisión de Investigaciones Científicas de la Provincia de Buenos Aires (CIC); CERZOS, Bahía Blanca, Argentina*.

Although corn is used for beef cattle feeding in Argentina, its availability is limited in semiarid areas. This experiment was designed to evaluate the effect of replacing corn with oats on beef cattle performance. Eight Aberdeen Angus calves (229 kg initial BW) were individually housed and fed a mixed diet. The treatments were: 1) Oats grain diet (OGD): 20% hay plus 80% oats-pellet, and 2) Corn grain diet (CGD): 20% hay plus 80% corn-pellet. The hay was an alfalfa-grass mixture, and the pellet ingredients were 75.0, 14.4, 7.0, and 0.06% in OGD; and 75.0, 11.05, 10.0, and 0.45% in CGD of grain, wheat middlings, sunflower meal and urea respectively. Pellets also included 1.5% NaCl, 1.0% CaCO₃, and 1.0% mineral-vitamin mix with monensin. The average chemical composition of both diets was 14.6, 36.9, 17.5, and 9.8% of DM for CP, NDF, ADF, and ash, respectively. The treatments OGD and CGD were randomly allotted to 4 individually fed calves/treatment, fed ad libitum once daily at 0900 h for 62 d. Performance measurements included DMI, ADG, feed-to-gain ratio (FC), and total tract apparent DM digestibility (DIG). Blood samples collected via jugular venipuncture were analyzed for glucose (GLU), total protein (TP), and non-esterified fatty acids (NEFA). Data were analyzed by ANOVA as a completed randomized design. Results are reported in the table. The DMI and ADG were increased by CGD ($P < 0.05$); however, no differences were found for FC, probably because total DDMI was similar for the 2 diets. Blood measurements were not affected by treatments, remaining within standard reference values. As far as FC is concerned, oats seems to effectively replace corn in diets for growing beef cattle.

Table 1.

| Item | OGD | CGD | SEM | P = |
|-------------------------|------|------|------|--------|
| Performance, | | | | |
| DMI kg/d | 7.1 | 7.9 | 0.20 | 0.03 |
| DIG, % | 77.5 | 74.1 | 0.37 | 0.17 |
| DDMI, kg/d ¹ | 5.5 | 5.9 | 0.20 | 0.22 |
| ADG, g | 1225 | 1412 | 18 | 0.0003 |
| FC | 5.8 | 5.6 | 0.10 | 0.26 |
| Blood serum, | | | | |
| GLU, g/L | 1.41 | 1.19 | 0.17 | 0.26 |
| TP, g/100 mL | 6.79 | 6.53 | 0.09 | 0.14 |
| NEFA, mEq/L | 0.40 | 0.44 | 0.06 | 0.66 |

¹DDMI: digestible DM intake, computed from DIG x DMI

Key Words: oats, corn, beef cattle

364 The effect of steam-flaked corn storage method on enzymatic starch availability and in situ dry matter disappearance. K. L. Neuhold, J. J. Wagner^{*}, T. E. Engle, S. L. Archibeque, and K. S. Sellins, *Colorado State University, Fort Collins*.

The objective of this study was to investigate the effect of steam-flaked corn (SFC) storage method (SM) on in situ DM disappearance and enzymatic starch availability (SA). Steam-flaked corn was sampled immediately off the roller for five consecutive days and immediately prior to feeding on the following day. Two SM for SFC were evaluated: 1. stored overnight in an enclosed metal bin (HOT) or 2) stored overnight on a concrete slab allowing SFC to cool (COOL). Samples of SFC collected pre- and post-storage for each SM were submitted to a commercial laboratory for SA analysis. Additional samples were collected and prepared for in situ work through a 2mm screen. Dacron