

**776 Dietary coconut oil and conjugated linoleic acid reduce body fat in mice.** K. M. Hargrave\* and J. L. Miner, *University of Nebraska, Lincoln*.

Mice raised on a coconut oil (CO)-containing diet for 6 wk prior to the addition of conjugated linoleic acid (CLA) are more sensitive to CLA-induced body fat loss than mice raised on a soy oil (SO)-containing diet. Coconut oil is deficient in essential fatty acids. However the addition of linoleic acid to a CO-containing diet did not alter the enhanced sensitivity to CLA. The objective of this study was to determine if CO enhances sensitivity of mice to CLA-induced body fat loss independent of an essential fatty acid deficiency. Eighty male mice (12 wk old) were fed a purified SO-containing diet for a 1 wk adaptation. Mice were then blocked by body weight and randomly allotted to a treatment diet. Diets were arranged in a 2 x 2 factorial design with SO vs CO and 0 vs 0.5% CLA isomers. Mice were fed for 2 wk and body weight and feed intake were measured weekly. Mice were then killed and body fat and lean mass were determined by dual x-ray densitometry and fat pads and livers were weighed and collected. DNA fragmentation, indicative of apoptosis, was measured in one epididymal fat pad and is expressed as (fragmented DNA/total DNA)\*100. CO-fed mice consumed more ( $P < 0.05$ ) feed than SO-fed mice during both weeks of treatment but weighed less ( $P < 0.05$ ) in the second wk. CO+CLA mice consumed less feed than CO mice but SO and SO+CLA mice did not differ in feed intake (CO x CLA interaction,  $P < 0.05$ ). Both CO and CLA reduced ( $P < 0.001$ ) body fat and fat pad weights. There was a trend for a CO x CLA interaction ( $P = 0.06$ ) as CO+CLA mice were leaner than SO+CLA (11.94% vs 15.48% body fat, respectively). There were no differences in lean mass. CLA increased ( $P < 0.01$ ) liver weight. There were no differences in DNA fragmentation but CLA did increase ( $P < 0.001$ ) total DNA content of the fat pad. In summary both CO and CLA reduced body fat with a trend for an interaction. Therefore, feeding CO for a short time appears to increase the sensitivity of mice to CLA-induced body fat loss similar to a longer feeding period. This indicates that CO increases CLA-induced body fat loss in an essential fatty acid deficiency-independent manner.

**Key Words:** Conjugated Linoleic Acid, Coconut Oil, Body Fat

**777 Subcutaneous and abdominal fatty acid composition and CLA profiles in grain finished steers.** L. H. Baumgard\*<sup>1</sup>, S. R. Sanders<sup>1</sup>, O. B. Mendivil<sup>1</sup>, J. K. Kay<sup>1</sup>, J. A. Marchello<sup>1</sup>, P. Delmonte<sup>2</sup>, J. M. Griinari<sup>3</sup>, and M. P. Yurawecz<sup>2</sup>, <sup>1</sup>The University of Arizona, Tucson, <sup>2</sup>U.S. Food and Drug Administration, Washington, DC, <sup>3</sup>University of Helsinki, Finland.

Subcutaneous (SQ) and abdominal (AB) fat was collected 24 h after harvest from non-implanted Hereford steers (n=3) fed a high concentrate (80%), low forage (20%) finishing diet for 90 d. SQ and AB fatty acid (FA) composition was determined via gas chromatography, and the complete CLA profile (15 isomers) was characterized by triple-column silver-ion high performance liquid chromatography (Ag<sup>+</sup>-HPLC). Levels of total *trans*-18:1 was higher ( $P < 0.01$ ) in AB than SQ (2.37 vs. 1.56%) and the content of *trans*-6,7,8, *trans*-9, *trans*-10, *trans*-11 and *trans*-12 18:1 was 73, 14, 23, 62 and 82% higher ( $P < 0.04$ ), respectively, in AB compared to SQ. Conversely, SQ had a higher ( $P < 0.02$ ) content of unsaturated FA (51 vs. 37%), enhanced CLA levels (0.56 vs. 0.35%) and an increased  $\Delta^9$ -desaturase index (47 vs. 30) compared to AB. *cis*-9, *trans*-11 and *trans*-7, *cis*-9 CLA were the first and second most predominant CLA isomers, respectively, in both depots and were higher in SQ compared to AB (69 vs. 59% and 13 vs. 9% of total CLA, respectively). *trans*-10, *cis*-12 CLA was the third and seventh most abundant CLA isomer in SQ and AB depots respectively, but levels did not differ between depots (3.3% of total CLA). *trans*-11, *trans*-13 and *trans*-9, *trans*-11 CLA were the third and fourth most predominant CLA isomers in the AB depot and were higher compared to SQ (5.8 vs 1.5% and 4.9 vs. 2.5% of total CLA, respectively). When adipose depots were combined, the content of total CLA and both the *cis*-9, *trans*-11 and *trans*-7, *cis*-9 CLA isomer (products of  $\Delta^9$ -desaturase) were highly correlated with the  $\Delta^9$ -desaturase index ( $R^2 = 0.97, 0.85$  and  $0.81$ , respectively). These data indicate marked differences in fatty acid composition including CLA profiles between SQ and AB depots, and suggests the  $\Delta^9$ -desaturase system is responsible for *cis*-9, *trans*-11 and *trans*-7, *cis*-9 CLA being the predominant CLA isomers in beef adipose tissue.

**Key Words:** Beef, CLA, Adipose Depot

## Lactation Biology: Biology of Lactation

**778 Exogenous porcine prolactin stimulates mammary development in prepubertal gilts.** C. Farmer\* and M.-F. Palin, *Dairy and Swine R & D Centre, Agriculture and Agri-Food Canada, Lennoxville, QC, Canada*.

The impact of injecting gilts with porcine prolactin (pPRL) in the prepubertal period on mammogenesis was investigated. Crossbred gilts received sc injections of saline (controls; n = 12), 2 mg of pPRL (4PRL; n = 12) or 4 mg of pPRL (8PRL; n = 12) twice daily for a period of 28 d, starting at  $75.1 \pm 0.5$  kg BW. Injections of saline or pPRL were given at 0730 and 1530. Jugular blood samples were collected from all gilts the morning before the first injection, as well as 14 and 28 d later. These samples were assayed for PRL and insulin-like growth factor-I (IGF-I). Gilts were slaughtered on the 28th day of treatment and mammary glands were collected for dissection of parenchymal and extraparenchymal tissues, and for determination of DNA, dry matter, protein and fat contents. Treatments did not alter ( $P > 0.1$ ) IGF-I concentrations but concentrations of PRL at slaughter were greater ( $P < 0.01$ ) in both 4PRL and 8PRL compared to controls, while at mid-treatment, they were greater ( $P < 0.05$ ) only in 8PRL gilts. Parenchymal tissue weight increased with exogenous pPRL (199.8, 434.4 and  $364.1 \pm 28.4$  g for controls, 4PRL and 8 PRL, respectively;  $P < 0.001$ ) and DNA concentrations were greater in pPRL-treated gilts (2.3, 6.0 and  $6.2 \pm 0.3$  mg/g for controls, 4PRL and 8PRL, respectively;  $P < 0.001$ ). The percentages of protein and dry matter in parenchyma increased ( $P < 0.001$ ) while that of fat ( $P < 0.001$ ) and the protein to DNA ratio ( $P < 0.05$ ) decreased with exogenous pPRL. Treatment differences were always observed between the 4 mg dose and the controls, and no further differences were seen when increasing the dose to 8 mg daily. Extraparenchymal tissue weight and total parenchymal fat were unaltered by treatments ( $P > 0.1$ ). It is apparent that pPRL can stimulate mammogenesis in prepubertal gilts through hyperplasia. It would be of great interest to determine if this favorable effect translates into greater milk yield dur-

ing subsequent lactations. (Sincere thanks to Monsanto for supplying the pPRL).

**Key Words:** Mammary Gland Development, Prolactin, Gilts

**779 Gene expression profiling of bovine mammary epithelial cells in response to prolactin and extracellular matrix.** L. Rowley\*<sup>1</sup>, D. Baird<sup>2</sup>, T. Wilson<sup>3</sup>, J. Whitley<sup>1</sup>, C. Berends<sup>1</sup>, M. Wells<sup>1</sup>, and M. Goddard<sup>1</sup>, <sup>1</sup>Primary Industries Research Victoria, Attwood, Australia, <sup>2</sup>AgResearch, Lincoln, New Zealand, <sup>3</sup>AgResearch Molecular Biology Unit, University of Otago, Dunedin, New Zealand.

Dairy farming is a financially important agricultural resource to Australia and further economic gains could be realised through improved milk yield or composition. In order to manipulate milk production however, we need to more fully understand the functional regulation of milk protein synthesis and secretion in the bovine mammary gland. In order to identify regulatory mechanisms involved in the differentiation of the mammary gland, primary mammary epithelial cells were cultured in the presence and absence of both prolactin (1 $\mu$ g/mL) and extracellular matrix. Culture medium was analysed by Western blotting to evaluate milk protein synthesis and secretion. RNA was isolated from cells in culture to assess gene expression using cDNA microarrays containing 23k bovine expressed sequence tags. Microarray data was statistically analysed by mixed model analysis using REML (restricted maximum likelihood). When cultured in the presence of extracellular matrix, mammary epithelial cells were able to assume three-dimensional spherical structures similar to mammary secretory alveoli in vivo. Western blot analysis showed that the secretion of the milk proteins,  $\beta$ -lactoglobulin,  $\alpha_{S1}$ - and  $\beta$ -casein was greatly upregulated in the presence of both prolactin and extracellular matrix. Microarray analysis has identified genes

that are differentially regulated by prolactin and extracellular matrix. Further examination of differentially regulated genes may enable elucidation of the specific regulatory mechanisms and ultimately, control over the production and composition of milk.

**Key Words:** Microarray, Prolactin, Extracellular Matrix

**780 Microarray analysis of prolactin signalling in the bovine mammary gland during lactogenesis.** M. Wells<sup>\*1</sup>, C. Prosser<sup>2</sup>, D. Baird<sup>3</sup>, T. Wilson<sup>4</sup>, M. Auld<sup>5</sup>, J. C. Whitley<sup>1</sup>, J. K. Lee<sup>1</sup>, J. Argento<sup>1</sup>, and M. Goddard<sup>1</sup>, <sup>1</sup>Primary Industries Research Victoria, Attwood, Australia, <sup>2</sup>AgResearch, Ruakura, New Zealand, <sup>3</sup>AgResearch, Lincoln, New Zealand, <sup>4</sup>AgResearch Molecular Biology Unit, University of Otago, Dunedin, New Zealand, <sup>5</sup>Primary Industries Research Victoria, Ellinbank, Australia.

The Australia-New Zealand Dairy Genomics Program is a collaborative research project, which aims to improve milk production, alter milk composition and identify novel products. In order to achieve these aims, however, it is necessary to increase our understanding of regulatory mechanisms in the bovine mammary gland. The objective of this trial was to identify genes within the mammary gland that are prolactin responsive, and which therefore regulate lactogenesis and milk yield around calving. Bromocriptine, which blocks the peri-parturient surge in prolactin in dairy cattle, was administered to Friesian cows (5 mg/100kg body weight; n=5) every 2 days, beginning 12 days before expected calving and ending at calving. Controls (n=5) received saline-only injections. At 72 hours post-partum, animals were slaughtered and mammary tissue was collected for RNA isolation. Analysis of gene expression was performed using cDNA microarrays comprising 23,000 bovine expressed sequence tags (ESTs), with a mixed model statistical analysis using restricted maximum likelihood to estimate the variance components. Serum prolactin levels in treated animals decreased by ~90% relative to control cows. In the 3 days following calving, bromocriptine-treated cows demonstrated a 40% reduction in milk yield. Analysis of milk composition showed decreased concentrations of  $\alpha$ -lactalbumin,  $\beta$ - and  $\kappa$ -casein, whilst  $\beta$ -lactoglobulin and serum albumin increased. These results are consistent with a delay in the onset of lactogenesis due to the blocking of prolactin secretion by bromocriptine. Microarray analysis has identified 1254 differentially regulated ESTs (827 down-regulated and 427 up-regulated) in the mammary gland of bromocriptine-treated cows relative to control cows. Further investigation of differentially regulated genes will improve our understanding of the role of prolactin in lactogenesis in the dairy cow, and may provide opportunities for the manipulation of milk production.

**Key Words:** Microarray, Lactogenesis, Bromocriptine

**781 Expression of prolactin responsive genes following experimental manipulation of the prolactin axis during early lactation in dairy cows.** E. H. Wall<sup>\*1</sup>, H. M. Crawford<sup>2</sup>, G. E. Dahl<sup>2</sup>, and T. B. McFadden<sup>1</sup>, <sup>1</sup>University of Vermont, Burlington, <sup>2</sup>University of Illinois, Urbana.

Increased milking frequency during early lactation results in a persistent increase in milk yield, however the mechanisms underlying this effect are unknown. Frequent milking elicits additional episodes of milking induced prolactin (PRL) secretion as well as more frequent emptying of the gland. Our objective was to distinguish the relative contributions of each of these factors. We hypothesized that augmented PRL signaling mediates the response to increased milking frequency in early lactation. Hence, we proposed that treating cows milked 2X/d with exogenous prolactin would provoke responses similar to those of cows milked 4X/d. Conversely, blockade of milking-induced PRL release by injection of bromocriptine in cows milked 4X/d would result in similar responses as those of cows milked 2X/d. Twenty multiparous Holstein cows received 1 of 4 treatments from d 2 to 21 postpartum: 2X, 4X, 2X+PRL, or 4X+bromocriptine. Exogenous PRL or bromocriptine was administered coincident with the 3<sup>rd</sup> and 4<sup>th</sup> milkings. Mammary biopsies were obtained at 7 DIM (n=5 cows/treatment), and rates of [<sup>3</sup>H]-thymidine incorporation into DNA in vitro were measured. Expression of mRNA for PRL receptor (long form),  $\alpha$ -lactalbumin and suppressor of cytokine signaling-3 (SOCS-3) was measured by real time RT-PCR as indices of PRL signaling. Data were analyzed using the GLM procedure of SAS. Expression of  $\alpha$ -lactalbumin mRNA was greater (P<.06) in 2X+PRL cows compared to the other groups, which were similar. Abundance of PRL receptor mRNA was similar among 2X, 4X+bromocriptine, and

4X treated cows, but was reduced in 2X+PRL cows compared to the 4X group (P<.05). 2X cows expressed higher levels of SOCS-3 mRNA than all other treatment groups (P<.06). There was no treatment effect on [<sup>3</sup>H]-thymidine incorporation into DNA. The differences in expression of PRL-responsive genes suggest interactive effects of PRL and milk removal in regulation of mammary responses.

**Key Words:** SOCS, Milking Frequency, Prolactin

**782 Effects of 21-day short day photoperiod (SDPP) during the dry period on prolactin (PRL) concentrations, lymphocyte PRL receptor (PRL-R) mRNA, and general health of dairy cows.** E. D. Reid<sup>\*1</sup>, T. L. Auchtung<sup>1</sup>, D. E. Morin<sup>1</sup>, T. B. McFadden<sup>2</sup>, and G. E. Dahl<sup>1</sup>, <sup>1</sup>University of Illinois, Urbana, <sup>2</sup>University of Vermont, Burlington.

Manipulation of photoperiod during the dry period alters subsequent production and cellular immune function in cattle. Specifically, SDPP improves health and milk yield when compared with long day photoperiod (LDPP), likely via increased sensitivity to PRL. Prolactin and PRL-R are responsive to photoperiod and appear to be linked with immune function. However, the minimum duration of SDPP exposure necessary to produce these beneficial effects is unknown. The objective of this study was to determine the effect of 21 d of SDPP at the end of the dry period on PRL concentration, expression of lymphocyte PRL-R mRNA, and general health. Holstein cows (n = 32) were assigned randomly to one of four dry period treatments: LDPP (16 h light: 8 h darkness), SDPP (8 h light: 16 h darkness), AMB (natural lighting schedule during dry period), and SD21 (AMB until 21 d prepartum then SDPP). After parturition, cows were exposed to natural photoperiod. General health was monitored weekly throughout the dry period. Blood was collected at dry off and every 2 wk until 21 d prepartum, at which time sampling occurred weekly until calving. Concentrations of PRL were measured via RIA and expression of PRL-R mRNA in lymphocytes was measured using real-time PCR. There was no difference in PRL concentrations or PRL-R expression among the groups at dry off but by d 28, LDPP had higher (P < 0.05) PRL concentrations than AMB, SDPP or SD21. Prolactin did not differ among the AMB, SDPP, and SD21 groups during the dry period. Expression of PRL-R was higher (P < 0.05) in SDPP cows at d 28 than LDPP, SD21, or AMB, but not different (P > 0.10) between SDPP and SD21 a week prior to calving, after SD21 animals were switched from ambient photoperiod to SDPP. In conclusion, there is an inverse relationship between PRL concentrations and PRL-R mRNA expression in lymphocytes in LDPP and both SDPP and SD21 animals during the short day treatment.

**Key Words:** Cattle, Photoperiod, Immune Function

**783 Exposure to long day photoperiod during the dry period increases mammary gland expression of suppressors of cytokine signaling in dairy cows.** E. H. Wall<sup>\*1</sup>, T. L. Auchtung<sup>2</sup>, G. E. Dahl<sup>2</sup>, and T. B. McFadden<sup>1</sup>, <sup>1</sup>University of Vermont, Burlington, <sup>2</sup>University of Illinois, Urbana.

The mechanism by which short day photoperiod (SDPP; 8h light:16h dark) during the dry period enhances lactational performance in the subsequent lactation is unknown. Cows exposed to SDPP have lower circulating PRL and higher expression of PRL receptor in the mammary gland, whereas long day photoperiod (LDPP; 16h light:8h dark) elicits the reverse. Suppressors of cytokine signaling (SOCS) are induced by cytokines such as PRL and interferon- $\gamma$  (IFN- $\gamma$ ) and act in a negative feedback manner, inhibiting signaling of such cytokines. We hypothesized that altered expression of SOCS as a result of different daylength modulates mammary sensitivity to circulating PRL during the dry period. Multiparous Holstein cows were dried off 62 days before calving and assigned to LDPP or SDPP during the dry period. After calving, all cows were exposed to ambient photoperiod. Mammary biopsies were obtained at -40, -20, -7 and +7 days relative to calving (n=6 cows/treatment), and mRNA expression for SOCS-2, -3, cytokine inducible SH-2 protein (CIS) and IFN- $\gamma$  receptor was assessed by real time RT-PCR. Data were analyzed using the mixed procedure of SAS. Expression of SOCS-2 and CIS was low during the dry period, then increased in lactation (P<.05). Higher expression of both CIS (P<.05) and SOCS-2 (P<.09) mRNA was observed in LDPP cows relative to SDPP cows at 20d. CIS expression was also higher at +7d in LDPP cows compared to SDPP cows (P<.01). SOCS-3 and IFN- $\gamma$  receptor

expression increased from 40d to 7d ( $P < .05$ ) and remained high in lactation for both treatments. These data indicate that cows exposed to LDPP during the dry period experience higher SOCS expression, which may impair PRL induced mammary growth and lead to inferior milk production in the subsequent lactation. The increase in mammary SOCS expression from pregnancy into lactation implies a functional role for SOCS in bovine mammary gland during lactogenesis.

**Key Words:** SOCS, Photoperiod, Mammary Gland

**784 The effects of a 21-day short day photoperiod treatment during the dry period on dry matter intake and subsequent milk production in cows.** E. D. Reid<sup>\*1</sup>, R. L. Wallace<sup>1</sup>, T. B. McFadden<sup>2</sup>, and G. E. Dahl<sup>1</sup>, <sup>1</sup>University of Illinois, Urbana, <sup>2</sup>University of Vermont, Burlington.

The ability to increase milk production by altering day length is a practical management technique in the dairy industry. Long day photoperiod treatment (16 h light:8 h dark, LDPP) during lactation increases milk production in lactating cows. Short day photoperiod treatment (8 h light:16 h dark, SDPP) during the traditional 60 d dry period increases milk production in the subsequent lactation. The purpose of this study was to determine if the effects of SDPP during the dry period could be observed with a 21 d treatment, that could be implemented at the beginning of the transition period and reduce the amount of time animals spend in an enclosed facility. Thirty-one mature Holstein cows were assigned randomly to one of four dry period treatments: LDPP, SDPP, AMB (followed natural lighting schedule during dry period), and SD21 (AMB until 21 d prepartum followed by SDPP). After parturition, animals were exposed to natural lighting treatment during lactation. Milk samples were collected biweekly for 60 d and monthly thereafter. Dry matter intake (DMI) during the dry period was monitored daily. Statistical analysis was performed using a repeated measures model with photoperiodic treatment as the main effect and time as the repeated measure. Multiple comparison tests were conducted to determine significant differences between treatments. Mean SDPP DMI during the dry period was significantly greater than LDPP and AMB ( $P < 0.05$ ), whereas SD21 DMI was intermediate. Mean milk production was higher in SDPP animals ( $P < 0.05$ ), whereas LDPP, AMB, and SD21 were similar over the initial 60 d collection period. Of interest, SDPP, AMB, and SD21 animals display increased persistency when compared with LDPP, suggesting a beneficial effect on milk production through the entire lactation. We conclude that relative to LDPP, SD21 improves DMI during the dry period and increases subsequent lactational persistency.

**Key Words:** Cattle, Photoperiod, Milk

**785 Evidence that prolactin (PRL) mediates effects of milking frequency in early lactation.** H. M. Crawford<sup>\*1</sup>, T. L. Auchtung<sup>1</sup>, E. H. Wall<sup>2</sup>, T. B. McFadden<sup>2</sup>, and G. E. Dahl<sup>1</sup>, <sup>1</sup>University of Illinois, Urbana, <sup>2</sup>University of Vermont, Burlington.

Increasing milking frequency during the first 21 d of lactation results in a persistent increase in milk yield that continues after treatment has ceased. We hypothesized that greater milking frequency increases the number of PRL surges to in turn drive more extensive mammary cell differentiation. To test if PRL surge number was critical to milk yield responses, we assigned 47 mature cows to one of four treatments at calving: 2X (milked twice/d), 4X (milked four times/d), 2X+PRL (2X and PRL injections twice/d), and 4X+Bro (4X and bromocriptine to block two PRL surges/d). Treatments were given from d 2 to 21 postpartum; at d 22 treatments ended and all cows were milked 2X. Blood samples were collected weekly postpartum. Dry matter intake (DMI) was recorded from d 1 to 42 postpartum and milk samples taken weekly. Cows were divided into 2 groups due to season of calving; group 1 consisted of 2X, 4X, and 2X+PRL treatments, and group 2 consisted of 2X, 4X, and 4X+Bro treatments. Basal PRL concentration for d 4 2X+PRL cows was greater than 4X cows ( $P < .09$ ). Basal PRL concentration for d 14 2X cows was higher than 4X+Bro cows ( $P < .12$ ). Energy corrected milk (ECM) was analyzed from week 1 to 6 postpartum. Average daily ECM for the 6 wks for group 1 were 40.5, 45.7, and 46.9 kg/d for 2X, 4X and 2X+PRL. 2X+PRL cows had greater average daily ECM than 2X cows ( $P < .11$ ). Group 2 average ECM for the 6 wks were 51.4, 51.5, and 49.1 kg/d for 2X, 4X and 4X+Bro. For group 1, 4X cows milk yield was greatest for wk 1 ( $P < .05$ ), and greater than 2X for wk 3 ( $P < .02$ ). 2X+PRL cows milk yield was greater than 2X cows for week 3 ( $P < .11$ ) and than 2X and 4X cows for weeks 5 and 6 ( $P < .15$ ). For group 2, 4X

cows milk yield was greater than 2X and 4X+Bro at week 4 ( $P < .06$ ). In group 1 DMI was not different among treatments. In group 2 DMI was greater for 4X+Bro cows than 4X cows ( $P < .09$ ). In summary, increasing PRL pulsatility in early lactation increased ECM similar to the effect of 4X milking.

**Key Words:** Cattle, Frequent Milking, Prolactin

**786 Impact of increased milking frequency in early lactation in multiparous dairy cows.** M. J. VanBaale<sup>\*1</sup>, D. Ledwith<sup>2</sup>, J. M. Thompson<sup>3</sup>, R. J. Collier<sup>1</sup>, and L. H. Baumgard<sup>1</sup>, <sup>1</sup>The University of Arizona, Tucson, <sup>2</sup>Stotz Dairy, Buckeye, AZ, <sup>3</sup>California State Polytechnic University, San Luis Obispo.

Although frequently recommended and occasionally practiced on dairy farms, the effects of increased milking frequency (IMF) on production parameters are poorly understood. Two hundred multiparous cows were randomly assigned to one of five milking frequency treatments at parturition to investigate IMF (6X vs. 3X) effects during early lactation and subsequent milk yield persistency with or without bST. Treatments were 6X milking for 0 (control; milked 3X) or the first 7, 14, 21 DIM (all 4 treatments initiated bST at 63 DIM), or 6X for the first 21 DIM (no bST administration throughout the entire lactation). Cows were housed in a dry lot facility under a thermal neutral environment throughout the study. Individual milk yields were collected daily and milk components were obtained monthly. All cows were body condition scored at parturition and every four wks thereafter. Blood was collected from the coccygeal vein at parturition and weekly for 5 wks thereafter using a subset of cows ( $n=15$ /trt from control and the cows assigned to the 21 d 6X treatment with bST). Data reported here in were analyzed through 63 DIM (prior to bST administration). Milk yield tended ( $P = 0.07$ ) to differ between treatments but effects were small (41.2, 39.8, 41.5, 39.1, and 41.0 kg/d, respectively). No overall treatment effects ( $P > 0.20$ ) were observed for milk fat and protein percentages (3.80 and 2.80) nor SCC (220). Treatments did not alter ( $P > 0.07$ ) overall BCS (3.57) or circulating plasma NEFA levels ( $P > 0.74$ ; 467  $\mu\text{eq/l}$ ). Data suggest that IMF (6X vs. 3X) immediately post partum does not improve milk yield during the first 9 wks of lactation in multiparous cows milked 6X for 7, 14, or 21 d. However, IMF effects (with and without bST) on future milk yield and lactation persistency are currently not known.

**Key Words:** Increased Milking Frequency, Early Lactation, Dairy Cows

**787 Effects of milking frequency during early lactation on performance and health of dairy cows.** J. Fernandez<sup>\*</sup>, C. M. Ryan, D. M. Galton, and T. R. Overton, Cornell University, Ithaca, NY.

Holstein cows ( $n=105$ ) entering second or greater lactation were used to determine the lactational and health responses to increased milking frequency (IMF) during early lactation. At parturition, cows were assigned to either a control (twice-daily milking during the entire lactation at 12-h intervals; 2X) or IMF (four times per day milking at 5 to 7-h intervals from d 1 through 21 postpartum, then twice daily at 12-h intervals for the rest of lactation; 4X) treatment. Milk yield and composition data were collected for the first 9 monthly test days. Cows milked 4X during the first 21 d of lactation tended to have increased milk yield during the first 9 monthly test days (35.5 vs. 33.9 kg/d;  $P < 0.12$ ) compared to the cows milked 2X. Milking cows 4X during the first 21 d of lactation tended to decrease milk fat percentage (3.37 vs. 3.52%;  $P < 0.07$ ) and decreased milk true protein percentage (2.83 vs. 2.93%;  $P < 0.02$ ) such that yields of milk fat (1.20 vs. 1.20 kg/d), 3.5% fat-corrected milk (35.2 vs. 34.2 kg/d) and true protein (1.01 vs. 1.00 kg/d) during the first 9 monthly test days were not affected ( $P > 0.15$ ) by treatment. Concentrations of NEFA (707 vs. 639  $\mu\text{Eq/l}$ ) in plasma collected during d 5 to 20 postpartum were not affected ( $P > 0.15$ ) by treatment; however, concentrations of plasma  $\beta$ -hydroxybutyrate tended to be increased in the cows milked 4X (12.1 vs. 10.1 mg/dl;  $P < 0.14$ ). Overall, milk yield responses to IMF during early lactation were modest, and yields of fat and protein in milk were not affected by IMF during early lactation in this experiment.

**Key Words:** Dairy Cow, Milking Frequency

**788 Effects of continuous milking, bST and early-lactation milking frequency on mammogenesis, milk yield and composition in primiparous cows.** A. C. Fitzgerald\*, E. L. Annen, P. C. Gentry, L. H. Baumgard, and R. J. Collier, *University of Arizona, Tucson.*

Continuous milking (CM) of bST-supplemented primiparous cows results in production losses of 20 to 25%, suggesting mammary growth was inhibited. We hypothesized continuous (throughout late gestation and early lactation) bST supplementation and/or early-lactation increased milking frequency (IMF) would alleviate production losses in CM glands through improved mammary epithelial cell (MEC) functionality and proliferation. Primiparous cows were randomly assigned to either continuous bST (+bST; n = 4) or no bST (-bST; n = 4) treatment throughout the experiment. Within each animal, udder halves were randomly assigned to either CM or a 60-d dry period (CTL) treatment. CTL halves were dried -60 d relative to expected parturition date. CM glands were milked twice daily until parturition or spontaneous dry-off. At parturition all cows were milked four times daily (4X) until 30 d postpartum. Time points for mammary biopsies averaged -19, -7, +2, +7, and +20 d relative to parturition. Average d dry for CTL glands was 59.5 and 49.3 d for 4X+bST and 4X-bST treatments. Due to spontaneous dry-off, CM halves were dry for an average of 1.0 and 13.5 d for 4X+bST and 4X-bST treatments. Prepartum half-udder milk yield was greater (P < 0.01) in +bST cows than -bST cows (11.7 vs. 9.2 kg/d). Postpartum milk yield was reduced (P < 0.01) in CM udder halves regardless of bST treatment (15.0 vs. 25.0 kg/d; CM vs. CTL). Milk composition (fat, protein, SCC linear score) was not affected by CM or bST. MEC proliferation (Ki67 antigen index) was greater (P < 0.01) in CTL glands at d -7 (6.2 vs. 3.4%, CTL vs. CM), but was not affected at d -19, +2, +7, or +20. MEC proliferation was unaffected by bST. Decreased milk yield in CM halves was not overcome by bST in primiparous cows milked 4X. Further, MEC proliferation was reduced in CM halves near parturition (-7 d).

**Key Words:** Continuous Milking, bST, Mammary Cell Proliferation

**789 The anticancer effects of vaccenic acid in milk fat are due to its conversion to conjugated linoleic acid via  $\Delta^9$ -desaturase.** A. L. Lock\*<sup>1</sup>, B. A. Corl<sup>1</sup>, D. E. Bauman<sup>1</sup>, D. M. Barbano<sup>1</sup>, and C. Ip<sup>2</sup>, <sup>1</sup>Cornell University, Ithaca, NY, <sup>2</sup>Roswell Park Cancer Institute, Buffalo, NY.

*Cis-9, trans-11* conjugated linoleic acid (CLA) has been shown to be anticarcinogenic in a number of animal tumor models. Dairy products are the principal source of CLA in human diets and endogenous synthesis from vaccenic acid (*trans-11* 18:1; VA), the major biohydrogenation intermediate produced in the rumen, is the predominant source of CLA in milk fat. Foods rich in CLA are therefore also rich in VA. We previously reported that dietary VA caused a dose-dependent increase in the accumulation of CLA in the mammary fat pad; this was accompanied by a parallel decreased risk of tumorigenesis in the mammary gland. In an attempt to delineate a direct versus an indirect action of VA, the objective of this study was to determine whether treatment with sterculic oil (SO), a potent inhibitor of  $\Delta^9$ -desaturase, would reverse the cancer-protective effect of VA derived from milk fat. Female Sprague-Dawley

rats (9 per diet) were injected with a single dose of carcinogen (methyl-nitrosourea), and fed one of 4 diets: 1) low VA, 2) low VA + SO, 3) high VA, and 4) high VA + SO. After 6 wk, the mammary glands were evaluated histologically for the appearance of premalignant lesions, and tissues analyzed for fatty acids. Total premalignant lesions were 83, 80, 43 and 68 for treatment 1, 2, 3 and 4, respectively (P<0.05). In the same order, the CLA concentrations (g/100g fatty acids) in the mammary fat pad were 2.13, 2.14, 4.75 and 2.98, while the VA concentrations were 0.54, 0.74, 4.89 and 8.20 (P<0.001). Thus the feeding of VA increased mammary tissue level of CLA and reduced the risk of developing premalignant lesions in the mammary gland. Treatment with SO reversed the effects of VA. It is most likely that the anticarcinogenic effect of VA is mediated through its conversion to CLA via  $\Delta^9$ -desaturase, and when this conversion is blocked by sterculic oil, the biological response to VA is altered.

**Key Words:** Vaccenic Acid, Conjugated Linoleic Acid, Mammary Cancer

**790 Relationships between somatic cell count and bacterial infection in Italian buffaloes.** P. Boettcher\*<sup>1</sup>, A. Stella<sup>2</sup>, G. Pisoni<sup>3</sup>, C. Sgoifo Rossi<sup>3</sup>, R. Fedeli<sup>3</sup>, M. Rinaldi<sup>3</sup>, and P. Moroni<sup>3</sup>, <sup>1</sup>IBBA-CNR, Seagrata, Italy, <sup>2</sup>CERSA-FPTP, Seagrata, Italy, <sup>3</sup>University of Milan, Italy.

The objective of this study was to examine factors affecting somatic cell count (SCC) and bacterial infection in Italian buffaloes. The data used in the study were 1930 test-day records of SCC and bacterial presence in each of the four udder quarters of 48 buffalo cows in two Italian herds. Nearly 65% of the records showed presence of bacteria. Fourteen different species were observed. Staphylococcus species were the most commonly observed bacteria, detected in 47% of the samples. Streptococcus uberis was the next most common, observed in approximately 8% of the samples. Various linear mixed models were used to determine the statistical significance of the effects of various factors on SCC. For this analysis, SCC was transformed to somatic cell score (SCS) using the standard log 2 transformation. Fixed effects in the model included herd, parity number (1, 2, 3, 4, 5, and > 6), days in milk, location of the quarter (e.g. left-front, right-rear, etc.), and infection status. Infection status was defined in two different ways. In the first, two classes were established: 1) free from bacteria and 2) infected with any species. The second approach had four groups: 1) uninfected, 2) infected with Strep uberis, 3) infected with a Staphylococcus species, and 4) infected with any other species. Cow and quarter-nested-within-cow were random effects in the model. No significant difference in SCS was observed across herds. Mean SCS tended to increase with age up until third lactation, and then decreased during later lactations. Consistent with previous studies in other species, SCS tended to increase as lactation progressed. Significant differences in SCS were observed among the different quarters of the udder, as SCS was highest in the front-left quarter (mean = 3.16) and lowest in the right-rear quarter (mean = 2.22). When infection status was defined as "infected" or "healthy", SCS was slightly higher in infected quarters, but the difference was not significant. The analysis based on different bacterial groups indicated that only Strep uberis was associated with significantly (P #8804 0.0006) elevated levels of SCS (3.29 vs. 2.37) with respect to uninfected quarters.

**Key Words:** Somatic Cell Score, Mastitis, Buffalo

## Nonruminant Nutrition: Sow Feeding

**791 A new sow model to study amino acid arterio-venous differences and uptake by the mammary gland before and after farrowing.** Z. Mroz\*<sup>1</sup>, W. Krasucki<sup>2</sup>, and S. J. Koopmans<sup>1</sup>, <sup>1</sup>Wageningen University and Research Centre, Division Nutrition and Food, Lelystad, The Netherlands, <sup>2</sup>Agricultural University of Lublin, Poland.

A new sow model was developed to study the post-absorptive kinetics of amino acids in the mammary gland during pre- and postfarrowing periods. For this purpose, six multiparous sows at late pregnancy were fitted with three blood catheters (*A. epigastrica cranialis superficialis*, *A. iliaca externa*, *V. epigastrica cranialis superficialis*) to measure: 1) arterio-venous differences (AVD), extraction rate (ER) and uptake

of essential amino acids in the mammary gland, and 2) blood acid-base characteristics as affected by two factors - sampling time (pre-prandial versus post-prandial) and phase of the reproductive cycle (pre- and post-farrowing). The AVD, ER and amino acid uptake in the mammary gland of sows as affected by the post-farrowing phase are presented in Table 1. In general, we found that this new sow model can be useful for studying dynamics of essential amino acids uptake for colostrum or milk synthesis. Also, the requirement of the mammary gland in pregnancy and lactation for specific amino acids can be estimated.

Amino acid arterio-venous differences (ADV), extraction rate (ER) and amino acid uptake in the mammary gland of sows as affected by the post-farrowing phase