220 The effects of environmental stress on the performance of dairy cattle. J.N. Spain*, M. Lucy, and D. Spiers, *Brody Environmental Center, University of Missouri - Columbia.*

Environmental stress reduces the productivity and health of dairy cattle resulting in significant economic losses. Heat stress affects animal performance and productivity of dairy cows in all phases of production. This effect in calves and growing heifers is due to repartitioning of energy necessary for maintenance of homeothermy. The outcomes include decreased growth, increased susceptibility of disease, and ultimately delayed initiation of lactation. Dry cows exposed to thermal stress during late pregnancy have reduced milk yield during the subsequent lactation period. Heat stress is most apparent in the lactating dairy cow that must dissipate excess heat resulting from increased metabolism. Dry matter intake and milk yield decrease as cows are exposed to ambient temperatures above the upper critical temperature of their comfort zone. Cow health is adversely affected as evidenced in the increased somatic cells in milk during summer months. Heat stress also negatively affects reproductive function. Normal estrus activity and fertility are disrupted in dairy cattle during summer months. Given the negative effects of heat stress, research has focused on means of improving animal performance by assisting the dairy cow in maintaining #normal# thermal balance. Research has focused on methods of reducing heat gain through dietary supplementation and environmental modification. Manipulations of the diet to reduce the heat of digestion and metabolism have been proposed as a way of reducing internal heat load. Supplemental shades and housing systems have been developed to reduce exposure to solar radiant heat load. To facilitate heat loss, supplemental and strategic cooling systems have been developed and proposed. With the ever-increasing genetic potential for milk synthesis and the concomitant increase in metabolic heat production, the methods used to describe, monitor, and alter the thermal balance of heat stressed dairy cattle must be studied further.

Key Words: Dairy Cattle, Heat Stress

221 Survival, performance, and productivity in swine as influenced by adverse environmental temperatures. J.A. Carroll*, *Animal Physiology Research Unit, Agricultural Research Service-USDA, Columbia, Missouri.*

The impact of thermal stress on survival, performance, and productivity is evident in all stages of swine production. Thermal stress is associated with reduced survival of the neonate, poor reproductive performance in sows and boars, and poor growth and carcass quality in finishing pigs. Thermal stress invokes numerous changes in the pig#s metabolism, behavior, and endocrine system. While the primary causes of neonatal mortality have been attributed to crushing, starvation, and disease, the actual causes of mortality may be more closely linked with one another than previously believed. We now know that interactions exist among thermal status, nutrition, and disease in pigs. Piglets with disease and nutritional problems experience chilling and express altered behaviors that increase the likelihood of being laid on by the sow. At birth, neonatal pigs have a limited ability to cope with environmental stressors (cold, disease, limited nutrition) that predispose it to relatively high rates of neonatal morbidity and mortality. In contrast to older animals, the early neonatal piglet does not increase its intake in response to cold temperature. Intake actually decreases during cold exposure, increasing the likelihood of starvation. Unlike the young pig, in which exposure to cold stress poses major health risks, in older pigs, exposure to heat stress hinders performance and productivity. At high ambient temperatures, sufficient feed intake by the sow is likely a greater concern for piglet survival and performance. Exposure to ambient temperatures greater than 25°C decreases intake in lactating sows, resulting in reduced milk production and associated piglet growth. In boars, heat stress has been shown to alter sperm cell count and quality, thus decreasing reproductive efficiency and capabilities. Finally, in finisher pigs, heat stress has been reported to reduce growth rate and alter carcass composition. Therefore, heat stress not only reduces overall productivity in finishing pigs, but also reduces the value of the final product. Given the associated economic losses due to thermal stress in pigs, continued research on the interactions among thermal stress, nutritional requirements, immunological status, and overall performance are undoubtedly needed and warranted.

Key Words: Pig, Environmental Temperature, Stress

222 Economic losses from thermal stress by U.S. livestock industries. N. R. St-Pierre*[1] and G. Schnitkey[2], [1]*The Ohio State University, Columbus,* [2]*University of Illinois, Urbana.*

Farm animals have well known zones of thermal comfort (ZTC). The range of ZTC is primarily dependent on the species, the physiological status of the animals, the relative humidity and velocity of ambient air, and the degree of solar radiation. Economic losses are incurred by the U.S. livestock industries because farm animals are raised in locations and/or seasons where temperature conditions venture outside the ZTC. The objective of this study was to provide estimates of the economic losses sustained by major U.S. livestock industries from thermal stress. Species (production) considered were: chicken (meat), chicken (eggs), turkey (meat), cattle (meat), cattle (milk), and pig (meat). Losses considered were: (1) decreased performance (growth, lactation, egg production), (2) increased mortality, and (3) decreased reproduction. USDA and industry data were used to estimate the population size of each species in each month of the year, for each of the 50 States. Weather data from the National Weather Service were used to estimate mean daily maximum and minimum temperatures and relative humidity, and their variances for each of the 50 States. A model based on a plateau and abrupt threshold leading to a linear decrease in performance and reproduction and a linear increase in mortality above and below the ZTC was used for each species. Solar radiation and air velocity were assumed negligible. Probabilities of exceeding the minimum or maximum values of ZTC were calculated from means and variances of weather data. Two losses were estimated. The total potential losses (TPL) were calculated as if no thermal stress abatement strategies were used by any of the animal industries. Clearly, this estimate is biased upwards but it sets a ceiling to the magnitude of the actual losses. Total abated losses (TAL) were calculated by the additional factoring of the prevailing management practices used by each industry to reduce the effects of thermal stress. Details of the results will be presented by species and for each of the major animal producing States.

Key Words: Thermal Stress, Economic Losses, Animal Production

Graduate Paper Competition
ADSA Production Division, ADSA Southern Branch, and Northeast ASAS/ADSA Section

223 Beta-Lactoglobulin as a facilitator of transcellular transport of IgG in Caco-2 cells. L. F. Sutton*[1], M. Worku[2], and B. Alston-Mills[1], [1]*North Carolina State University,* [2]*North Carolina A&T Universtiy.*

An earlier investigation suggested that Beta-Lactoglobulin (BLG) can facilitate IgG uptake in intestinal cells of neonatal piglets. The objectives of the present study were to use an in vitro model to corroborate in vivo data. Also investigated were properties of specific binding using competition at receptor sites, type of Fc receptors, and overall passage of the IgG molecule from apical to basolateral sides of the intestinal cell. The human intestinal cell line Caco-2 was used to investigate effects of BLG. Cells were grown in a porous transwell system, seeded at $4.6x10^4$ cells/well, with a total of 18 wells. Media were added to both compartments in the transwell system with 2.5ml added to the basolateral side and 1.5ml to the apical. Media were changed every other day. Cells were cultured as a monolayer until confluency was reached (day 14) and the tightness of the monolayer was measured by determining the transepithelial electrical resistance (TEER). After apical projections and villi differentiations were observed, approximately day 21, several treatments were used to identify uptake and passage of IgG. Fluorescently labeled IgG was added with unlabeled IgA to determine specificity of binding at the receptor on the apical side. Labeled IgG was added alone in varying concentrations to determine levels of uptake. After a 2 hour incubation, BLG was bound to IgG as a complex. This complex was then added to the apical membrane compartment. Additionally, BLG and IgG were added separately but simultaneously. IgG transcellular transport was evaluated by fluorimetry and microscopically. Unlabeled IgA and labeled IgG competitively bound to the polymeric Ig receptor. Uptake of IgG was evident after incubation with the Caco-2 cells but

fluorescence was highest in cells in which BLG was also added. Greater concentrations of IgG allowed for increased uptake, but persistence in the cell was optimal with the addition of BLG. These results suggest that BLG may, in fact, enhance and protect IgG in passage of Caco-2 cells. Results were best when IgG and BLG were added to Caco-2 cells, separately rather than as a complex.

Key Words: Beta-Lactoglobulin, Caco-2 cells, IgG

224 The effect of *Kluyveromyces marxianus* and *Saccharomyces cerevisiae* on fatty acid composition of equine milk. P. M. Yocum*, V. Fellner, and B. Alston-Mills, *North Carolina State University*.

Equines are non-ruminant herbivores with hindgut fermentation. Therefore, biohydrogenation of dietary fat and composition of milk lipids may differ from bovines. Two different yeast species were used to determine effects on fatty acid composition of mare milk. Twelve mares were randomly assigned to 1 of 3 groups. The composition of the herd was consistent with common breeds and ages of horses in North Carolina. Mares were allowed access to grass pasture and water ad lib. A commercial pelleted feed was administered at 1% body weight divided into 3 feedings per day along with coastal bermuda grass hay. Yeast treatments were standardized to colony forming units (CFU) as per manufacturer recommendation and administered 14 days prior to expected foaling. Group 1 served as the control group. Group 2 was given 20g of Turval$^{\#}$12 fodder, which included live *Kluyveromyces marxianus* yeast, for 5 days on and 2 days off. Group 3 was given 8g of BIOSAF$^{\#}$, a concentrate of live *Saccharomyces cerevisiae* yeast, for 5 days on and 2 days off. Twenty-five mls were hand milked from each mare on day 0 (parturition) and days 14, 28, 42 (treatment ceased), and 56 post partum. Milk samples were refrigerated until analyzed. Fatty acid composition was determined using a 100 meter x 0.25 millimeter fused silica capillary column on a SP 2560 gas chromatograph. Fatty acid composition was constant among the control group over time. Stearic acid was not present in the milk of control mares and mares receiving Turval$^{\#}$ 12 yeast. Turval$^{\#}$ appeared to decrease content of fatty acids C_{16} and lower while increasing $C_{18:1}$ and higher. Biosaf$^{\#}$ appeared to have the opposite effect. This suggests that Turval$^{\#}$ is down regulating *de novo* synthesis of fatty acids while Biosaf$^{\#}$ is up regulating *de novo* synthesis of C_{10} through C_{16}. Small quantities of $C_{18:0}$ were observed in the milk of mares receiving Biosaf$^{\#}$ yeast. Thus, differential effects were observed on fatty acid composition based on yeast species used in treatment groups.

Key Words: Equine milk, *Saccharomyces cerevisiae*, *Kluyveromyces marxianus*

225 Rapid detection of sub-clinical mastitis in dairy goats. C. Gill*, S. Horner, V. Mc Whinney, and D. Mc Whinney, *Prairie View A&M University*.

Simple and rapid diagnostic tools for the detection of sub-clinical mastitis are essential for the survival of the goat dairy industry. This is especially important due to the indiscriminate use of antibiotics for the treatment of clinical mastitis. The overuse of antibiotics contributes to antibiotic resistance in both dairy cattle and dairy goats. In clinical mastitis the infected goats have reduced udder function and milk production is reduced. Symptoms of sub-clinical mastitis are more subtle and not easily detected. The objective of this study was to determine the sensitivity and specificity of a rapid detection bacterial test strip(V-Strip^{TM}). Milk was taken from teats of normal and infected goats during late lactation and analyzed with the V-Strip^{TM}, traditional Foss Somatic Cell Count (SCC), California Mastitis Test, heterotrophic bacterial plate count, and selective and differential bacterial analyses. Our results have shown correlation between the California Mastitis Test, the Foss-O-Matic Cell Count and the V-Strip^{TM}. Goats showing high heterotrophic plate counts ($1x10^6$), SCC count>1 million and in which —italicizestaphlococcus was isolated had a positive reaction to the bacterial activity on the V-Strip^{TM}. Scanning the results of the bacteria activity on the V-Strip^{TM} enhanced its readability. There were some variations among goats with a high SCC and those with no identifiable bacterial activity on the V-Strip^{TM}. These results indicated that a higher concentration of dye may be needed in the V-Strip^{TM} for visual detection of bacterial activity in goats' milk.

Key Words: Mastitis, Goat, Rapid detection

226 Supplemental lactoferrin improves performance of dairy calves during the preweaning phase. E. D. Robblee*[1], P. S. Erickson[1], N. L. Whitehouse[1], A. M. McLaughlin[1], C. G. Schwab[1], J. J. Rejman[2], and R. E. Rompala[3], [1]*University of New Hampshire, Durham, NH,* [2]*ImmuCell Corporation, Portland, ME,* [3]*Blue Seal Feeds, Inc., Londonderry, NH*.

Lactoferrin (Lf) is a milk protein that exhibits broad-spectrum antimicrobial properties. Previous studies have shown that supplemental Lf can alter the microbial populations in the gut of non-ruminants, and increase preweaning average daily gains in calves. In the present study, 40 Holstein calves were used to examine the effects of supplemental Lf (0, 1, 2, or 3 g/d) on health, growth, and feed intake from 3 d of age to 2 wk postweaning. Lf was mixed and fed with a non-medicated milk replacer. Calves were housed in individual pens and offered a textured, non-medicated calf starter and water for ad libitum intake. Body weight, wither height, hip height, and heart girth were measured weekly. Daily dry matter intakes (DMI) of milk replacer and calf starter were determined. Fecal scores (1 = constipated, 4 = watery diarrhea) were recorded three times per week. Calves were weaned when the following four criteria were met: 1) minimum of 21 d of age, 2) DMI of starter was at least 1% of birth weight for three consecutive days, 3) cumulative DMI of starter was at least 9% of birth weight, 4) weight gain was at least 12% of birth weight. Preweaning average daily gains and gain to feed ratios increased linearly with Lf supplementation, whereas postweaning gain to feed ratios decreased linearly with Lf. Overall average daily girth gains increased linearly with Lf. Preweaning average daily hip height gains followed a quadratic response, with 2 g Lf/d having the lowest gain. Postweaning average daily hip height gains increased linearly with Lf. Preweaning fecal scores responded quadratically, with 1 g Lf/d having the lowest score. Days medicated responded similarly to fecal scores preweaning and overall. Wither heights, body weights, weaning ages, and DMI#s were not different among treatments. Based on the observed increased gain to feed ratios and average daily gains, and the reduced fecal scores and morbidity for the preweaning phase, it appears that Lf may be a beneficial supplement in the diets of dairy calves during this period.

Key Words: Lactoferrin, Calves, Preweaning

227 Lactating dairy cows endogenously synthesize *trans*-7, *cis*-9 CLA. B.A. Corl*[1], L.H. Baumgard[1], J.M. Griinari[2], P. Delmonte[3], K.M. Morehouse[3], M.P. Yurawecz[3], and D.E. Bauman[1], [1]*Cornell Univ., USA,* [2]*Univ. of Helsinki, Finland,* [3]*Food and Drug Admin., USA*.

Conjugated linoleic acids (CLA) have beneficial health effects in studies with animal models. *cis*-9, *trans*-11 and *trans*-7, *cis*-9 CLA are the most prevalent isomers in ruminant food products. The majority of *cis*-9, *trans*-11 CLA in milk fat is endogenously synthesized by Δ^9-desaturase and we tested the hypothesis that *trans*-7, *cis*-9 CLA is also endogenously synthesized. In exp. 1, sterculic oil (SO) was abomasally infused (4 d) to inhibit Δ^9-desaturase. Four cows (115 ± 9 DIM) were used in a 4 x 4 Latin square design and treatments were: skim milk (500 mL/d; control), partially hydrogenated vegetable oil (250 g/d; PHVO), SO (8.8 g/d), and PHVO+SO. Samples of milk, plasma, and rumen fluid were collected. In exp. 2, we used a *trans*-10, *cis*-12 CLA supplement to inhibit Δ^9-desaturase. Four cows (228 ± 54 DIM) were abomasally infused (5 d) with 0 g/d (control) or 14.0 g/d of 10,12 CLA supplement with milk and plasma samples collected. Samples were analyzed by GC to derive the total fatty acid profile and by Ag^+-HPLC to determine the CLA isomer profile. In exp. 1, SO decreased milk fat *cis*-9, *trans*-11 CLA by 65% (SO vs. control) and 61% (PHVO+SO vs. PHVO). Milk fat content of *trans*-7, *cis*-9 CLA decreased 71% (SO vs. control) and 68% (PHVO+SO vs. PHVO). In exp. 2, 10,12 CLA supplement decreased milk fat content of *cis*-9, *trans*-11 and *trans*-7, *cis*-9 CLA by 25% and 44%, respectively. Milk fat *cis*-9 $C_{14:1}$ was reduced 84% by SO infusion and 43% by 10,12 supplement infusion. Using *cis*-9 $C_{14:1}$ content to correct for the extent of Δ^9-desaturase inhibition, endogenous synthesis of *trans*-7, *cis*-9 CLA represented 85% and 102% in exp. 1 and 2, respectively. Similar corrected values for *cis*-9, *trans*-11 CLA indicated endogenous synthesis accounted for 77% and 58%, respectively. When combined with CLA isomer patterns in rumen fluid and plasma, results indicate the majority of *cis*-9, *trans*-11 CLA was endogenously

synthesized with a minor portion from rumen escape, whereas *trans*-7, *cis*-9 CLA was almost exclusively from endogenous synthesis.

Key Words: CLA, desaturase

228 Observational study assessing the significance of nutritional and management factors associated with milk urea nitrogen levels during the non grazing season. E. Leger*, I. Dohoo, G. Keefe, J. Wichtel, P. Arunvipas, and J. VanLeeuwen, *Atlantic Veterinary College*.

The objective of this study was to assess the impact of nutritional and management factors on MUN levels during the non-pastured period. Eighty-three Prince Edward Island (PEI) and nine Nova Scotia (NS) dairy herds were enrolled in the study. In each of these commercial herds, the amount of variation in test-day MUN which could be explained by nutritional and management factors was examined. Thirty-one herds were classified as total mixed ration herds (TMR) and 61 as component herds (CR). Between October 1999 and January 2001, all herds were visited twice and contacted once by telephone. Stored feeds were sampled as required and a detailed questionnaire relating to nutrition and management was completed during each contact. Collected ration information was evaluated using two computer programs (Spartan and Cornell-Penn-Miner (CPM) Dairy). Multi-level analysis were used to compute the relationship between various CPM and Spartan outputs including the energy-protein ratio (EPR), a ratio which represents the protein and energy requirements relative to protein and energy delivery, feeding practices, feed additives and MUN levels. The CPM EPR accounted for 0.5% of the total observed variation in MUN whereas the Spartan EPR explained 5.9 %. When CPM protein and energy fractions were regressed individually or as a group, they could only explain an additional 5.5 % of the observed MUN variation. Stage of lactation, feed delivery and significant interactions explained an additional 0.79 % of the variation in MUN. Under commercial settings the relationship between MUN and dietary components is weaker than under controlled experimental settings. On commercial farms, MUN values are influenced by a number of factors that are not part of routine nutritional monitoring. This suggests that MUN values may be of more limited use as a nutritional monitoring tool than would be expected from the experimental study data.

Key Words: Milk Urea Nitrogen, Dairy Nutrition, Epidemiology

229 Experimental analysis of activity in healthy dairy cows. J.L. Edwards* and P.R. Tozer, *Pennsylvania State University, University Park, PA*.

A major problem in the dairy industry has been the ability to detect health problems before clinical signs were present. Activity could be one method to identify potential health problems in cows when they are in a subclinical state. Activity, health, and other data was collected on 349 cows in a Florida herd. The Afikim computerized milking and management system measures activity from a pedometer, and records the average steps per hour per day. Health data was used to separate cows into healthy and sick groups. A healthy cow was defined as one which did not have an occurrence of a metabolic or digestive disease, a retained placenta, lameness, or injury during the current lactation. The data was further divided by season, lactation number, and three different physiological stages of lactation. These stages were defined as before the first detected heat or pre-breeding, breeding, and after the last detected heat or post-breeding. Twenty-four autoregressive models were used to fit the data and identify normal activity in healthy cows. Pre-breeding data showed an autoregressive 3, AR(3), or AR(4) model with more variability in the first lactation compared to second and subsequent lactations. General trends showed a very high activity level during the first days of lactation that tapered off until the first heat cycle. The breeding stage was generally an AR(2) with a 21 and 22 day lag, and during the post-breeding stage models were an AR(2) or AR(3). After the last heat cycle, the cows had relatively minimal activity. Further research will be done to compare the models of healthy cows with sick cows to observe activity affected by a metabolic or digestive disease. The final goal will be to predict a disease occurrence based on activity before the cow showed clinical signs of illness.

Key Words: Pedometer, Activity, Autoregressive

230 Effect of various zeolites on nutrient utilization by ruminal microorganisms during continuous culture fermentation. M. Pickett*[1], T. W. Cassidy[1], and G. A. Varga[1], *The Pennsylvania State University, PA*.

A dual flow continuous culture system was used to investigate the effects of various zeolites on ruminal fermentation and nutrient digestibility. Phillipsite (P) and Clinoptilolite (CL), both naturally occurring hydrophilic zeolites, were selected for their ability to adsorb ammonium. The synthetic hydrophobic zeolite, CBV, was selected for its ability to remove odor causing organic molecules. The four treatments, P, Cl, CBV, and control (C) were evaluated using a completely randomized design during three replicates. Diets were formulated to contain on a DM basis 49% forage and 51% concentrate with a nutrient composition of 17.5% CP, 1.73 Mcal/kg NEL, and 34% NDF. All zeolites were included at 2% of ration DM. Four continuous culture fermenters were used with solid mean retention time and liquid dilution rate of 24 h and 11%/h, respectively. On day 7-9 effluents were collected daily and composited for nutrient digestibility determination and for analysis of ammonia-N, and VFA. pH did not differ across treatments and averaged 6.26 0.03. Ammonia-N concentration averaged 8.25 mg/100ml 1.29 and did not differ across treatments. Apparent DM digestibility was significantly ($P< 0.02$) reduced for all zeolites when compared to the control (47.6 vs. 43.7). Only CL significantly ($P< 0.09$) reduced NDF digestibility in comparison to the other treatments (64.9, 63.3, 58.0, and 63.4, C, CBV, CL, and P, respectively). Digestibility of total nonstructural carbohydrates was lower ($P<0.09$) for all zeolite treatments compared to the control (73.2 vs. 74.8%). Total VFA concentration was higher ($P< 0.12$) for all zeolites compared to the control (96.4 vs. 84.6 mM), while individual VFA concentrations did not differ across treatments. Bacterial N content was lowest ($P<0.02$) for CBV (6.8, 6.4,6.9, and 6.6, respectively). Zeolite addition to the diet reduced the digestibility of some nutrients, however ruminal fermentation patterns were not negatively impacted by zeolite addition.

Key Words: Zeolites, Ruminal Fermentation, Continuous Culture

231 Influence of nutrition management on rumen fermentation, blood metabolites, type and growth of holstein neonatal calves. B. Saremi* and A. Naserian, *Ferdowsi University Of Mashhad, Mashhad, Khorasan, Iran*.

Calf development is one of the most important parts of the dairy industry. Studies have been done in development of gut tissues and variability of blood metabolites because of their influence on growth and metabolism of neonatal calves. The objective of this study is to determine the influence of two feeding methods on rumen fermentation parameters, blood metabolites,and type and growth of neonatal calves. Twenty female holstein calves were randomly placed on treatments and fed colostrum at 10% of birth weight and milked until 45 days old. Both groups were fed high quality alfalfa and calf starter from seven and thirty days of age and were weaned at 45 days. Calf starter and high quality alfalfa were offered until 90 days old. The weight and frame measures of calves and blood samples were taken from 0 to 90 days in regular periods and measured the glucose, total protein and PUN content. Rumen fluid samples were taken in days 30, 45, 60, 75, 90 by stomach tube. Feed intake was measured daily. There was no difference between treatments on blood glucose ($p\leq0.065$), protein and urinary nitrogen levels of plasma and rumen fluid ammonia ($p\leq0.077$). There was no difference of period of growth in protein level of plasma ($p\leq0.079$). There was a difference in glucose and urinary nitrogen levels of plasma ($p\leq0.0001$), rumen fluid pH and ammonia due to period of growth ($p\leq0.0001$) and in rumen fluid pH between treatments ($p\leq0.0054$). The calves feed intake (concentrate, alfalfa, total DMI) were different between treatments ($p\leq0.017$, 0.009, 0.0013) and growth period ($p\leq0.0001$). There were period of growth differences between weight of calves, stomach size, pin to hook length and metacarpus size ($p\leq0.05$). Heart girth, pin width, body length, wither height and hip height didn't show any significant difference between treatments. All typical factors and weight of calves were different due to the growth period of calves ($p\leq0.0001$).

Key Words: Holstein dairy calves, nutrition management, type and development

232 Alcohol stability of milk and its relation to milk and blood composition in Holstein dairy cows. Sasan Sobhani*, Reza Valizadeh, and Abbasali Naserian, *Ferdowsi University, Agriculture college, Animal Sci. Dep.,Mashhad, Khorasan, Iran.*

The alcohol test is used as the initial classification of milk in dairy farms. It is used as a measure of the natural PH of the milk: acidity, which produces instability of milk proteins to heat. In practical conditions the test could be also positive immediately after milking and therefore this milk maybe rejected by the milk processing industry. This study focuses on variations in some milk and blood composition in individual Holstein cows related to this test. Ten cows with alcohol positive milk and 10 cows with normal milk were selected randomly from a large commercial dairy farm. In the first stage milk and blood samples were taken from all cows. The second stage of this trial continued only with alcohol positive milk cows, and alcohol test were performed for their milk until their milk turned into normal state and then milk and blood samples were taken again. After chemical analyzing of the milk and blood samples, their means were calculated. Comparison of the means of alcohol positive milk cows with normal group showed that there were significant differences ($p \leq 0.05$) in milk pH, lactose and soluble calcium, magnesium, phosphorous, citrate and potassium and also in blood potassium, chlorine, glucose and pH. But there were not any difference ($p \leq 0.05$) in protein, fat, SNF, sodium, chlorine and urea of milk and blood calcium, magnesium, phosphorous, sodium and urea. Moreover, comparison of the means of alcohol positive milk cows with themselves after their milk turned into alcohol negative test showed that there were significant differences ($p \leq 0.05$) in milk pH, lactose and soluble calcium, magnesium, sodium and potassium and blood glucose and its pH. But there were not any significant differences in the other measured factors. Results show that low levels of blood glucose (39.8 mg/100ml) could be probably the original factor for the incidence of this problem, which require more investigations.

Key Words: Alcohol stability of milk, Milk and blood composition, Dairy cow

Dairy Foods Processing

233 Impact of a novel fat removal process on the fat removed from aged full-fat Cheddar cheese and the fat portion of reduced-fat Cheddar cheese. B. K. Nelson* and D. M. Barbano, *Northeast Dairy Foods Research Center, Cornell University, Ithaca, NY.*

A novel fat removal process was previously developed for the production of reduced-fat Cheddar cheese with typical Cheddar flavor. The physical process involved tempering shredded aged full-fat Cheddar cheese to a specified temperature and then centrifuging the heated shreds to remove fat. Conditions of 30°C and 23,500 × *g* for 5 min removed 50% of the fat. While the original intent of this investigation was to characterize the fat removed from the full-fat Cheddar cheese, properties of the fat portion of the reduced-fat Cheddar cheese and the aged full-fat Cheddar cheese were also determined. The fatty acid composition of the removed fat was significantly more unsaturated than the fat portions of the reduced- and full-fat cheeses. The triglyceride molecular weight distribution of the removed fat had significantly fewer triglycerides with carbon numbers from 46 to 52 and significantly more triglycerides with carbon numbers from 28 to 42 compared to the fat portions of the reduced- and full-fat Cheddar cheeses. Major differences were observed in the melting profiles of the removed fat and fat portions of the reduced- and full-fat Cheddar cheeses. Only 82.1% of the fat in the reduced-fat cheese and 92.8% of the fat in full-fat Cheddar cheese were liquid at 30°C, while 99.6% of the removed fat was liquid at the same temperature. The different properties of the fat removed from aged full-fat Cheddar cheese compared to ordinary milkfat namely more unsaturation and a lower melting point may prove to be useful in some food product formulations.

Key Words: Cheddar cheese, Fat

234 Milk pH as a function of carbon dioxide concentration, temperature, and backpressure in a heat exchanger. Y Ma* and D Barbano, *Cornell University, Ithaca, NY.*

Raw skim milk, with or without added CO_2, was heated, held, and cooled in a tubular heat exchanger (380 ml/min). The experiment was replicated twice and for each replication, milk was first carbonated at 4°C to contain 0 (control), 1200, and 2400 ppm added CO_2 using a continuous carbonation unit. After 1 d storage at 4°C, sub-portions of milk at each CO_2 level were heated to 40, 56, 72, and 80°C, held at the desired temperature for 30s (except 80°C, holding 20s), and cooled to 4°C. At each temperature five backpressures were applied: 10 (control, without added pressure), 20, 30, 40, and 50 psi. Backpressure was controlled with a needle value at the heat exchanger exit. Both the pressure gauge and pH probe were inline at the end of the holding section, just before the cooling section. Milk pH during heating depended on CO_2 level, temperature, and pressure. ANOVA analysis showed a significant three-way interaction of the above three factors. The pH of the control milk at both the entrance and exit of the heat exchanger at 4°C was 6.90. However during heating of control milk, pH decreased linearly as a function of increasing temperature but was independent of pressure (Table). The pH of milk with added CO_2 decreased with increasing CO_2 level and pressure (Table). For milk with added CO_2, at a fixed CO_2 level, the effect of pressure on pH decrease was greater at a higher temperature. At a fixed temperature, the effect of pressure on pH decrease was greater for milk with a higher CO_2 level. Thermal death of bacterial during pasteurization of milk without added CO_2 is probably due not only to temperature but also to the "invisible" decrease in pH that occurs during the process. Increasing milk CO_2 level and backpressure decrease the milk pH even further during heating and may further enhance the microbial killing power of pasteurization.

Table. Influence of CO_2 concentration, backpressure, and holding temperature on milk pH in the holding tube.

	Control	1200	ppm	CO_2	2400	ppm	CO_2
Holding temperature	10-50 psi	10 psi	30 psi	50 psi	10 psi	30 psi	50 psi
40°C	6.58	6.06	6.05	6.05	5.90	5.79	5.78
56°C	6.46	6.00	5.97	5.96	5.92	5.72	5.72
72°C	6.35	5.98	5.89	5.88	5.93	5.80	5.67
80°C	6.26	6.00	5.86	5.83	5.96	5.81	5.64

Key Words: Milk pH in Heat Exchanger, Carbon Dioxide, Pressure and Temperature

235 Determination of optimum sampling protocol before milk pick up from Ontario farms. V Servello, I McMillan, R Lencki, and A Hill*, *University of Guelph.*

The objective of this research was to assess the optimum sampling protocol to be followed when obtaining milk samples before pick up from Ontario farms. The study indicated that representative milk samples could be obtained after 2 minutes of agitation as opposed to the 5-minute agitation standard. This result was independent of farm-to-farm variations such as tank shape, size, percent fill, impeller size, rpm, temperature changes, and milk composition. The research involved creaming, intermittent agitation, agitation, and bottom vs. top sampling tests. Creaming tests, which assessed the creaming rate of raw milk for a 3-hour period, indicated that milk stays homogeneous during the first 40-50 minutes of setting. Intermittent agitation tests, which determined the agitation time required to obtain a homogenous milk sample after 1, 2.5 and 4 hr of creaming in full and half full tanks, indicated that if the milk is left to cream from 1 to 4 hours, a homogeneous sample could be obtained after agitating the milk for 2 minutes regardless of % fill variations. Agitation tests, which assessed the agitation time required to obtain a representative sample after 3 hours of creaming from 26 different tanks, showed that 2 minutes of agitation were required. Bottom vs. Top sampling tests, which compared the standard sampling procedure (Top sampling) with a sampling method that uses a device, which fits the outlet valve of a bulk tank (Bottom sampling), indicated that a homogeneous sample could be obtained after 2 minutes of agitation regardless of the sampling method used. On the basis of these results, the optimum sampling protocol recommended was to agitate the milk for 2 minutes every hour, and to take a sample before milk pick up after 2