**NE1** The effect of heat treatment of ultrafiltered concentrated milk on its coagulation properties. S.K. Sharma, A.R. Hill, R. Y. Yada and H.D. Goff. Department of Food Science, University of Guelph, Guelph, Ont. N1G 2W1

The coagulation times and curd firmness of renneted (0.3 mL/L) ultrafiltered (UF) concentrated milk were determined using a Nanorex viscometer at 32°C. Coagulation time was considered the point at which the viscosity increased compared to the initial milk viscosity. The coagulation times of UF concentrated milks decreased (22 min. to 10 min.) with increasing concentration (1X - 4X). Heat treatment (85°C for 15 min) slightly increased the coagulation times of UF milk compared to 1X heat treated milk which failed to coagulate. When unheated UF concentrated milk was blended with heated UF milk (ratios 75:25, 50:50 and 25:75) the coagulation times were not altered compared to the unheated UF milk. However, the slopes (rate of firmness) and curd firmness (viscosity at 60 min intervals) decreased in direct proportion to the amount of heat treated milk. These properties may be of importance for avoiding the hard texture of cheese manufactured from UF milk.


Two experiments were conducted to evaluate 24-h in vitro digestion by rumen bacteria isolated from faunated and defaunated (by treating with AOT) dairy cows. In experiment 1, ground grass silage and alfalfa hay were used as substrates. ADF digestibility by bacteria from defaunated versus faunated cows was lower (P=.10) for both grass silage (30.3 vs 37.1 %) and alfalfa hay (22.5 vs 26.6 %). DM and NDF digestibilities, and ammonia nitrogen (NH₃-N) concentration were unaffected by bacterial source. In experiment 2, the effects of varying levels (0, 15.5, 31.0, 46.5 and 62.0 ppm) of AOT on bacteria from faunated and defaunated cows were determined using grass silage as the substrate. Increasing level of AOT reduced (P<.05) digestibilities of DM, NDF, and ADF. Mean in vitro digestibilities were lower (P<.05) for bacteria from defaunated than faunated cows. Neither bacterial source nor AOT level affected NH₃-N concentrations. These data suggest that cellulolytic, but not proteolytic rumen bacterial activity was altered by defaunation.
Energy value of a dietary fat supplement for dairy cows fed silage-based rations.


Energy value of a dietary fat supplement (Ca soap) was measured using twelve lactating (603 kg BW, fed ad libitum) and six non-lactating Holstein cows (663 kg BW, fed near maintenance) while housed in the Beltsville open circuit respiration chambers. Treatments consisted of 4 total mixed rations (40% corn silage, 10% alfalfa silage, 50% grain) formulated to contain 16 or 20% CP with and without Ca soap added by substituting 3% fat supplement for an equal weight of corn plus minerals. Effect of Ca soap on energy balance was measured during 6 d collection period following 5 wk adaptation to diet in a single reversal experiment. Dry matter intake of lactating cows (20.5 vs 19.4 kg/d) was lower for Ca soap, but IE was not different (94.04 vs 92.44 Mcal/d). Actual milk yield was higher (32.0 vs 34.3 kg/d) for Ca soap, but milk energy yield was not different (22.18 vs 23.07 Mcal/d). Energy value of fat supplement was computed using diet means for lactating and dry cows, assuming It, DE, and ME of corn replaced by fat to be 4.40, 3.75, and 3.34 Mcal/kg, respectively. Estimate of IE, DE, and ME of Ca soap was 8.83, 8.55, and 8.19 Mcal/kg DM for lactating cows vs 7.96, 7.06, and 8.80 Mcal/kg DM for non-lactating cows. Energy from dietary fat as Ca soap is digested and absorbed efficiently by Holstein cows.


Effects of partial substitution of whey protein for milk protein on the yield, texture and ultrastructure of Latin American frying cheese (Queso Blanco) were studied. Queso Blanco was prepared by heat acid precipitation from recombined milk containing 12% solids-not-fat (SNF), 4.2% protein (N x 6.38) and 3.5% fat. SNF was supplied as skim milk powder (35% protein) and 35% whey protein concentrate (WPC) in proportions varying from 0 to 50% WPC. Cheese fat (13.3-19.5%), protein (15.2-29%), recovery of solids (45.8-52.2%), and recovery of protein (67.4-90.3%) all decreased with increasing levels of WPC. Cheese yield increased with WPC due to higher moisture (47-54%). None of the treatments showed measurable meltability at 232°C (Schreiber test). Sensory analysis (expert graders) indicated optimum sliceability and lack of mealiness in the range of 20-30% WPC. Instrumental hardness and firmness values (texture profile analysis) showed no relationship to WPC levels. Conventional and low temperature SEM indicated more open structure at higher levels of WPC. Queso Blanco ultrastructure was similar to that of Cheddar cheese.

Control of gaffkemia in a lobster feed lot. Robert C. Bayer and Peter C. Daniel, University of Maine, Orono, Maine 04469

Lobster feed lots or tidal lobster pounds are a unique system for storing live lobsters for a duration of up to six months. In Maine, approximately 6 million pounds of lobsters are held in pounds beginning in late August for sale the following spring. These animals have recently molted, have soft shells and a relatively small quantity of meat for the size of their shell. The lobster pound is analogous to a cattle feed lot; the lobsters are fed and "fattened". Among feed lot lobsters, gaffkemia, a disease caused by the bacterium Aerococcus viridans, results in severe mortality. Oxytetracycline (OTC) can be used for the control of this disease. A dose titration study (4 replicates of 15 lobsters per treatment) was done by feeding OTC-supplemented at levels of .5, 1.1, or 2.2 mg OTC g^-1 of diet or an unsupplemented diet. The lobsters were challenged by infection with Aerococcus viridans. Mortality was 100% for the non-medicated group and as low as 15% in a medicated group.

A second study used a more natural spread of infection by placing one infected lobster in each replicate. Mortality from gaffkemia was 78% of 150 lobsters that consumed the non-medicated diet compared with 13 or 2% for those receiving 1.1 or 2.2 mg OTC g^-1 diet respectively. Residue analysis was done on lobsters that were fed 1.1 or 2.2 mg g^-1 for 10 days. Muscle, the primary tissue, was free of residue at 14 or 28 days, in trials conducted at ambient temperature of 15-19 or 14-15°C, respectively.
NE6 Effects of low and high fill diets on intake and production in lactating dairy cows. T.K. Miller*, W.H. Hoover, W.W. Poland, Jr. and W.V. Thayne. West Virginia University, Morgantown.

Thirty-two lactating dairy cows were allotted to two groups based on previous lactation mature equivalent milk production (avg 30 and 23 kg/day) and randomly assigned to four dietary treatments. Diets with slow (high fill-HF) or fast (low fill-LF) estimated rate of NDF disappearance with or without the addition of 1.5% sodium bicarbonate were limit fed 2 wk prior to calving then fed ad libitum until 10 wk after calving. Regardless of buffer addition, total milk and milk protein production in kg/day and NDF and ADF intake as percentages of body weight were significantly higher (P<.01) for cows given the LF diet (35.22 vs 32.07, 1.13 vs 0.97, 1.16 vs 1.04 and 0.58 vs 0.51, respectively). In a summary of pooled data from high and low production groups, diets with rapid rates of fiber digestion resulted in increased milk production and daily milk protein yield with little effect on DM intake, body weight and milk fat percentages. The addition of sodium bicarbonate resulted in significant production increases only in lower producing animals.

KEY WORDS: fill, fiber digestion, milk production

NE7 Lactation performance of cows fed corn conserved as dry or high moisture shell, high moisture ear, or earlage in silage based diets. H. Tyrrell, Agricultural Research Service, Ruminant Nutrition Laboratory, Beltsville, MD 20705.

The objective was to measure lactation performance of high producing Holstein cows fed total mixed rations containing 30% alfalfa silage, 20% corn silage, 10% protein-mineral-vitamin mix and 40% corn as either ground dry shell (DS), rolled high moisture shell (HMS), rolled high moisture ear (HME), or ground earlage (EL) during lactation week (LW) 6-15. Thirty two cows in their 2nd or later lactation were fed the HMS diet ad lib from calving through LW 5 after which they either continued on HMS or switched to another diet based upon milk yield during LW 4-5. Measurements included daily feed intake, milk yield and diet DM plus weekly milk composition and body weight. During LW 4-5, cows assigned to DS, HMS, HME, and EL consumed 21.1, 19.1, 20.5, and 20.9 kg/d DM; weighed 624, 602, 608, and 632 kg; produced 38.6, 38.0, 38.5, and 39.4 kg/d milk; containing 3.13, 3.21, 3.39, and 3.10% milk fat. During LW 14-15 (expressed as % of LW 4-5), DM intake was 126, 112, 104, and 101%; body weight was 103, 102, 100, and 100%; milk yield was 94, 95, 89, and 88%; and contained 91, 91, 107, and 105% fat compared to the control period (LW 4-5). Cows fed DS consumed more DM, maintained BW better and produced more milk energy than cows fed HMS, HME, or EL. Cows fed HMS maintained BW and milk yield, but had serious milk fat depression. Cows fed HME and EL did not maintain feed intake or milk yield.

Energy value of corn conserved as dry or high moisture shell, high moisture ear, or earlage in silage based diets. H. Tyrrell, Agricultural Research Service, Beltsville.

Energy value of 4 total mixed rations containing 30% alfalfa silage, 20% corn silage, 10% protein-mineral-vitamin mix and 40% corn as either ground dry shell (DS), rolled high moisture shell (HMS), rolled high moisture ear (HME), or ground earlage (EL) was determined using 8 lactating (643 kg BW, fed ad libitum) and 4 non-lactating Holstein cows (729 kg BW, fed near maintenance) in a 4X4 latin square experiment. Energy and nitrogen balance was measured over 6 d while cows were housed in the Beltsville open circuit respiration chambers after 5 wk adaptation to diet. DM Intake (kg/d) of lactating cows was lower for HMS (18.3) and HME (18.8) than DS (20.1) and EL (19.7). Milk yield (29.2 kg/d) was not different among diets. Apparent digestibility of energy (%) by dry cows was lower for HME (73.2) and EL (72.6) than DS (76.2) or HMS (75.2). Lactating cows digested less energy from all diets than dry cows and less from EL (67.5) than HMS (69.4), but not HME (68.7) or DS (68.0). Metabolizable energy (Mcal/kg DM) reflected diet differences in DE for dry cows (2.95, 2.90, 2.71, and 2.72 for DS, HMS, HME, and EL), but for lactating cows, ME was lower than in dry cows only for DS and was not different among diets (2.76, 2.82, 2.73, and 2.72). Net energy value for lactation of the four diets were not different (1.66, 1.66, 1.62, and 1.64 Mcal/kg DM for DS, HMS, HME, and EL). Energy value for lactation of high moisture and whole ear corn is comparable to dry shell in total mixed silage diets.

To determine the extent of lysine limitation and acquire estimates of postruminal lysine requirements, 4 Holstein cows (571 kg BW) with ruminal and T-type cannulae were assigned to a 4 x 4 Latin square design at 29 to 31 wk postpartum. Cows received daily duodenal infusions of (g/d): (1) water; (2) 8 DL-methionine (Met) + 8 L-lysine (Lys); (3) 8 Met + 16 Lys; and (4) 8 Met + 24 Lys. Mean intake of feeds (kg DM/d) were: corn silage, 10.5; haycrop silage, 3.1; corn meal, 2.2; wheat middlings, .9; soybean meal, .9; and distillers grains w/solubles, .9; CP of ration DM ingested was 13 %. Intake of DM (kg/d), yields of milk and milk protein (kg/d), and content of milk protein (%) were: (1) 16.7, 23.0, .721, 3.15; (2) 18.2, 20.7, .669, 3.25; (3) 19.3, 22.1, .733, 3.29; and (4) 18.5, 22.1, .729, 3.30. Intakes of DM and yields of milk and milk protein were not different (P > .05). Content of milk protein from duodenal infusions of 16 or 24 g/d Lys was greater (P < .05) than for the water control, but not different from infusion of 8 g/d Lys. Postruminal Lys requirements for cows in this study are difficult to estimate because of the uncertainty as to whether or not Lys and Met were limiting for milk protein synthesis. Based on postruminal flows of Cr₂O₃, Lys and Met flows to the small intestine (excluding infusates) were 160 and 41 g/d.

Enumeration of Staphylococcus aureus via absorbance at OD₆₅₀

K.E. Squiggins, A.J. Guidry, L.W. Douglass and D.C. Westhoff. USDA-ARS, Beltsville, MD 20705 and University of Maryland, College Park 20742.

Bacterial counts, using a modified Breed method, were plotted against absorbance to develop regression equations for estimating number of S. aureus in suspension. Eight strains of S. aureus were grown on various media, formalin killed, diluted in PBS and mildly sonicated. Each suspension was diluted to absorbance readings from 0.60 to 1.60 at OD₆₅₀. The S. aureus were then diluted in a solution of crystal violet, bovine sera, ethanol, and .01M PBS pH 6.8, to approximately 10⁶ cells/ml. The S. aureus-dye suspension (10 µl) was spread over 1 cm² and allowed to dry. The film dried evenly due to the lower surface tension caused by the ethanol. A fixed diameter of each smear was counted using a lens reticle. Simple linear regression of count on absorbance accounted for 99.1 % of treatment variance. Pairwise comparison of standard curves by strain showed 60 of 66 were different (LSD at P < .05). Growth conditions and handling were critical to avoid shrinkage or swelling of cells, which affected absorbance. Trypsin to remove protein A decreased absorbance by encapsulated organisms.

Fluorescence-activated cell analysis: Applications in mastitis research.


A flow cytometer analyzes and separates cells on the basis of size, shape and fluorescence. Circulating leukocytes could be differentiated on the basis of size and shape. Granulocytes appear as a distinct population of cells, separate from lymphocytes and monocytes. Within the granulocyte population, neutrophils were distinguished from eosinophils on the basis of red and green fluorescence after incubation in acridine orange. When milk somatic cells are tagged with carboxydimethylfluorescein diacetate, neutrophils are distinguishable from other cell types via cell size and green fluorescence. Phagocytic ability of neutrophils was determined after incubation in fluorescein labelled Staphylococcus aureus. The percentage and intensity of fluorescence of neutrophils with internalized and adherent S. aureus was determined by histogram analysis. The measurement of oxidative product formation, an indirect measurement of bactericidal capacity by neutrophils, was determined by measuring the oxidation of intracellular dichlorofluorescin to fluorescent dichlorofluorescein, after stimulation of neutrophils with phorbol myristate acetate.
A MODEL FOR STUDYING THE EFFECT OF CAPSULE ON STAPHYLOCOCCUS AUREUS VIRULENCE. A.J. Guidry, K.E. Squiggins, M.F. Kavlick, and E.F. Erbe
USDA-ARS, Beltsville, MD and University of Maryland, College Park.

The capsule of Staphylococcus aureus serves as a virulence factor. S. aureus strains, Smith compact (Cp - no capsule), Smith diffuse (Df - large rigid capsule), and a Smith diffuse mutant (Df_e - very large flaccid capsule), were used as a model to study the effect of capsule on virulence and as a source of capsule antigen for preparation of a vaccine. Relative virulence in mice (LD_{50} [x10^7]) was Df(3), Df_e(8) and Cp(>200). Immunization of cows with Cp increased serum agglutination titers to Cp, but not to the capsules of Df and Df_e. Immunization with Df or Df_e increased titers to Df and Df_e capsules. Absorption of each antiserum with Cp decreased ELISA activity to cell wall, but not to capsule, to prebleed levels. Absorption of each antiserum with Df or Df_e decreased ELISA activity to capsule to prebleed levels. Because Df capsule cross reacts with encapsulated S. aureus isolated from bovine mastitis, commonality of antigens between Df and Df_e and ease of removal of the capsule from Df_e make the latter a prime candidate for preparation of a S. aureus capsule vaccine for bovine mastitis.

Correlations between discounted lifetime income and income per day and D.H.I. measures of productivity. W.R. Congleton, Jr.*, and M.P. Colca. University of Maine Orono, 04469.

Relationships between milk production and lifetime income of the dairy cow were evaluated. Twenty-eight dairy herds of 200 cows were simulated for 20 yr. Each herd was characterized by a feed cost, milk price, cow salvage value, discount rate, production level, frequency of incidence of mastitis and other health disorders, and a unique production environment for each year. Observations of total cumulative income for 14,898 cows were collected from birth and discounted at 0%, 5% and 10%. These values for actual profitability were correlated with performance information which would be available from Dairy Herd Improvement including 305-day first lactation production (305M), breeding value for milk (BVM), Estimated Relative Producing Ability for milk (ERPA), lifetime milk (LFM) and Relative Net Income (RNI). All observations were deviated from contemporaries freshening + 6 mo. Correlations between 305M and lifetime income increased from .52 to .59 while correlations between LFM and lifetime income decreased from .84 to .78 as the discount rate increased from 0 to 10%. Correlations between RNI and lifetime income were about .1 higher than LFM. Both BVM and ERPA had correlations with lifetime income between .52 and .64. On a per day basis, the correlations between 305M per day from birth and income per day ranged from .65 to .67. The correlations between income per day from birth and LFM/day and RNI/day were .78 and .83 with discounting lifetime income having little effect on the magnitude of the correlations.

Use of mount detectors and chalk with a vaginal probe as estrous detection aids to improve reproductive efficiency of dairy cattle. J.A. Pennington, Western Kentucky University, Bowling Green.

Holstein cows (n=170) in three dairy herds were assigned to treatments as follows: control cows with no estrus detection aid (C); cows fitted with mount detectors plus chalk (K/C); and cows fitted with mount detectors plus chalk which were checked for vaginal conductivity when both aids were positive--cows then were bred even if standing estrus was not detected if vaginal conductivity indicated a cow near estrus (K/C/V). Cows were observed for estrus at least twice daily and detection aids updated once daily when necessary at milking. Days from calving to first detected estrus, first breeding, second detected estrus, second breeding, and conception or termination from experiment when not pregnant for C, K/C, and K/C/V groups were 85, 77, 90; 86, 81, 95; 124, 118, 109; 133, 119, 118; and 126, 106, 111. Although K/C enhanced reproductive efficiency compared to controls, use of vaginal probes did not further increase reproductive performance of cows treated with K/C.

Twenty-seven French Alpine kids were assigned at random by sex (5 males and 4 females per group) to one of three treatments. The control diet (1), an 18% protein high energy starter pellet, was supplemented with chlortetracycline, 30 g/tom (2) or lasalocid-sodium (Bovatec®), 50 g/tom (3). Kids were housed in individual pens, offered concentrate, hay and water free choice and fed whole, pasteurized goat's milk at a rate of 10% body weight adjusted weekly. Kids were weaned at six weeks. Fecal examination at that time found all animals free of internal parasites. Feed intake and growth were poor on the control diet following weaning.

<table>
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Weight gains of male goats supplemented with lasalocid-sodium were superior (p<.10) to those on the chlortetracycline and control diets. No treatment differences were observed in females. The observed advantage of the lasalocid-sodium treatment may be magnified if kids were housed in groups and contaminated with coccidia.