431 Quality attributes of strawberry swiss style yogurt in the North Carolina marketplace. A. Hansen* and M. Keziah, *North Carolina State University Raleigh, N.C. USA.*

Approximately 300 samples of strawberry swiss style yogurt were obtained from various local dairies and grocery stores across North Carolina. The samples were collected over a two year period and analyzed for appearance, body, texture and flavor. The evaluation was conducted with 15 trained dairy judges according to ADSA protocol. The variation in quality and uniformity was quite extensive across brands. The color went from white to pink to purple for strawberry yogurt. The body and texture was from a runny liquid to a firm gel. The flavors were from slight strawberry, strawberry, chocolate and banana for swiss style strawberry yogurt. The major appearance defects were most to least color leaching, lacks fruit, lumpy, shrunken, free whey and atypical color. The body and texture defects from most to least were gel-like, weak, ropy and grainy. The flavor defects from most to least were acetaldehyde, high acid, lacks flavoring, unnatural flavoring and too sweet. In most cases the national brands had fairly good strawberry flavor but poor color and gel-like body. The store brands had appearance and colors from white or pink to purple. In many of the store brands we observed color leaching, no fruit and lacks fruit. The body and texture in most cases were gel-like with less samples grainy, weak and ropy. The flavoring of the store brands we identified were acetaldehyde, high acid, lacks flavoring, too sweet, banana and chocolate. It is evident that more quality assurance is needed to improve the quality of strawberry swiss style yogurt

Key Words: Swiss Style Yogurt, Marketplace, Quality

432 Consumer acceptability of lucuma and cherimoya ice cream. A. Hansen*[1], M. Keziah[1], and T. Salas[2], [1]*North Carolina State University Raleigh, N.C. USA,* [2]*Gen Peru Lima, Peru.*

Raw milk and cream were obtained from the NCSU dairy plant to produce a 14% fat ice cream. Powdered skim milk was used to raise the milk solids to 9%. Granulated cane sugar was used at the rate of 15% and ice cream stabilizer was at 0.3% The ingredients were blended and batch pasteurized at 165° F for 30 minutes and then homogenized at 2000 psi on first stage and 500 psi on second stage. The mix was then cooled to 35° F with chill water. The mix was aged for 48 hours and then flavored with frozen lucuma and cherimoya puree. The mix was frozen in a Cherry Burrell Vogt Freezer at 85% overrun, packaged in half-gallon containers and placed in a -30° F hardening freezer. Approximately three weeks later ice cream was removed from the hardening box and tempered at 0° F for sensory testing. Twenty-eight consumers screened for ice cream use participated in a consumer hedonic panel to measure degree of liking of lucuma and cherimoya ice creams. Panelists used a nine-point hedonic scale ballot to rate overall impression, flavor and mouthfeel. Statistical analysis of the sample results reveals that consumers scored the lucuma ice cream overall impression and flavor significantly higher than that of the cherimoya ice cream. The overall impression and flavor scores for the lucuma sample averaged in the "like moderately" to "like very much" range while the cherimoya sample averaged in the "neither like nor dislike" range. Consumers failed to reject the null hypothesis of no difference in mouthfeel. A preference for the lucuma ice cream overall impression and flavor can be inferred from these hedonic scores.

Key Words: Lucuma, Cherimoya, Ice Cream

433 Effect of CO_2 Addition to Raw Milk on Protein and Fat Degradation at 4°C . Y Ma* and David Barbano, *Northeast Dairy Foods Research Center, Department of Food Science, Cornell University.*

Fresh raw milks, with low ($3.1x10^4$ cell/ml) and high ($1.1x10^6$ cells/ml) somatic cell count (SCC), were standardized to 3.25% fat and from each a preserved (with 0.02% potassium dichromate) and an unpreserved portion were prepared. Subsamples of each portion were carbonated to contain 0 (control, pH 6.9), and 1,500 (pH 6.2) ppm CO_2, or HCl acidified to pH 6.2. Results of HCl acidified milk helped explain if there was a direct CO_2 effect or simply a pH reduction effect. Samples were stored in gas-tight glass jars at 4°C and analyzed on d 0, 7, 14, and 21 for proteolysis (decrease of CN as a percentage of true protein), lipolysis (increase in free fatty acid), and microbial count. As expected, more proteolysis and lipolysis occurred in high SCC milk. For unpreserved milks at d 21, psychrotrophic bacteria count reached 10^8 cfu/ml for both control and HCl acidified samples; in CO_2 added sample, the count was ca. 10^6 cfu/ml. At d 21, for control and HCl acidified unpreserved milks, average CN as a percentage of true protein decreased from 81 to 68% and average free fatty acid increased from 0.18 to 0.28 meq/kg milk primarily due to microbial growth; average changes were 81 to 80% and 0.18 to 0.19 meq/kg, respectively, for CO_2 added milk. Microbial growth was effectively inhibited in all preserved milks. Data for preserved milk gave information regarding the direct impact of CO_2 on protein and fat degradation by native milk enzymes separated from degradation brought about by enzymes of microbial origin. Compared with control, both carbonated and acidified preserved milks showed less proteolysis, suggesting that the inhibitory effect of CO_2 on proteolysis was due to pH reduction. No effect of CO_2 or acidification on lipolysis in preserved samples was observed. Carbonation reduced microbial growth in raw milk at 4°C and slowed down proteolysis as a consequence of milk pH reduction. High quality raw milk (low initial bacteria count, low SCC) with 1,500 ppm CO_2 can be stored at 4°C for at least 21 d with minimal protein and fat degradation, i.e., with $< 1\%$ decrease in CN as a percentage of true protein and < 0.01 meq/kg increase in free fatty acid.

Key Words: Carbon Dioxide, Prolonged Storage of Raw Milk, Protein and Fat Degradation

434 Effect of storage time and temperature on the serum phase of cultured cream cheese. L Acosta and P.S. Kindstedt*, *University of Vermont, Burlington, VT/USA.*

Syneresis is a problem in Cream cheese that is characterized by whey separation at the cheese surface and general wheying-off during heating. Previous studies demonstrated that the water-holding capacity of cultured Cream cheese decreased during storage at 4° and 25° C, and that changes occurred much more rapidly at 25° C. The objective of this study was to evaluate time and temperature dependent changes in the composition and viscosity of the serum phase of Cream cheese. Four 13.6-kg blocks of cultured Cream cheese made with locust bean gum stabilizer were obtained from a commercial source within 10 d after manufacture. Blocks were sectioned into samples that were vacuum packaged and randomly assigned to one of two storage temperatures: 4° and 25° C. Samples were randomly chosen for analysis after 1, 4, 7, 10, 14, 21 and 28 d of storage at 25° C, and after 0, 14, 27, 41, 55, 69, 83, 96 and 111 d of storage at 4° C. Samples were centrifuged at 12,500 x g for 75 min at 25° C to obtain expressible serum (ES). The ES was analyzed for crude protein, Ca, P, K, Mg, Na, Zn, and viscosity. For each storage temperature, RCB ANOVA was used to determine the significance of changes during storage. Linear regression was used to compare rates of change at 4° and 25° C. The amount of ES increased significantly during storage at 4° and 25° C; the rate of increase was substantially greater at 25° C. Crude protein in the ES increased significantly but only slightly during storage at 25° C, and did not change significantly at 4° C. Mineral contents did not change significantly at either storage temperature. In contrast, the viscosity of ES decreased significantly during storage at 4 and 25° C; the rate of decrease was much greater at 25° C. The amount and viscosity of the ES showed an inverse exponential relationship (R =.85). The results suggest that decreased water-holding capacity of Cream cheese during storage is caused by changes in the stabilizer function and not by changes in the distribution of protein and minerals between the protein-fat matrix and serum phases.

Key Words: Cream cheese, Syneresis, Expressible serum

435 Effect of storage time, storage temperature and pH on the viscosity of aqueous solutions of locust bean gum. M.L. Gigante*[1], M. Almena-Aliste[2], and P.S. Kindstedt[2], [1]*State University of Campinas, Campinas, SP/Brazil,* [2]*University of Vermont, Burlington, VT/USA.*

Previous studies demonstrated that the viscosity of the serum phase of cultured cream cheese (made with locust bean gum stabilizer) decreased in a temperature-dependent manner during storage at 4 and 25°C. The

objectives of this study were to determine whether aqueous solutions of locust bean gum (LBG) undergo similar temperature-dependent changes in viscosity during storage, and whether pH influences those changes. LBG solutions (.15, .30, .45, and .60%) were prepared in distilled water. Finely powdered LBG was sifted slowly into the vortex of rapidly stirred (9000 - 1,200 rpm) water at 84 1°C. The solutions were then stirred at room temperature for 4 h and then held undisturbed for 16-18 h at 4°C. The solutions were then divided into three treatments and lactic acid was added to adjust the pH to 5.3, 4.8 and 4.3 (± .05). The acidified solutions were dispensed into sterile culture tubes and stored at 4 or 20°C for up to 28 d. Samples were randomly chosen after 1, 4, 8, 12, 16, 20, 24 and 28 d and analyzed for viscosity at 25°C (Brookfield) and turbidity (absorbance, 420 nm). The entire experiment was replicated three times. For each LBG concentration, the effects of pH, storage time and storage temperature were evaluated by ANOVA according to a split split-plot design. The viscosity of LBG solutions decreased and turbidity increased significantly during storage. These changes were greater at 20°C than at 4°C. Also, viscosity decreased more rapidly at higher pH. The observed changes in turbidity and viscosity indicate that the state of the LBG stabilizer changed during storage, possibly due to self-association. It is possible that similar changes may occur in LBG contained within the serum phase of cream cheese. Thus, changes in stabilizer function may account for the previously observed changes in the serum phase of cultured cream cheese during storage. Finally, results of the present study suggest that the pH of cream cheese may influence the rates at which the serum viscosity and water-holding capacity of the cheese decrease during storage.

Key Words: Cream cheese, Stabilizer, Locust bean gum

436 Application of a model system to study the effect of pH on the serum phase of cultured cream cheese during storage. M.L. Gigante*[1], M. Almena-Aliste[2], and P.S. Kindstedt[2], [1]*State University of Campinas, Campinas, SP/Brazil,* [2]*University of Vermont, Burlington, VT/USA.*

Previous studies demonstrated that the viscosity of locust bean gum (LBG) in aqueous solution decreased during storage and was affected by storage temperature and pH of the solution. The present objective was to determine whether the pH of cream cheese influences temperature-dependent changes in the serum phase during storage. Three 13.6-kg blocks of cultured Cream cheese made with LBG were obtained from a commercial source within 15 d of manufacture. Blocks were sectioned into samples that were randomly assigned to three treatments. A model system was used to change cheese pH. One group of samples was exposed to volatile ammonia to increase the pH to ca. 5.2. A second group was exposed to volatile acetic acid to decrease the pH to ca. 4.5. A third group served as a control (pH ca. 4.8). Samples from each pH treatment were vacuum packaged and randomly assigned to one of two storage temperatures: 4 and 20°C. Samples were randomly chosen for analysis after 4, 8, 12, 16, 20, 24 and 28 d of storage. Samples were centrifuged at 12,500 x g for 75 min at 25°C to obtain expressible serum (ES). The ES was analyzed for viscosity at 25°C (Brookfield) and turbidity (absorbance, 420 nm). Effects of pH, storage time and storage temperature were evaluated by ANOVA according to a split split-plot design. Amount of ES increased significantly during storage, and was affected by storage temperature and cheese pH. Significantly more ES was obtained at higher temperature and higher pH. Viscosity of ES decreased significantly during storage and was affected by storage temperature and cheese pH. Viscosity decreased more rapidly at higher temperature and higher pH. Turbidity of ES was not affected by storage temperature or cheese pH. The observed changes in amount and viscosity of ES during storage suggest that the state of LBG within the serum phase of the cheese changed in a temperature and pH-dependent manner. However, in contrast to LBG in aqueous solution, these changes could not be detected by measuring the turbidity of ES, possibly due to the centrifugation conditions used to obtain ES.

Key Words: Cream cheese, Stabilizer, Locust bean gum

437 Effect of centrifugation conditions on expressible serum obtained from cultured cream cheese. M. Almena-Aliste*[1], M.L. Gigante [2], and P.S. Kindstedt[1], [1]*University of Vermont, Burlington, VT/USA,* [2]*State University of Campinas, Campinas, SP/Brazil.*

Previous studies showed that the amount and viscosity of expressible serum obtained from cream cheese varied significantly from batch to batch and with temperature and time of storage. The objective of this study was to evaluate the effect of centrifugation conditions on expressible serum in an attempt to gain insight into the causes of variation in serum viscosity and cheese water-holding capacity. Cream cheese was obtained from a commercial source and centrifuged at 3 different forces (13,000, 16,000, and 20,000 x g) and 2 different temperatures (cheese pretempered to 25 °C, centrifuged at 25 °C; cheese pretempered to 60 °C, centrifuged at 25 °C). Three replications were performed at each force x temperature combination. Expressible serum was analyzed for viscosity at 25 °C (Brookfield), turbidity (absorbance, 420 nm) and total solids. Data were analyzed by ANOVA according to a 3x2 factorial design. Six different batches of cheese that varied widely in properties were evaluated using this experimental design. Centrifugation force significantly affected the amount of ES obtained from all six cheeses, but significant interactions of force x temperature occurred with three of the cheeses. In general, higher g-force resulted in greater ES. Total solids decreased slightly (< 0.2%) but significantly with higher centrifugation force. In contrast, viscosity was not affected by centrifugation force in 5 of 6 trials. Turbidity results varied widely among cheeses and were inconclusive. The data suggest that functioning stabilizer in the serum is not sedimentable at up to 20,000 x g. Centrifugation temperature significantly affected viscosity and turbidity in 5 of the 6 trials. Higher centrifugation temperature resulted in higher viscosity and higher turbidity. In contrast, total solids varied only slightly (< 0.3%) between temperatures, and the effect was not consistent from trial to trial. The data suggest that the higher cheese temperature before and during centrifugation altered the state of the stabilizer and enhanced its water-binding capacity and ability to increase the viscosity of the serum phase of the cheese.

Key Words: Cream cheese, Expressible serum, Stabilizer

438 Isolation and characterization of gitty prticles in cream cheese. Mihir R. Sainani*, Harit K. Vyas, and Phillip S. Tong, *California Polytechnic State University, San Luis Obispo, CA.*.

A gritty/grainy mouthfeel is an undesirable textural defect in cream cheese. Grittiness develops when the coagulated curd (pH 4.55 - 4.6) is heat-treated during cheese making. The objectives of this study were 1) to isolate and characterize gritty particles from cream cheese and 2) to study the effect of gritty particles on texture of the cheese. Gritty particles were isolated from cream cheese by washing with water at 25°C and then 50°C. The mixture was then cooled and held overnight at 10°C and the top fat layer was decanted. These steps were repeated 4- 5 times to get a good isolation of the particles. The particulate suspensions were used for estimating particle size using Coulter LS230 particle size analyzer. The suspensions were subsequently vacuum filtered through 2.5 μm filter. The filtered particles as well as cheese were analyzed for moisture, fat, protein and ash using standard AOAC methods and lactose was estimated by the difference. To study the effect on the cheese texture, gritty particles were added at 5, 15 and 25% (w/w) levels to smooth cream cheese and a sensory ranking test was done on the samples (15 panelists). In another experiment, the isolated particles were further separated into two size classes of 8 to 130μm and $\geq$130μm using filters. These particles were then mixed with smooth cream cheese at 16 and 29 % (w/w) and a sensory test was conducted on these samples. It was found that the particles were 26% (dry matter basis) higher in protein content and 66 and 63% (dry matter basis) lower in ash and lactose, respectively, as compared to the cheese. The particle size was in the range of 0.42μm to 1500μm. Sensory results suggested that the cream cheese added with particles even at 5% level was perceived as more gritty than the control sample. It also revealed that the perceived grittiness increased with increase in the amount and size of particles. It was concluded that particles were higher in protein content than the cheese and that the size and number of particles affected the grittiness of cream cheese.

Key Words: Grittiness, Cream Cheese

439 Fortification of fluid skim milk with conjugated linoleic acid (CLA). W.S. Campbell*, J. Parker, M.A. Drake, and D.K. Larick, [1]*North Carolina State University.*

Nutraceutical products make up the fastest growing segment of the U.S. food industry. Conjugated linoleic acid (CLA) occurs naturally in milk at low levels and is an anticarcinogen. Research indicates that concentrations of 1 to 3 g CLA/day would provide protective anticarcinogenic benefits. Increased levels of CLA in fluid milk would produce a nutraceutical dairy beverage. The objectives of this study were to develop a CLA fortified milk with improved nutritional properties. CLA (1 g, 2g, or 3 g /240g) and derivatized whey protein concentrate (DWPC) (0%, 0.25%, 0.5%) were added to raw skim milk prior to homogenization, HTST pasteurization and aseptic packaging. Headspace volatiles were evaluated by purge and trap gas chromatography. Viscosity was determined using a controlled stress rheometer and visual properties (L*, a*, b*) were evaluated with a colorimeter. CLA fortified skim milk had minimal levels of hexanal and sensory data did not indicate substantial flavor deterioration as compared to control. The addition of CLA increased the whiteness of the milk, but did not significantly affect viscosity. Addition of DWPC at .25% in skim milk mimicked the viscosity of reduced fat milk, however, visual properties were not affected. These results indicate that skim milk may provide a vehicle for CLA consumption and that DWPC enhances the viscosity of skim milk such that it is more similar to reduced fat milk.

Key Words: Conjugated linoleic acid, Milk

ASAS Nonruminant Nutrition: Alternative Ingredients (Nursery & Specialty Grain)

440 Supplementation of α-1,6-galactosidase and β-1,4-mannanase to improve soybean meal utilization by nursery pig. S. W. Kim*[1], I. Mavromchalis[2], and R. A. Easter[2], [1]*Texas Tech University,* [2]*University of Illinois.*

Soybean meal contains 5.6% α-galactoside and 1.2% β-galactomannans that pigs can not utilize because of they lack appropriate enzymes, resulting in gas production and flatulence. Two experiments were conducted to test a hypothesis that dietary supplementation of an enzyme mixture (carbohydrase, mainly composed of α-1,6-galactosidase and β-1,4-mannanase) improves nutrient utilization of soybean meal in nursery pigs. In the first experiment, 108 weaned pigs (21 d; Camborough-15 x line 326, PIC, Franklin, KY) were offered three diets containing either 0% (control), 0.025%, or 0.050% of the carbohydrase for a 5-wk period in six replicates with 6 pigs per pen. Overall, growth response of pigs fed diets containing enzyme was greater ($P < 0.05$) than control group (11% improvement compared to control). Average daily gain was greater ($P < 0.07$) only in pigs fed a diet with 0.025% carbohydrase during the fourth wk post-weaning. There was no improvement in average daily gain in pigs fed a diet with 0.050% of carbohydrase. However, gain/feed ratio was greater ($P < 0.05$) in pigs fed a diet with 0.025% of enzyme during the last 4 wk of the experiment. In the second experiment, ten cannulated female pigs (Camborough-15 x line 326, Pig Improvement Company) were used to measure the effect of the carbohydrase supplementation (0.025%) on the apparent ileal digestibility of energy and amino acids with five pigs assigned to each treatment. Ileal samples were collected for 2-d following by 5-d adjustment period during the fifth wk post-weaning. Apparent ileal digestibility of gross energy was greater (7% improvement, $P < 0.05$) in the carbohydrase-supplemented diet. Also, apparent ileal digestibility of lysine, threonine, and tryptophan was greater (3% improvement, $P < 0.05$) in the carbohydrase-supplemented diet. In conclusion, a carbohydrase composed of α-1,6-galactosidase and β-1,4-mannanase can increase growth performance in nursery pigs by improving the digestibility of energy and amino acids in corn-soybean meal-based diet.

Key Words: Nursery pigs, Soybean meal, Carbohydrase

441 Performance of weaned piglets fed insect-protected (MON 810) or near isogenic corn. G. Piva*[1], M. Morlacchini[2], A. Pietri[1], A. Piva[3], and G. Casadei[1], [1]*Istituto di Scienze degli Alimenti e della Nutrizione, U.C.S.C., Facolt di Agraria, Italy,* [2]*CERZOO,* [3]*DIMORFIPA, Facolt Medicina Veterinaria, Bologna, Italy.*

The aim of the experiment was to compare the nutritive value for piglets of insect-protected corn (Bt) containing the Cry1A(b) protein (MON 810) with non-modified near isogenic control corn (IC), both produced on two Italian farms located in Lodi and Venezia provinces. The trial utilised 128 weaned Large White piglets weighing 8.8 (1.27) kg. Animals were divided into 4 treatments of 32 animals each (4 pens each of females and castrated males each with 4 pigs/pen). Five climate controlled rooms each containing 6 pens except the fifth room containing 8 pens were used. Treatments were blocked by sex and treatment within each room. Nutritional analytes were not different ($P<0.05$) between IC and Bt corn. Animals were fed test diets containing 33% corn for 35 days. Feed intake of pigs did not differ ($P<0.05$) among experimental diets. Feed:gain was not different ($P<0.05$) among treatments during any period on study (0-14 d, 15-35 d and 0-35 d). Overall ADG was 5.6% higher ($P<0.05$) for Bt corn fed pigs (396 g/d) compared with IC pigs (375 g/d). Pigs fed the B.t corn had 2.8% heavier final live weights (22.6 kg) compared to the IC corn fed pigs (22.0 kg) ($P<0.05$). Differences in performance may be attributed to Bt corn having a 69% lower level of fumonisin B_1 than IC corn and 14.4% lower deoxynivalenol (DON). We conclude that performance of piglets fed Bt corn is at least as good as those fed IC corn.

Key Words: Pigs, Transgenic corn, Mycotoxins

442 Effects of feeding blends of grains naturally-contaminated with *Fusarium* mycotoxins on growth and brain regional neurochemistry of starter pigs and the efficacy of supplemental yeast cell wall polymer in detoxification. H.V.L.N. Swamy[1], T.K. Smith[1], E.J. MacDonald[2], and A.E. Sefton[3], [1]*University of Guelph, Guelph, Ontario, Canada,* [2]*University of Kuopio, Kuopio, Finland,* [3]*Alltech Biotechnology Center, Nicholasville, Kentucky, USA.*

Naturally-contaminated grains have been reported to be more toxic than equivalent amounts of purified mycotoxin based on chemical analysis. An experiment was conducted, therefore, to determine the effect of feeding a blend of grains naturally-contaminated with *Fusarium* mycotoxins to starter pigs and to test the efficacy of a polymer extracted from yeast cell wall as a dietary treatment for *Fusarium* mycotoxicoses. A total of 175 starter pigs (initial weight of 10 kg) were fed 5 diets (7 pens of 5 pigs per diet) for 21 days. Diets included a control, a blend of contaminated grains and contaminated grains + 0.05, 0.10 and 0.20% yeast cell wall polymer (MTB-100, Alltech Inc.). Diets containing contaminated grains averaged 3.85 ppm deoxynivalenol, 26.88 ppm fusaric acid and 0.4 ppm zearalenone. Weight gain of all pigs fed contaminated grains was significantly reduced compared to control especially in the first week of feeding. The feeding of contaminated grains significantly reduced concentrations of dopamine in the hypothalamus and concentrations of norepinephrine in the pons. The ratio of 5-hydroxyindoleacetic acid to serotonin was also elevated in pons. The feeding of 0.2% yeast cell wall polymer largely prevented these neurochemical changes. It was concluded that the feeding of grains naturally-contaminated with *Fusarium* mycotoxins can alter brain neurochemistry in starter pigs and that the changes can largely be prevented by the feeding of yeast cell wall polymer at the appropriate concentrations although this may not be reflected in increased growth rate.

Key Words: Pigs, *Fusarium*, Deoxynivalenol

443 Influence of type of cereal and level of fiber on performance of early-weaned piglets. G. G. Mateos*[1], A. Alcantarilla[1], M. A. Latorre[1], R. Lazaro[1], E. Gomez[2], and N. Laso[2], [1]*Universidad Politecnica de Madrid. Spain,* [2]*Centro de Pruebas de Porcino. Junta Castilla y Leon. Spain.*

A trial was conducted to investigate the influence of type of cereal and level of crude fiber used in the diet on performance of early weaned piglets. There were eight treatments and eight replicates per treatment with 5 piglets (blocks 1 and 2) or 12 piglets (blocks 3 and 4) per replicate. The control diet included 8% fish meal, 15% dried whey, and 12% fullfat soy bean, and contained 52% of cooked and expanded corn. Treatments B, C, D, and E substituted 30% of the corn for 30% of cooked decorticated oats, cooked oats, cooked rice, and raw oats, respectively.