associated with GD. The objective of this study was to assess the clostridial challenges present in asymptomatic broilers raised under different feeding regimes: a conventional program, including non-endemic and endemic GD sites, and an antibiotic free (ABF) program. Three birds from seven different flocks from each of the three groups were sampled at approximately five weeks of age to obtain gastrointestinal tract (GIT), liver, and spleen samples from 63 total birds. The samples were plated on selective media and multiplex PCR was performed to verify toxigenicity. Of the total birds sampled in each group, 33.3% from the conventional GD broilers, 19.0% from the conventional non-endemic broilers, and 38.1% from the ABF broilers were positive for toxigenic *C. perfringens* but not for *C. septicum*. All livers and spleens were negative for known toxigenic *Clostridium*. RAPD PCR was performed on the *C. perfringens* isolates and used to construct a dendrogram to determine genetic diversity. Isolates from different birds within a site, as well as isolates from different sites in the same program showed genetic relatedness, however, no clear correlation could be made to identify pathogenic lineages. The most notable finding in this study was that an unidentifiable anaerobic gram positive rod-shaped organism, possibly a unique toxigenic *Clostridium* species was found in 28.6% of endemic GD birds, 23.8% of nonendemic birds, and 14.3% of ABF birds. Future research will focus on obtaining samples of live birds with symptoms of GD from endemic sites to determine if this unknown organism is involved in GD disease.

Key Words: Poultry, *Clostridium*, Broilers

T88 Prevalence of unusual viral RNA, enteropathogens, Cryptosporidia in poultry litter, pig wastes and waterways of Ireland and their impact on environmental health. J. R. Rao*[1,2], D. W. A Nelson[2], L. Xiao[3], M. Matsuda[4], T. Sekizuka[4], C. J. Lowery[6], J. S. G. Dooley[6], B. C. Millar[5], P. J. Rooney[5], and J. E. Moore[5], [1]*Environmental and Public Health Microbiology Unit, Agri-Food & Biosciences Institute*, *Belfast, Northern Ireland, UK*, [2]*The Queen's University of Belfast*, *Belfast, Northern Ireland, UK*, [3]*Division of Parasitic Diseases, Centers for Disease Control and Prevention*, *Atlanta, Georgia*, [4]*Laboratory of Molecular Biology, School of Environmental Health Sciences, Asabi University*, *Fuchinobe, Sagamihara, Japan*, [5]*Northern Ireland Public Health Laboratory, Department of Bacteriology, Belfast City Hospital*, *Belfast, Northern Ireland, UK*, [6]*School of Health and Life Sciences, University of Ulster*, *Coleraine, County Londonderry, Northern Ireland*.

Contaminated straw and water used in the poultry houses were among the most likely sources suggested for the entry of viruses including highly pathogenic H5N1 (AIV) in France or Germany. We found (see review Rao et al 2007 CIMB, 9: 103-122) that mushrooms and substrate composts (raw ingredients straw and poultry litter) carried unusual compendium of dsRNAs associated with mushroom virus (X). In Ireland, a viable option for disposal of raw or composted animal agriculture farm waste is land spreading as a cheap nutrient supplement but many are unaware of the silent dangers of pathogen spreading from this practice. Our results indicated that a number of novel eubacteria together with faecal parasites (e.g. Cryptosporidium spp) and some complex viral RNA components were prevalent in mostly wet straw / compost wastes arising from poultry litter and slurry or slurry solids from pig farms, particularly of those located in the vicinity of the mouth of rivers. Our model study was carried out in Lough Neagh, County Antrim, Northern Ireland as it enters into the province's largest watercourse, a niche for flocks of mute swans (Cygus olor) from north-western continental Europe which are partially migratory or nomadic. The migratory bird populations inhabit surface waters, including rivers, ponds and lakes. Following varying degrees of water treatment, the water is utilized for t animal production, particularly poultry and/or pig farms; the Lough itself is frequently used for recreational purposes, including wind-surfing and water/jet-skiing. We also report our findings on the potential risk of avian carriage of viral elements, bacteria or parasitic faecal pathogens and emerging zoonoses that could be potentially transmitted via poultry dwellings in contact with the water and the impending risk to plant, animal and human health.

Key Words: Unusual Viral RNA, Enteropathogens, Avian Influenza

Dairy Foods: Cheese, Dairy Products and Chemistry

T89 The impact of fat reduction on flavor and flavor chemistry of Mozzarella cheeses. A. J. Krause*, R. E. Miracle, J. P. Evans, and M. A. Drake, *North Carolina State University*, *Raleigh*.

Mozzarella cheese is available on the market in whole milk, part-skim milk, and fat-free varieties. Fat-free Mozzarella lacks the milkfat flavor and richness of its whole and part- skim milk counterparts. It has been theorized that lactones may be responsible for the delicate sweet aromatic flavor in full fat Mozzarella cheeses and their addition to lower fat cheeses could produce more desirable flavors. In this study, the sensory profiles and volatile compounds in all three types of Mozzarella cheese were characterized. Whole milk, part-skim, and fat-free Mozzarella cheeses were obtained from a commercial supplier on multiple occasions. Cheeses were evaluated by a trained descriptive panel and by instrumental volatile analysis. For instrumental analysis, volatiles were extracted by solid phase micro-extraction (SPME) and solvent extraction followed by solvent assisted flavor evaporation (SAFE). SPME samples were injected on a gas chromatograph with mass spectrometry detection (GC-MS). Duplicate samples extracted with diethyl ether and concentrated were evaluated by subsequent GC–olfactometry and GC–MS with aroma extract dilution analysis (AEDA). Compounds were identified by retention index, aroma of reference compounds and mass spectra. The mozzarellas were differentiated by both sensory and instrumental volatile analyses ($p<0.05$). Descriptive panelists differentiated the full fat, part-skim and fat-free cheeses by the attributes cooked, milkfat, and sour taste. Fat free cheeses lacked milkfat flavor and exhibited lower cooked flavor and sour taste when compared to the other cheeses. Volatile flavor compounds that differed significantly ($p<0.05$) among the cheeses included: esters, sulfur compounds, and lactones which corresponded to the main flavor variables from the trained panel. Direct injection of solvent extracts showed higher levels of delta lactones in whole milk cheese versus part-skim or fat-free product. These results suggest that lactones contribute to the characteristic sweet aromatic flavor of whole milk Mozzarella cheese.

Key Words: Mozzarella, Flavor Chemistry, Flavor

T90 Fate of lysostaphin in milk through the cheesemaking process. D. L. Van Hekken*[1], R. J. Wall[2], G. A. Somkuti[1], and P. M. Tomasula[1], [1]*USDA-ARS*, *Wyndmoor, PA*, [2]*USDA-ARS*, *Beltsville, MD*.

Transgenic cows secreting over 3 µg lysostaphin/mL milk are usually resistant to mastitis caused by *Staphylococcus aureus*, but it is unclear if active lysostaphin will persist through dairy processing steps or impact the production of fermented dairy foods. The objective of this study was to determine the fate of lysostaphin as milk is pasteurized and then processed into cheese. Raw milk from transgenic cows was heat treated at 63°C for 30 min, 73°C for 15 sec (HTST), and 135°C for 2 s. Only the HTST milk was processed into a semi-hard cheese. Aliquots were taken at each processing step and assayed to determine the quantity (ELISA) and activity (ability to inhibit S. aureus growth) of lysostaphin. Results indicated that the majority of the lysostaphin was present in the skim milk portion and was not affected by pasteurization. Although the quantity and activity of the lysostaphin decreased during cheesemaking, active lysostaphin was present in the whey and cheese, even after 90 d of 4°C aging. Because lysostaphin is not a natural milk constituent, further research is required to evaluate its potential as a bioprotective agent against staphylococci and its impact on food quality.

Key Words: Cheese, Milk, Transgenic Cows

T91 Effects of High Pressure Processing on the reduction of *Listeria monocytogenes* in the manufacture of soft cheeses. C. P. Rodriguez*[1], E. Patazca[1], and J. E. Schlesser[2], [1]*National Center for Food Safety and Technology-Illinois Institute of Technology*, *Summit-Argo, IL*, [2]*National Center for Food Safety and Technology-FDA*, *Summit-Argo, IL*.

During the ripening or storage of soft cheeses food borne pathogens may survive and grow due to the high moisture content and increase in pH during aging. High pressure processing (HPP) has been proposed as an alternative to heat treatment for the reduction of pathogens in the manufacture of soft cheese. Possible advantages of HPP of cheese would include reduction of pathogens levels without affecting cheese aging. The effectiveness of HPP to reduce *L. monocytogenes* on Camembert cheese was evaluated. Camembert cheese was inoculated with a cocktail of 5 *L. monocytogenes* strains (903, 1364, 1446, Scott A and OSY 8578). Samples were tested at various levels of high pressure, processing time and final temperature. Cheese samples (~35g) were immersed in the *L. monocytogenes* cocktail, drained, and packed in high barrier nylon/EVOH/PE vacuum pouches with a double seal. Samples were triple bagged. Quality assessment was determined by analyzing untreated uninoculated whole cheeses for texture, color and regrowth of mold mycelium. Cheese samples treated at 400 to 500 MPa, 25°C for 2 to 5 min resulted in less than $1\log_{10}$ reduction in levels of *L. monocytogenes*. HPP at 600 MPa, 25°C and 45°C for 2 to 5 min and HPP at 700 MPa, 35°C for 5 min resulted in a 4 to $5\log_{10}$ reduction in levels of *L. monocytogenes*. A 5 or more $\log_{10}$ reduction was observed at 700 MPa HPP levels for 5 min at 25°C and 45°C. Whole camembert cheeses were pressure treated at 600 MPa for 2 min at 25, 35 and 45°C to conduct preliminary quality assessment of Camembert cheese after HPP. The HPP Camembert cheese seemed more dense and firmer in texture. Mold mycelium destruction resulted in loss of white color of the surface of the cheese. No change in flavor was noted. Experiments were conducted on Camembert cheese to determine optimal conditions for the reduction of *L. monocytogenes* after HPP. A $5\log_{10}$ reduction level of Lm was observed on cheese samples pressure treated at 600 to 700 MPa for 2 to 5 min.

Key Words: Listeria Monocytogenes, Soft Cheese, High Pressure Processing

T92 Sensory and instrumental classification among Ragusano P.D.O cheeses of different quality. S. Carpino*[1], I. Caminiti[1], T. Rapisarda[1], and G. Licitra[1,2], [1]*CoRFiLaC, Regione Siciliana*, *Ragusa, Italy*, [2]*D.A.C.P.A. Catania University*, *Catania, Italy*.

Sensory and instrumental profiles of ripened Ragusano cheeses (three to seven months), representing 100 batches produced during the 2006 season, from different farms throughout the P.D.O. production area in Sicily were measured. The current study was undertaken to determine if sensory and instrumental analysis discriminate different qualities, gold quality ($Q \geq 90$) and good quality ($Q < 90$) of the tested cheeses. The cheeses were tested using a MS-based Electronic Nose (EN) and a trained sensory panel. EN data were collected from a head space extraction of volatile organic components from each cheese. An EN was used to detect volatiles in the mass-to-charge (m/z) range of 10 to 160 amu. Statistical analyses on normalized data sets found a group of mid-range masses that efficiently separated cheeses by PCA. Twelve trained panelists tested all the products and QDA was used to describe the cheeses. A quality score (Q) was developed by comparing mean ratings on 14 descriptive attributes with means and standard deviations of 'gold' standard cheeses on the same attributes. Gold quality cheeses ($Q \geq 90$) had significantly lower salt content than good quality ones ($Q < 90$). Gold quality cheeses also had smaller surface holes, weaker in bitterness and bad taste and were more yellow and softer than their good-quality counterparts. Principal components analysis on the EN data separated all cheeses by quality score with an high gold cheeses axis on PC1 (57%) and a separation between good quality cheeses on PC2 (26%). Principal components analysis on the sensory data separated cheeses by quality score with a gold quality cheeses axis on PC1 (23%) and a separation between good quality cheeses on PC2 (16%) confirming the EN results for bitterness, taste, and aroma. Both EN and traditional sensory analysis found similar differences among cheeses. While EN technology is simpler and faster to use, especially if there are a lot of samples, the human perception is probably still superior in detecting subtle differences.

Key Words: Ragusano, Electronic Nose, Sensory analysis

T93 Changes in acidification during cheesemaking in relation to the aroma development of a farmstead cheddar cheese: A preliminary study. M. Almena*[1], P. Kindstedt[1], S. Carpino[2], T. Rapisarda[2], and G. Licitra[2,3], [1]*University of Vermont*, *Burlington*, [2]*CoRFiLaC, Regione Siciliana*, *Ragusa, Italy*, [3]*D.A.C.P.A. Catania University*, *Catania, Italy*.

Among the reasons why farmstead cheeses are greatly appreciated by consumers are: their complex sensory quality, the close link to the environment where the cheese itself is produced, and the cheesemaker ability. Farmstead cheesemakers have to cope with greater changes in milk composition than commodity producers, and often their practices

are only based on experience rather than control processing techniques. However, the importance of controlling pH during cheesemaking is well known, as well as the major effect of pH on textural quality. This study explores how changes in the acidification pattern during cheesemaking affect the aroma development of a farmstead cheddar cheese. Five cheese fabrications were manufactured following 2 different acidification patterns. Two fabrications were made following an acidification pattern with pH values of 6.25 at draining and 5.25 at milling, and three with pH values of 6.40 at draining and 5.30 at milling. After pressing, all cheeses were analyzed for pH, salt and moisture; and after 1-year of ripening, aroma compounds were evaluated using both gas chromatography olfactometry analysis (GCO) and gas chromatography mass spectrometry. Young cheeses had similar physicochemical characteristics, with average values of 5.10 for pH; 35% moisture and 1.65% salt contents. Interestingly, the volatile compounds extracted from all the ripened cheeses were fairly similar, with the significant exception of acetic acid. Acetic acid (sour aroma) was only found on the 3 cheeses using the acidification model with higher pH values, indicating that post-acidification during manufacture occurred. Some of the common volatile compounds in all the samples and the sensory descriptors associated with were: dimethyl sulfide (sulfur/cabbage) – diacetyl (buttery) – thiophene (garlic) – ethyl butyrate (apple) – butanoic acid (cheese/butyric) – methional (potato) and 1-octen-3-one (mushrooms).

Key Words: Acidification Profile, Aroma, Farmstead Cheddar

T94 Texture profile analysis and melting in relation to proteolysis as influenced by aging temperature and cultures in Cheddar cheese. T. C. Rasmussen*[1], D. J. McMahon[1], J. R. Broadbent[1], and C. J. Oberg[2], [1]*Western Dairy Center*, *Logan, UT*, [2]*Weber State University*, *Ogden, UT*.

Changes in cheese physical properties during aging are related to proteolysis by coagulant type, culture enzymes and non-starter lactic acid bacteria. Storage temperature also affects aging rate. Cultures are important for flavor development, but less is understood about their role in melting and textural properties. Our objective was to make Cheddar cheese using different cultures, to age it at 5 and 15 C, and measure physical and proteolytic properties over 12 mo. Cheese was manufactured using Lactococcus lactis starter culture either alone or combined with one or both of lac- Lc. Lactis or Lactobacillus helveticus adjunct cultures. Three replicates of cheese were made using 682 kg milk. Cheese composition was 35.5 ± 1.0% moisture, 52.5 ± 2.5% FDB, 1.65 ± 0.05% salt, and pH 5.2 ± 0.1. All cheeses were initially stored at 5 C, then half moved to 15 C after 21 d. Texture profile analysis was performed using 25% and 60% compression and melting measured using a Meltmeter at 60 C. The data were analyzed based on culture and temperature over 12 mo storage time. The overall hardness decreased, while the cohesiveness decreased for all treatments. Extent of melting was correlated with hardness ($R = 0.62$, $P < 0.0001$), cohesiveness ($R = 0.40$, $P < 0.0001$), and inversely with adhesiveness ($R = 0.24$, $P < 0.0001$). Correlations with adhesiveness and cohesiveness were not linear. Proteins were extracted from cheese at 1 wk, 1, 2, 4, 6, 9 and 12 mo of aging using 0.5 M sodium citrate solution containing 1% NaCl. Purified extracts were then applied to an HPLC C8 reverse phase column and large hydrophobic peptides and protein peaks monitored at 214 nm. Melting was inversely correlated with the amount of intact α_{s1}-casein remaining in the cheese ($R = -0.54$, $P < 0.0001$) and directly correlated with a peak assigned to α_{s1}-casein (f 24 – 199) peptide ($R = 0.56$, $P < 0.0001$).

Key Words: Cheese Ripening, Melting, Proteolysis

T95 Strategies for the manufacture of low fat Cheddar cheese. S. P. Adams*[1], D. J. McMahon[1], J. R. Broadbent[1], S. L. Larsen[1], and M. Drake[2], [1]*Western Dairy Center*, *Logan, UT*, [2]*SouthEast Dairy Foods Research Center*, *Raleigh, NC*.

Common problems with low fat cheeses include lack flavor and hard and rubbery texture. This has limited market growth for low fat cheeses. Our objective was to make interventions that would improve low fat Cheddar cheese quality, by increasing moisture content and altering physicochemical properties. These interventions included, changes to the make-procedure in cooking temperature, increasing pasteurization temperature from 72 C to 85 C to denature whey proteins, homogenizing half the milk at 5.5 MPa to incorporate fat globules into the protein matrix, and pre-acidifying milk to pH 6.3 to reduce calcium content. These modifications were initially studied individually using milled and washed curd techniques. Cheese was made from 160 kg milk standardized to 0.5% fat and a 9-kg block of cheese produced. Cheeses with 52 to 54% moisture and pH 5.15 to 5.25 were preferred, and the inclusion of a cold water curd wash step helped achieve this goal. Higher pasteurization temperature and pre-acidification had beneficial effects but homogenization did not improve cheese appearance or texture. A 2x2 factorial experiment was then undertaken to compare pasteurization temperature and preacidification. Cheeses were stored at 6 C for 1 mo and analyzed by texture profile analysis. Descriptive sensory analysis of flavor was performed after 2 mo using a trained panel. Higher pasteurization temperature significantly increased moisture by 4% and subsequently decreased instrumental hardness ($p = 0.024$) and cohesiveness ($p = 0.001$). Preacidication increased instrumental cohesiveness ($p = 0.002$). No change in meltability was observed between the cheeses. Compared to full fat cheese made with the same cultures, the low fat cheeses had more intense cooked flavor, whey flavor, diacetyl flavor and sulfur flavors. They had less milkfat (lactone) flavor. The cheeses made from milk heated to 85 C had a slight rosy flavor.

Key Words: Low Fat Cheese, Preacidification, Flavor

T96 Prato and Roquefort cheeses from dairy ewes fed with protected fat. R. M. S. Emediato*, E. R. Siqueira, M. M. Stradiotto, M. I. F. B. Gomes, S. A. Maestá, A. Piccinin, E. O. Queiroz, and C. Móri, *São Paulo State University*, *Botucatu, São Paulo, Brazil*.

This trial aimed to evaluate the effect of the milk from Bergamasca ewes fed with inclusion of 3.5% of protected fat in the concentrate on cheese yield, cheese composition, its caloric value and acceptation index of Prato (typical Brazilian cheese) and Roquefort (typical French cheese) cheeses. Seventy seven ewes allocated in 2 groups according to parturition and age: Control (C) and protected fat (PF). Diets were isoenergetic and isonitrogenous, containing 16% CP and 70% TDN on a dry-matter basis. For both treatments it was used the mixed milk production system (lambs housing at night and with its mothers after milking at morning) with one daily milking. Lambs were weaned with

45 days of age. Milked milk was identified and frozen at -15°C for a period of 3-6 months and then used for cheese manufacture. For Prato cheese, each replication has represented milk from each fortnight of the experimental period (60 days) and for Roquefort cheese, each replication has represented milk from the whole experimental period. After cheeses ripening, it was calculated cheese yield and samples were collected for cheese composition and caloric value. Acceptation index was performed with at least 50 people for each cheese. Statistical analysis was performed by means of SAEG 9.0 software. For Prato cheese, treatment C have presented higher protein content and caloric value (26.64 vs 24.60% and 364.52 vs 359.52 Kcal/100g, respectively) and lower fat content (17.82 vs 19.46%) than PF. For Roquefort cheese, treatment PF have presented higher humidity and fat content (49.58 vs 46.83 and 13.40 vs 11.80, respectively) which resulted in higher cheese yield (6.51 vs 7.34 liters of milk/kg of cheese) than C. Both cheeses from both treatments have presented acceptation index higher than 70%, which represented a good acceptation. The fat content in the Roquefort cheese was lower than the usual, which can be explained by lower milk fat content during suckling period than the weaned period (2.25 vs 7.75%, respectively). Mixed Protected fat increases cheese composition and yield without modify its acceptation, which is interesting for cheeses producers and industry.

Key Words: Acceptation Index, Prato, Roquefort

T97 Optical measurement of kinetic changes in curd moisture content and whey fat concentration during syneresis in cheese manufacturing. M. Castillo*[1], C. C. Fagan[2,1], F. A. Payne[1], C. P. O'Donnell[2], and D. J. O'Callaghan[3], [1]*University of Kentucky*, *Lexington*, [2]*University College Dublin*, *Ireland*, [3]*Moorepark, Teagasc*, *Cook, Ireland*.

Syneresis is crucial in cheese making and exerts a tremendous impact on the final quality attributes of cheese. Currently, no technologies are available to control curd moisture content on-line and, as a result, syneresis is empirically controlled. The regulation of curd moisture actually requires control of milk coagulation, cutting time and syneresis. A novel light scatter sensor technology, which is able to monitor milk coagulation and curd syneresis using just one sensor, was used to study the kinetics of changes in curd moisture and whey fat contents induced by curd shrinkage in a stirred, pilot-scale cheese vat. A three-factor, randomized, central composite design (20 runs and three replicates) were used to evaluate the effect of temperature, $CaCl_2$ and cutting time on the kinetics of syneresis. We hypothesized that the varying response of the sensor during syneresis may be a result of curd shrinkage or compositional changes in whey fat content. It has been widely documented that curd shrinkage, whey separation, and fat globules dilution follow a first order kinetic reaction. Thus, the changes in curd moisture and whey fat contents and in the sensor response (R) during syneresis were fitted to first order kinetic equations. The R^2 values between the experimental and fitted data for curd moisture content, whey fat concentration, and R ranged between 0.95-0.97, 0.98-1.00, and 0.87-0.96, respectively. The magnitude of the kinetic rate constants obtained agreed with the existing literature and the rate constants responded consistently to temperature. These results suggest that changes in the variables studied during syneresis followed first order kinetics. Indeed, the optically derived kinetic rate constants were significantly and positively correlated with the kinetic rate constants for changes in curd moisture and whey fat contents. These results clearly show not only the potential of the proposed technology for a comprehensive control of curd moisture content in cheese making but also reveals its potential as a powerful research tool to study coagulation and syneresis.

Key Words: Syneresis, Kinetics, Light Backscatter

T98 Effect of high fat supplements for grazing dairy cows on textural properties of Cheddar cheese. R. Nyoka*, A. R. Hippen, A. N. Hassan, and K. F. Kalscheur, *South Dakota State University*, *Brookings*.

Previous studies showed that grazing on pasture and feeding diets supplemented with fish meal increased the level of conjugated linoleic acid (CLA) and its related isomers in cow's milk. The objective of this study was to determine the effects of such diets on the textural characteristics of Cheddar cheese. The diets of 27 multiparous Holstein (18) and Brown Swiss (9) cows grazing alfalfa/grass pasture were supplemented with partial Total Mixed Rations (pTMR) containing 1) dried distillers grains with solubles (DDG), 2) soybean meal (SB), or 3) fishmeal (FM). Milk was collected from morning milking and stored at 4°C for cheese making the following day. Cheddar cheese was manufactured from pasteurized milk (heated at 63°C for 30 min, and then cooled to 31°C) standardized to casein: fat ratio of 0.78. Moisture, fat, free oil and pH were tested in the fresh Cheddar cheese. No significant differences in moisture, pH and fat on dry matter basis were observed among treatments. Free oil was higher ($P<0.05$) in the DDG (17.78%) and FM (17.59%) cheeses than in the control Soybean cheese (15.78%). Cheese texture, free oil, and pH were monitored during ripening. Texture attributes (hardness, springiness, cohesiveness, gumminess and chewiness) decreased ($P<0.05$) during the first mo of ripening. Whereas, hardness, gumminess and cohesiveness continued to decrease between mo 1 and 3, an increase in chewiness and springiness was observed in all cheeses during this period. There were no significant differences among treatments in all cheese texture attributes. In conclusion, this study shows that diets that increase the level of CLA in milk did not affect cheese texture.

Key Words: High Fat Diets, Cheddar Cheese, Texture

T99 Evaluation of chemical composition of traditional Chinese goat's milk cake. H. Zhang*[2], S. Gokavi[1], C. Maduko[3], Y. Park[3], and M. R. Guo[1], [1]*University of Vermont*, *Burlington*, [2]*Inner Mongolia University*, *Huhott, China*, [3]*Fort Valley State University*, *Fort Valley, GA*.

Goat's milk cake is a fresh cheese-like product, which has been traditionally produced and consumed for centuries in the Southwestern province Yunnan of China. It is made by acidifying the milk using natural acidulant extracted from the leaves and vines of *Marsdenia tenacissima*. Thirteen milk cake samples collected from different households were analyzed for gross composition, mineral content protein and fatty acid profiles. The pH value ranged from 4.08+0.02 to 6.51+0.01, total solids 42.41+0.14 to 52.53+0.10%, fat 19.75+0.32 to 28.40+0.31%, protein 17.93+0.07 to 21.56+0.77%, ash 1.66+0.00 to 2.07+0.04% and lactose 0.91+0.36 to 1.52+0.33%. The average contents of calcium, phosphorous, potassium, magnesium, sodium, zinc and sulphur are 0.58, 0.50, 0.12, 0.03, 0.03, 0.002 and 0.16 g

/100 g, respectively. The major proteins identified by sodium dodecyl sulphate polyacrylamide gel electrophoresis were caseins (35.35+5.44 – 60.37+5.61%), β-lactoglobulin (7.41+1.18 – 10.50+2.13%) and α-lactalbumin (3.65+1.48 – 6.87+1.00%) and their amounts were comparable to those of cow's milk (casein 57.00+6.36%, β -lactoglobulin 10.80+0.42% and α-lactalbumin 6.41+0.44%). Gas chromatography analysis showed that the major fatty acids present in goat's milk cake were butyric acid (C4:0), caproic (C6:0), capric (C10:0), lauric (C12:0) and myristic acid (C14:0). The only unsaturated fatty acid present in significant amount was oleic acid (C18:1) (5.47+0.24 – 12.97+3.32%). Variations in chemical composition of these goat's milk products might due to lack of manufacturing standard, which may require further studies.

Key Words: Goat Milk Cake, Chemical Composition, Protein and Fatty Acid Profiles

T100 Development of cholesterol-reduced Camembert cheese made by crossliked β-CD cyclodextrin. K. H. Seon, E. K. Hong, and H. S. Kwak*, *Sejong University*, *Seoul, Korea*.

The present study was carried out to examine the physicochemical and sensory properties in cholesterol-reduced Camembert cheese made by crosslinked β-cyclodextrin (β-CD). The composition of Camembert cheese treated by crosslinked β-CD was similar to the control and the cholesterol removal reached 90.6%. No significant difference was found in total amount of short-chain free fatty acids between experimental cheese and control at every storage period. The release of butyric and capric acid mostly contributed to the increase of total amount of short-chain free fatty acids in both groups. The cheese made by β-CD-treated cream produced similar amount of individual free amino acids to control in 4 wk ripening period. All rheological properties increased continuously during 4 wk ripening and those were higher in cholesterol-reduced Camembert cheese than those in control. Moldy characteristic in appearance, flavor and taste were increased dramatically through ripening period in both experimental and control cheeses. Based on these results, no profound difference was found in most physicochemical and sensory properties between cholesterol-reduced Camembert cheese and control. Therefore, this study may suggest the possibility to develop the cholesterol-reduced Camembert cheese using crosslinked β-CD.

Key Words: Camembert Cheese, Crosslinked β-CD, Cholesterol Removal

T101 The effect of salt on chemical and sensory attributes in cholesterol-reduced Cheddar cheese made by crosslinked β-cyclodextrin. K. H. Seon, E. K. Hong, and H. S. Kwak*, *Sejong University*, *Seoul, Korea*.

This study was designed to examine the effect of salt on the quality of cholesterol-reduced Cheddar cheese, which was resulted in changes in fatty acids, bitter amino acids and sensory evaluation. The sample cheeses were made by cream separation followed by 10% of crosslinked β-cyclodextrin(β-CD) treatment, and various concentrations of salt added were 1.0, 1.5, 2.0, 2.5 and 3.0%. The samples were tested periodically during 9 week ripening time. In previous study in our lab the ripening time was accelerated extensively in β-CD treated Cheddar cheese making. The cholesterol removal from the cheese was 91.7%. The production of short-chain free fatty acids(SCFFA) increased during ripening. When the contents of salt were added more into the cheese, the amounts of SCFFA significantly decreased during ripening. Higher salt-added cheese produced lower levels of bitter amino acid during ripening. In sensory analysis, the score of bitterness also showed lower levels from higher salt-treated sample. Hardness scores in texture increased during ripening in all samples, however, the levels were lower at higher contents of salt. On the basis of the results, this study suggested that higher levels of salt-treated Cheddar cheese made from crosslinked β-CD improved bitterness and sensory aspects.

Key Words: Cheddar Cheese, Salt, Crosslinked β-Cyclodextrin

T102 The effect of high pressure and low temperature on chemical properties and nutrients in milk. H. Y. Kim, S. A. Maeng, S. H. Kim, and H. S. Kwak*, *Sejong University*, *Seoul, Korea*.

This study was carried out to investigate the effect of pasteurization treated by high pressure and low temperature on chemical properties and nutrients in milk. The factors used were pressure(200MPa), temperature (-4, 4, 12 and 20°C) and time (10, 20 and 30 min). Thiobarbituric acid value(TBA) showed higher at longer time(30 min) and higher temperature(20°C). In the production of short-chain free fatty acid, samples were not different from treated time and low temperatures, however, significantly($P<0.05$) different from high temperatures(12 and 20°C). The productions of free amino acids in the samples were higher than that of control, and they were increased in proportion to treated time and temperature. In the analysis of water-soluble vitamin, L-ascorbic acid, niacin and riboflavin decreased significantly in proportion to treated time and temperature, however, pyridoxine and thiamine did not decrease significantly($P<0.05$). Based on the results of this study, short time and low temperature are effective on properties and nutrient in pasteurized milk treated by high pressure and low temperature.

Key Words: High Pressure, Milk, Vitamin

T103 Microencapsulation of Korean mistletoe extract with polyacylglycerol monostearate. N. C. Kim[1], J. B. Kim[2], J. Ahn[1], and H. S. Kwak*[1], [1]*Sejong University*, *Seoul, Korea*, [2]*Handong Global University*, *Pohang, Korea*.

The present study was carried out to find the optimum conditions for Korean mistletoe extract microencapsulation and its stability in simulated fluids in vitro. As a coating material, polyacylglycerol monostearate (PGMS) was used. Three different conditions were investigated such as the ratio of coating to core materials, amount of distilled water addition and spray pressure. The highest efficiency of microencapsulation was found in the ratio of 15:1 (w/w) as coating to core material. In addition, 40 mL of distilled water addition at 2000 psi spray pressure increased the microencapsulation efficiency up to 78.3%. The shape of microcapsule was spherical and irregular, and the average size was about 30.0Î¼m. In vitro study, only 14.8% of Korean mistletoe extract was released in stimulated-gastric fluid (pH 2) for 60

min incubation. Comparatively, the release of Korean mistletoe extract increased dramatically from 15.8% (0 min) to 83.2% (pH 8) for 60 min incubation in simulated intestinal fluid. Therefore, this study indicated that PGMS cane be used as an effective coating material to microencapsulate Korean mistletoe extract

Key Words: Microencapsulation, Polyacylglycerol Monostearate, Korean Mistletoe Extract

T104 Microencapsulated Korean mistletoe extract for milk fortification. N. C. Kim[1], J. B. Kim[2], J. Ahn[1], and H. S. Kwak*[1], [1]*Sejong University*, *Seoul, Korea*, [2]*Handong Global University*, *Pohang, Korea*.

This study was designed to develop a microencapsulated Korean mistletoe extract that could be used to fortify milk and to determine the sensory properties of milk fortified with microencapsulated Korean mistletoe. Coating material was polyacylglycerol monostearate. The highest efficiency of microencapsulation was 78.3% with 15:1:40 ratio (w/w/v) as coating to core materials to distilled water at 2,000 psi. When microencapsules were added and stored at 5°C for 12 days, 8.3 mg of Korean mistletoe extract was released in 100 mL milk. The TBA value was increased during storage and was significantly lower in capsulated group compared with that in uncapsulated group. In addition, the color values (L, a and b) viscosity were significantly different between capsulated and uncapsulated Korean mistletoe extract added groups when 1 or 2% Korean mistletoe extract added. With 1% microencapsulation addition, most sensory aspects were slightly different between capsulated and control, however, a significant difference was found between capsulated and uncapsulated groups in all storage periods. The present study indicated that the addition of microencapsulated Korean mistletoe extract with PGMS is effective for fortifying milk.

Key Words: Korean Mistletoe, Milk, Microencapsulation

T105 Occurrence of aflatoxin M1 in Manchego cheese. G. Battacone*[1], M. I. Berruga[2], M. Palomba[1], M. P. Molina[3], M. Roman[4], and A. Molina[2], [1]*Università degli Studi di Sassari*, *Sassari, Italy*, [2]*Universidad de Castilla-La Mancha*, *Albacete, Spain*, [3]*Universidad Politécnica de Valencia*, *Valencia, Spain*, [4]*Qualiam*, *Madrid, Spain*.

Manchego is a cured, hard, enzymatically coagulated cheese, made in the four provinces of the Castilla-La Mancha Region (South East Spain) with milk of the Manchega breed ewes. It is the most popular Spanish sheep cheese, produced according to the EU regulation for Guarantee of Origin (POD, 1984), with a total yield of about 8000 Tn per year (44 % of POD Spanish cheeses in 2006). Currently eighty cheese factories are registered in the Council of POD Manchego. A different processing technology is adopted whether the milk has been previously pasteurized or not. In order to guarantee high standard of safety for this internationally recognized product, according to the international regulations about consumer health risks, it is important to investigate the possible occurrence of Aflatoxin M1 contamination. The aim of this work was to determine the level of Aflatoxin M1 contamination in Manchego cheese in a representative sample of cheese factories of the region of Castilla-La Mancha. Two months aged samples of cheese (ready to be sold at the market) from fifty five cheese factories were randomly collected in spring 2006. Chemical composition (fat, protein, salt and moisture) was determined by a FoodScan™ Lab Dairy Analyser (Foss). The immunoaffinity technique was used to extract the Aflatoxin M1 from the cheese samples, and its concentration was determined by HPLC method. The results showed a mean composition of Fat/DM = 51.06±2.2 %; Protein/DM = 39.89±2.6 %. No statistical differences were found among provinces or method of elaboration. All analyzed cheese samples showed Aflatoxin M1 concentrations lower than the detection limit (2.2 ng/kg), suggesting a high safety standard of this dairy product.

Key Words: Aflatoxin M1, Ewe's milk, Cheese

T106 Prediction of fatty acid contents by mid-infrared spectrometry. P. Dardenne[1], F. Dehareng[1], H. Soyeurt*[2,3], and N. Gengler[2,4], [1]*Agricultural Walloon Research Centre, Quality Department*, *Gembloux, Belgium*, [2]*Gembloux Agricultural University, Animal Science Unit*, *Gembloux, Belgium*, [3]*FRIA*, *Brussels, Belgium*, [4]*FNRS*, *Brussels, Belgium*.

The interest for the dairy products with higher nutritional quality increases. The aim of this research was to elaborate different calibration equations to predict by Mid-Infrared Spectrometry the fatty acid contents in bovine milk. 1,609 milk samples were collected between March 2005 and May 2006 for 475 cows from 6 dairy breeds (Dual Purpose Belgian Blue, Holstein, Jersey, Montbeliarde, Normande and Red and White) in 8 herds. 78 samples were chosen using Principal Components approach based on spectral variability. All samples were scanned by MilkoScan FT6000. The reference fatty acid concentrations were measured by gas chromatography with a capillary column of 100 m length. The calibration with Partial Least Squares (PLS) on 78 samples showed a ratio of standard error of cross-validation to standard deviation (RPD) ranged between 1.5 and 6.76. The FA present in high concentration in milk were better predicted as in previous studies. In conclusion, the development of this fast method to predict the FA contents and directly integrating in the milk recording structure gives new perspectives for the dairy industry to detect easily and finally improve nutritional quality of their dairy products.

Key Words: Fatty Acid, Mid-Infrared, Milk

T107 Isolation and characterization of growth factor in goat milk. F. Y. Wu*, M. W. Chien, P. H. Tsao, Y. J. Tsai, Y. C. Lee, and T. Y. Kuo, *National Ilan University*, *I-Lan, Taiwan, ROC*.

Human milk contains various growth factors important for neonatal gastrointestinal tract development. The major growth factor activity in human milk has been identified as epidermal growth factor (EGF). Goat milk also contains growth factor activity. However, the type of growth factor has not been characterized. Further gained knowledge of the growth factor will be useful for developing goat milk-based nutraceutical products. Milk from pregnant does was centrifuged at 3,000 × g for 20 min at 2°C to remove fat and pellet. Casein was precipitated at pH 4.2. The activity, measured by ^{3}H-thymide incorporation in MME cell line, remained in the whey. Growth factor activity was harvested by ammonium sulfate precipitation at 70%

saturation. After dialysis, the sample was ultrafiltrated and separated into different molecular weight fractions with 50, 30 and 3 kDa cutoff membranes. More than 90% activity was present in the >50 kDa fraction, in contrast to the 6 kDa molecular weight of EGF. Subsequently, activity was found within the eluent of 15 to 19ml when gel filtration chromatography was performed by Superdex 200 HR 10/30. Isoelectric focusing using Rotofor cell showed that the activity was in around pH 6.3 fraction, which also differs from the pI 4.6 of EGF. ECL-western blots using different antibodies against various growth factors were performed on all fractions. Since serum albumin, with 67 kDa molecular weight, is also present in the milk extract, blotting results should be carefully interpreted to avoid false positives because some antibodies were generated against antigens conjugated to BSA. Our results showed that the major growth factor in goat milk is different from that of human milk.

Key Words: Growth Factor, Goat Milk, Isolation

T108 Production of conjugated linoleic acid by a mixed commercial culture of L acidophilus, L bulgaricus and S. thermophillus in whole milk. P. Ramírez-Baca*[1,2], E. Escárcega-Padilla[1], S. Torres-Ceniceros[1], J. Meza-Velásquez[1], S. Esparza-González[1], J. Vázquez-Arroyo[1], R. Rodríguez-Martínez[2], and G. V. Nevárez-Moorillon[3], [1]*Universidad Juárez Edo. de Durango*, *Gómez Palacio, Durango, México*, [2]*Universidad Autónoma Agraria Antonio Narro, Unidad Laguna*, *Torreón, Coahuila, México*, [3]*Universidad Autónoma de Chihuahua*, *Chihuahua, Cihuahua, México*.

CLA is a mixture of positional and geometrical linoleic acid isomers with nutritional and health beneficial properties such as being an antiatheroesclerotic, anticarcinogen and antidiabetic agent and an immune system modulator naturally found in food products with fats from animal origin. Since fermented milks have an important role because of its nutritional properties and benefits to digestive tract, the objective of this study was to evaluate CLA production of L acidophilus associated or not with commercial mixed cultures, during milk fermentation. Whole milk was inoculated with L acidophilus alone or L acidophilus associated with S thermophilus and L bulgaricus and incubated at 35°C at four different incubation times. CLA production was measured and data were analyzed by the proc GLM of SAS, considering time and interaction of microorganisms as factors for analysis. Although there was no significative difference (P>0.05) in CLA production, neither by microorganism or time, there is a necessity to continue elucidating the biological mechanisms involved in CLA synthesis with different microorganisms and higher fermentation times.

Key Words: Conjugated Linoleic Acid, L. Acidophilus, Fermented Milk

T109 Poly(L-lactic acid) production from whey permeate. Y. Gao*, F. Zhao, A. Richardson, J. Mendes, D. Savin, and M. Guo, *University of Vermont*, *Burlington*.

The extensive use of commodity plastic products results in serious environmental pollution. Poly(lactic acid) is a biodegradable and biocompatible polymer of lactic acid. In the present study, whey permeate was used as the substrate for poly(lactic acid) production. A mixed culture system including *L. casei* and *L. lactis* was selected based on the ratio of L- to D-lactic acid produced, yield, and productivity from nine homofermentative lactic acid bacterial cultures. After optimization of fermentation conditions, the content of lactic acid is 192 g/L of original broth, the productivity, lactose utilization and purification of L-lactic acid is 4.46 g/Lh, 96.01% and 95%, respectively. The lactic acid recovery process consists of removal of cells and proteins by centrifugation and low molecular weight membrane (<10000 NMWC) separation of the fermentation broth. Decolorization of the product is achieved using 1% activated charcoal stirring overnight. L-lactic acid purification is achieved by extraction of the broth at pH 7 using diethyl ether to remove organic components followed by extraction at pH 2 with the same solvent followed by vacuum evaporation to recover lactic acid. The poly(L-lactic acid) was prepared by using the purified lactic acid with a condensation polymerization process initiated by sulfuric acid. The characterization of poly(L-lactic acid) will be discussed.

Key Words: Poly(lactic acid), Fermentation, Cheese Whey Permeate

T110 Digestion of CLA-enriched milk fatty acids studied in a dynamic *in vitro* gastrointestinal model. R. Gervais*[1], I. Fliss[1], E. E. Kheadr[1], E. R. Farnworth[2], M. R. Van Calsteren[2], C. Champagne[2], and P. Y. Chouinard[1], [1]*Nutraceuticals and Functional Foods Institute (INAF), Université Laval*, *Québec, QC, Canada*, [2]*Agriculture and Agri-food Canada*, *St-Hyacinthe, QC, Canada*.

The objective of the present study was to evaluate the digestibility of fatty acids (FA) from CLA-enriched milk using a dynamic, multicompartmental *in vitro* model (TIM-1; TNO, Zeist, The Netherlands) simulating the human stomach and small bowel. More precisely, the model consisted of 4 compartments simulating the stomach, duodenum, jejunum and ileum. Temperature was maintained at 37° and the pH was monitored and controlled in each compartment. In order to produce CLA-enriched milk, 28 Holstein dairy cows were fed a total mixed ration supplemented with 4% safflower oil. Milk was sampled from each cow and analyzed for milk FA composition. CLA-enriched milk was collected from the cow with the highest CLA content (47 mg/g of fatty acids). Milk was standardized at 3.25% fat, pasteurized, distributed in 300-ml aliquots, and then stored at 4°C until used. Briefly, 300 ml milk was subjected to *in vitro* digestion study using TIM-1 model. Gastric (0.25ml/min), biliary (0.25ml/min) and pancreatic (0.25ml/min) secretions were delivered to the appropriate sections in TIM-1 model through computer-controlled pumps. Ileal delivery of chyme was collected during 360 min of digestion and subjected to FA analysis. Lipid extraction was performed using the Bligh and Dyer method and FA were methylated and analyzed using GLC. Results revealed that the digestibility of total milk FA was 70.2% (SD±3.0). CLA appeared to be highly digestible compared with other long-chain FA of CLA-enriched milk. The TIM-1 model could provide important data regarding the digestibility of FA according to their chain length, degree of saturation, lipid form, or their triglyceride positional distribution.

Table 1. Digestibility coefficients of individual FA of CLA-enriched milk in TIM-1 model (n=2).

FA	%	FA	%	FA	%
10:0	94.2±3.0	18:0	65.4±9.5	*c*11 18:1	65.9±1.5
12:0	83.2±3.1	*t*6-8 18:1	61.8±1.9	*c*12 18:1	65.9±1.2
14:0	72.4±1.7	*t*9 18:1	64.0±2.4	*c*13 18:1	71.7±0.6
*c*9 14:1	79.1±1.9	*t*10 18:1	63.6±4.6	*t*16 18:1	65.5±3.7
15:0	71.2±2.6	*t*11 18:1	64.8±3.6	*c*9,12 18:2	63.1±0.9
16:0	69.7±5.0	*t*12 18:1	63.5±2.0	20:0	66.2±10.9
*c*9 16:1	67.3±0.6	*c*9 18:1	65.5±1.7	*c*9,12,15 18:3	68.7±0.2
17:0	68.8±6.8	*t*15 18:1	73.3±4.4	*c*9*t*11 18:2	80.3±1.0

Key Words: CLA, Fatty Acid Digestibility, TIM-1

T111 Sensory profiles and volatile components of milk protein concentrates and isolates. R. E. Miracle*, J. Childs, and M. A. Drake, *North Carolina State University*, *Raleigh*.

Milk protein concentrates and isolates (MPC, MPI) have been recently utilized in food processing as protein fortifiers. MPC and MPI, unlike whey protein concentrates and isolates (WPC, WPI) contain both casein and whey proteins. MPC have a wide protein content range, 35 to 85 % (w/w), with no standard identity. Characterizing flavor variability of this emerging dried ingredient across the world market is crucial. Identification of distinguishing sensory properties and key volatile flavor compounds is the important first step in learning how the inclusion of milk proteins may affect product flavor. The objective of the current study was to characterize the flavor properties of domestic and international MPC and MPI using sensory and instrumental analyses. Milk proteins (MPC and MPI) were received from commercial facilities in North America and Europe. Products were stored in the dark at 21C, 40% RH and sampled for sensory and instrumental analysis. Milk proteins were rehydrated at 10% solids (w/w) for all analyses. A trained descriptive sensory analysis panel conducted flavor profiling of the rehydrated milk proteins. Instrumental volatiles were extracted by solid phase micro-extraction (SPME) followed by gas chromatography-mass spectrometry. Compounds were identified by comparison of retention indices and GC-MS data against reference standards. Selected compounds were quantified by the construction of standard curves in water. The milk proteins were differentiated by both sensory and instrumental volatile analyses ($p<0.05$). Higher protein products (70-90 % protein) were characterized by tortilla, animal and mushroom flavors while lower protein products (9.6 – 56 % protein) were characterized by sweet aromatic, cereal, and cooked/milky flavors. Principal component analysis of volatile compounds likewise grouped the milk proteins by protein content. As protein content increased, volatile sulfur compounds and aldehyde levels decreased. Flavor properties of MPC and MPI are impacted by protein content and these results will be useful in optimization of processing methods and formulation design.

Key Words: Milk Proteins, Flavor, Milk Protein Concentrates

T112 Characterization of cucumber off-flavor in whey protein concentrate and isolate. J. M. Wright*, R. E. Miracle, and M. A. Drake, *North Carolina State University*, *Raleigh*.

Whey proteins are value-added proteins with multiple ingredient applications. A bland flavor is expected in both whey protein isolate (WPI) and concentrate (WPC). Off-flavors can carry through into ingredient applications and limit the use of these proteins in food products. A cucumber off-flavor was documented in WPI and WPC80. The objectives of this study were to characterize the volatile compounds responsible for this flavor and to document the impact of storage time on the development of this flavor. Additionally, proteins that initially exhibited the off-flavor were agglomerated with lecithin, so both agglomerated and non-agglomerated products were evaluated. Agglomerated and non-agglomerated WPI and WPC80 were collected from suppliers previously noted to develop this off-flavor, stored at 21C, and evaluated every 2 mo through 18 mo storage. At each timepoint, descriptive sensory analysis was conducted on the rehydrated whey proteins to document flavor profiles. Volatile compounds were extracted using solid phase micro extraction (SPME) followed by gas chromatography-mass spectrometry (GC-MS) and gas chromatography-olfactometry (GC-O) to identify and characterize aroma active compounds. Cucumber flavor developed with storage time (average time = 9 mo storage) and products agglomerated with lecithin developed this flavor more quickly than non-agglomerated products. Proteins exhibiting cucumber flavor had more aroma-active volatile compounds characterized as green/vegetative and higher levels of specific aldehydes (ex. hexenal, heptanal, 2,4-nonadienal, 2,4-nonadienal, 2-nonenal) than whey proteins without cucumber flavor. These results suggest that this off-flavor is caused by lipid oxidation and its formation is accelerated by the application of lecithin in the agglomeration process.

Key Words: Whey Proteins, Flavor, Flavor Chemistry

T113 Impact of storage temperature on flavor stability of low heat skim milk powder. R. E. Miracle*, A. E. Croissant, M. A. Lloyd, and M. A. Drake, *North Carolina State University*, *Raleigh*.

Fresh low heat skim milk powder (SMP) should ideally exhibit a mild and bland flavor reminiscent of fluid skim milk. A shelf life of anywhere between 6-36 months for non-instantized unfortified SMP stored at optimal storage conditions has been proposed by various sources. Optimal storage conditions (< 21C and < 50 % relative humidity (RH)) are often not feasible in primary U.S. export countries. The objective of the current study was to evaluate the impact of temperature on storage stability of low heat SMP using instrumental and sensory analyses. Low heat SMP commercially packaged in 3-ply 22 kg bags were received from six commercial facilities on the west coast of the United States within 3 weeks of production on three occasions. SMP were stored in the dark at 21C, 40% RH or 35C, 60% RH and sampled every 3 mo for sensory and instrumental analysis through 36 months. SMP were rehydrated at 10 % solids (w/w) for analysis. A trained descriptive sensory analysis panel conducted flavor profiling of the SMP. Instrumental volatiles were extracted by solid phase microextraction (SPME) followed by gas chromatography-mass spectrometry. Compounds were identified by comparison of retention indices and GC-MS data against reference standards. Selected compounds were quantified by standard addition. Instrumental and sensory profiles were impacted by both storage temperature and storage

time ($p<0.05$). For SMP stored at 21C, cardboard flavor and astringency increased and the concentration of many aldehydes increased while the abundance of maltol decreased with storage time ($p<0.05$). In contrast, similar flavors were detected in SMP stored at 35C along with other flavors: tortilla, burnt feathers, and brothy. Higher concentrations of aldehydes and sulfur compounds were also identified in samples stored at 35C when compared to SMP stored at 21C ($p<0.05$). Sensory and instrumental changes occurred more rapidly in SMP stored at 35C than products stored at 21C ($p<0.05$). Comparison of SMP storage stability at these two temperatures is useful for design of storage regimes and marketing programs.

Key Words: Skim Milk Powder, Flavor, Storage Stability

T114 Fatty acid profile and sn-2 fatty acid distribution of infant milk fat fortified with EPA and DHA. C. O. Maduko[1], Y. W. Park*[2,1], and C. C. Akoh[1], [1]*University of Georgia*, *Athens*, [2]*Fort Valley State University*, *Fort Valley, GA*.

Long chain polyunsaturated fatty acids, arachidonic acids (AA) and docosahexaenoic acid (DHA) contained in human milk have been identified with the proper development and function of the brain. The preferred sn-2 positions for palmitic acid in the triacylglyceride skeleton of human milk fat guarantees maximum fat and calcium absorption. Unlike human milk, vegetable oils as well as cow and goat milks do not contain eicosapentaenoic acid (EPA) and DHA. Vegetable oils contain low amount of AA, and they do not have an appreciable quantity of palmitic acid at the sn-2 position of their triacylglycerides. The objective of this study was to produce modified fat containing similar fatty acid profile and triacylglyceride composition to human milk fat for infant feeding. A blend of 2.1:1.1:0.8:0.4 ratio of coconut oil, safflower oil, soybean oil and menhaden fish oil was enzymatically interesterified with palmitic acid at a 1:1 substrate ratio, using commercial sn-1,3-specific lipase lipozyme RM IM, obtained from Rhyzomucor miehei as a biocatalyst. The mixture was separated by Thin Layer Chromatography (TLC) and the triacyglycerol (TAG) band was assayed for fatty acid content by a gas chromatography. Sn-2 positional determination of the TAG band was done by pancreatic lipase hydrolysis and separation by TLC. Fatty acid profile of the 2-monoacylglyceride band produced was analyzed by GC. The fatty acid profile of the modified fat appeared similar to that of human milk with appreciative quantities of EPA and DHA content. The sn-2 profile of the modified fat had a high percentage incorporation of C16:0, followed by C18:1, which is very similar to the sn-2 profile of human milk. It was concluded that infant milk containing EPA and DHA can be successfully produced by interesterification of palmitic acid using vegetable oil blends fortified with fish oil.

Key Words: Fatty Acid Profile, sn-2 Position, Infant Milk Fat

T115 Impact of agglomeration on the storage stability of whole milk powder. B. J. Wright* and M. A. Drake, *North Carolina State University*, *Raleigh*.

Whole milk powder (WMP) is a common ingredient used in many food products. Agglomeration is commonly applied to WMP to enhance solubility and dispersability. Research has not examined agglomeration effects on flavor and storage stability of WMP. The objective of this study was to determine the effects of agglomeration on the flavor and storage stability of WMP. Unagglomerated WMP (362 kg) was collected from two suppliers and batch-agglomerated with and without lecithin by a commercial agglomerator. The control (non-agglomerated) and agglomerated products were stored at 21C and evaluated every two months through 12 months storage. At each time point, descriptive sensory analysis was conducted on the rehydrated WMP to document flavor profiles. Volatile compounds were extracted using solid phase micro extraction (SPME) followed by gas chromatography-mass spectrometry (GC-MS) and gas chromatography-olfactometry (GC-O) to identify and characterize aroma-active compounds. Physical tests including color, solubility index, peroxide value, and dispersibility were also measured. Initial time zero tests indicated that agglomeration with or without lecithin did not impact flavor, volatile compound profile, or peroxide value of WMP ($p>0.05$). Agglomeration increased dispersability ($p<0.05$). Grassy and painty flavors developed in WMP with increasing storage time concurrently with changes in volatile compound profiles (e.g. increases in aldehydes and alcohols). Sensory and instrumental volatile compound changes occurred more rapidly in agglomerated products compared to non-agglomerated WMP, and these changes occurred more rapidly in WMP agglomerated with lecithin compared to products agglomerated without lecithin ($p<0.05$). These results suggest that agglomeration diminishes shelf stability of WMP and that lecithin further decreases shelf stability by enhancing lipid oxidation.

Key Words: Whole Milk Powder, Agglomeration, Shelf Life

T116 Cloning, expression and antibody production of caprine platelet-activating factor acetylhydrolase. P. H. Tsao*[1,2], T. Y. Kuo[1], J. T. Hsu[2], L. P. Chow[2], and F. Y. Wu[1], [1]*National Ilan University*, *Ilan, Taiwan*, [2]*National Taiwan University*, *Taipei, Taiwan*.

The presence of platelet-activating factor acetylhydrolase (PAH-AH) activity in goat milk (our unpublished data) could be responsible for the anti-inflammatory effect of goat milk as described in the text of ancient Chinese medicine. DNA sequences or amino acid analysis of caprine PAF-AH will be helpful for further study; however, these sequences have not been resolved. Degenerative primers were designed based on the consensus sequence of human, cow, and mouse PAF-AH, for the RT-PCR amplification of PAF-AH mRNA isolated from the buffy coat of goat blood. A full-length PAF-AH DNA, 1.3 kb in size, was generated. Subsequently, translation analysis predicted a 53 kDa protein. The DNA sequence shows 82% and 94% identity to human and cow PAF-AH sequences respectively, while amino acid sequence shows 78% and 92% identity to that of human and cow respectively. Caprine PAF-AH has a distinct N-terminal sequence of 17 amino acids when comparing it to other species. Using *pET24a* vector, a 20 kDa recombinant protein was generated. LC-MS/MS analysis showed a 26.1% coverage with the predicted 20 kDa sequence, indicating the protein was as expected. The recombinant protein was used to immunize rabbit, and using western blot, the anti-serum generated was able to detect both the 20 kDa recombinant protein and a 67 kDa band from the crude extract of goat colostrums, further confirming that the gene cloned was for PAF-AH.

Key Words: Platelet Activating Factor Acetylhydrolase, Caprine, Gene Cloning