478 Effects of different levels of 2 selected gums addition on textural properties of goat milk yogurts. B. P. Gupta*[1], Y. W. Park[1], J. Jones[1], and S. Ibrahim[2], *[1]Fort Valley State University, Fort Valley, GA, [2]North Carolina A&T State University, Greensboro.*

Sensory quality and consumer acceptability of yogurts are greatly influenced by textural characteristics of the products. Our previous work indicated that xanthan and locust bean were found to be the best choices among the 7 gums tested in improving the textural quality of goat milk yogurt. This present study was conducted to determine optimum levels of supplementation of the 2 gums in enhancing rheological quality of goat yogurts. Experimental yogurts were manufactured with addition of 0.2%, 0.3% and 0.5% of the 2 gums (wt/vol) to goat milk produced at the Georgia Small Ruminant Research & Extension Center, Fort Valley State University, Fort Valley, Georgia, and all gums treated yogurt products were stored for 0, 2 and 4 weeks in a 4°C refrigerator. Textural properties of all respective experimental goat yogurts were evaluated using a texture analyzer (Model TA.XT2i, Texture Technology Corp., Scarsdale, NY). Viscosity of yogurts was measured by firmness (g force) and consistency, and adhesiveness or stickiness was measured by cohesiveness (g force) and index of viscosity. Firmness and consistency for all yogurts made using 3 different concentrations of the 2 gums were generally higher than those of control samples, with a few exceptions. These results indicate that xanthan and locust bean fortifications to the goat milk had improved the textural qualities of the caprine yogurt products. Addition of 0.5% locust bean showed the highest firmness and that of 0.2% xanthan resulted in highest consistency among all treatments. Viscosity, cohesiveness and adhesiveness of 0.3% and 0.5% added locust bean showed higher and more consistent values than the other groups. It was concluded that the supplementations of 0.2% xanthan and 0.5% locust bean to the caprine milk improved the textural qualities of the goat milk yogurts.

Key Words: goat milk yogurt, gum, texture

479 Physico-chemical characteristics of fresh and corresponding pasteurized camel milks from intensive dairy farm in Saudi Arabia. E. Beaucher[1], N. Nogueira[1], B. Camier[1], J. Jardin[1], V. Briard-Bion[1], A. Musaad[2], G. Konuspayeva[2], B. Faye[2], and F. Gaucheron*[1], *[1]UMR 1253 Science et Technologie du Lait et de l'œuf, INRA-Agrocampus Ouest, Rennes, France, [2]Camel and Range Research Center, Al-Jouf, Sakaka, Saudi Arabia.*

Compared with cow milk, the knowledge concerning the physico-chemical characteristics of camel milk is confuse and sometimes discordant. Explanations concerning these discordances are differences in the geographical origin of camel milk and analytical methods used for the characterization. The objective of this study was to describe precisely the physico-chemical characteristics of fresh whole and corresponding camel milk from the Camel and Range Research Center located at Al-Jouf, Sakaka (Saudi Arabia).The analyses were performed to (1) Determine the global composition of this milk (total and whey proteins, main minerals, lactose and fat); (2) Identity of the main proteins by mass spectrometry previously separated by reversed phase chromatography (3) Characterize the micellar properties of casein micelle in terms of mineralization, size, charge and hydration. The collected milk came from 16 milking camels. The recovered volume, corresponding to 2 milking, was 150 L. One liter of raw milk and one liter of the corresponding pasteurized milk (70°C for 10 min) was sampled for the physico-chemical characterization. Experiments were performed in duplicate. For raw milk, the concentrations of dry matter, fat, lactose, total nitrogen, non-casein nitrogen, Ca, inorganic phosphate, Mg, Na, K, Cl and citrate were 110, 25.5, 49, 29, 9.6, 1.23, 1.52, 0.09, 1.07, 1.71, 1.54 and 1.67 g/kg. The chromatographic profiles of the main proteins were complex but the different caseins molecules were identified. No b-lactoglobulin was detected. Different molecular masses were also determined without identify precisely the corresponding proteins. Concerning the micellar characteristics, the zeta potential was about −15.5 mV, the hydration 1.70 g of water per g of dry pellet of ultracentrifugation and the average size of about 250 nm. These micelles contained Ca and inorganic phosphate with 0.04 and 0.04 g of these ions/g of casein. The mass ratio of micellar Ca/Pi was close to 1.0. All these parameters were not significantly affected by the pasteurization.

Key Words: camel milk, pasteurization, casein micelle

480 Changes and formation mechanisms of oxidized-flavor of milk powder during heat related processes. L. Zhang* and Y. Li, *Harbin Institute of Technology, College of Food Science and Engineering, Harbin Institute of Technology, Harbin, China.*

Oxidative deterioration of milk powder during processing and storage processes is a bottleneck in restricting application of milk powder. The aim of this work was study on the potential mechanism of formation in oxidized flavor of milk powder during heat-related processes. Solid-phase microextraction-gas chromatography-mass spectrometry was used to analyze the oxidized flavor during the raw milk heated process. Total antioxidant capacity (DPPH radicals scavenging activity) and peroxide value were used as the indicators of heated-induced changes in oxidative environment of milk. While the oxidized environment of milk fat and the exposure of flavor precursors were also analyzed by dynamic light scanning. The protein materials extracted from fat globule membrane were also analyzed by SDS-PAGE. The results showed the oxidized flavor, hexanal, heptanal, nonanal, 2-heptanone, 2-nonanone, were increased with the increasing the heat intensity among the range of heat temperature (70 to 90°C) and heat time (0.5 to 20 min). There was a good regression relationship between the oxidized flavor compounds and heat intensity. The correlation coefficients ranged from 0.868 to 0.936. For the antioxidant capacity, compared with the unheated samples, DPPH radicals scavenging activity of heated milk significantly decreased ($P < 0.05$), while peroxide value significantly increased ($P < 0.05$). The ranges of fat globule diameter d3,2 and specific surface area were 3.05 to 3.46 μm and 17038 to 20083 cm^2/mL respectively. Heat treatment at low intensity could not influence the distribution of milk fat globules. SDS-PAGE, which suggested the proteins, such as β-lactoglobulin, α-lactalbumin, xanthine oxidase and butyrophilin in fat globule membrane could be cross-linked through the molecular or intermolecular reactions. These results indicated that the formation of oxidized flavor compounds was improved due to the changes in oxidized status of milk during heat treatment.

Key Words: milk powder, heat process, oxidized flavor

481 Milk quality of Nguni cows of Southern Africa. M. Chimonyo*[1], M. Mapekula[2], and K. Dzama[3], *[1]University of KwaZulu-Natal, Pietermaritzburg, South Africa, [2]University of Fort Hare, Alice, South Africa, [3]University of Stellenbosch, Stellenbosch, South Africa.*

Efforts to produce milk in communal production systems of Southern Africa largely ignore the adapted indigenous Nguni cattle. The study was conducted to determine fatty acid, amino acid and mineral composition of milk from Nguni cows of Southern Africa. Milk samples from 16 Nguni cows grazing on rangeland were collected once per lactation phase, i.e., early lactation (January), mid lactation (April) and late lactation (June) in 2009 for milk composition analyses. Milk samples were analyzed for amino acids, fatty acids and mineral content. Data were analyzed using the PROC Mixed procedure with repeated measures analysis of SAS (2009). Least squares means were separated using the PDIFF option (SAS, 2009) when the F-test was significant at $P < 0.05$. Relative to crossbred cows, Nguni cows produced milk with higher ($P < 0.05$) protein content, essential amino acid levels, phosphorus and n-6:n-3 ratio. Milk yield, fat and total solids content, potassium levels and total mono-unsaturated fatty acids (MUFA) were, however, comparably low ($P < 0.05$). In the early and mid-lactation stages, milk from Nguni cows had higher ($P < 0.05$) essential amino acids (arginine, phenylalanine, histidine, isoleucine and leucine), calcium levels and polyunsaturated fatty acids to saturated fatty acids (PUFA/SFA) ratios than their crossbred counterparts. It was concluded that milk composition of Nguni cows is desirable for human consumption, especially in the early-to-mid lactation. The potential of improving milk production from Nguni cattle, widely considered to be beef-type cattle, is, therefore huge and deserves attention.

Key Words: fatty acids, food security, Nguni cattle

482 Physicochemical characteristics of nonfat dry milk and skim milk powder produced in the United States A. K. A. Ali*, K. E. Smith, K. J. Burrington, and J. A. Lucey, *Wisconsin Center for Dairy Research, University of Wisconsin-Madison, Madison.*

Nonfat dry milk powder (NFDM) is the most commonly produced dry milk product in the United States. It is a commonly used ingredient in many food applications to improve the body, texture, and flavor of products. Physicochemical properties, such as, moisture, color, particle size, and bulk density, can affect storage ability, handling and processing of milk powders. Objectives of this study were to determine physicochemical quality parameters of domestic NFDM and skim milk powder (SMP). In our study, 23 samples from 4 domestic producers of NFDM/SMP were obtained. Samples were 25 kg or 50 pound bags of low, medium and high heat NFDM/SMP that have not been agglomerated or instantized and were approximately 6 to 9 mo old. Moisture, color, particle size, and bulk density were determined. Accelerated storage testing of powder also was done at 70°C for one week. Moisture content of the samples varied from 3.90 to 4.59%. Samples had variations in lightness value L* (93.85–96.37) as well as b* value (12.32–17.99). Following accelerated storage DE* values, indicating total color change of the powders, ranged 46.53–90.13. DE* values showed significant positive correlation with the moisture content of the powders. The particle size in volume median diameter D (v, 0.5) of milk powders showed significant variations with a range of 21.05–73.92 µm. Significant differences in bulk density were not apparent between NFDM/SMP or between heat treatments. Differences were noted between one company versus the other 3 manufacturers indicating differences in processing conditions between manufacturers, rather than the actual type of milk powder product. The particle size and bulk density can influence the functional properties of powders (such as reconstitution ability, flowability, wettability, dispersibility, and compressibility) and there by influence the possible end use behavior of these products.

Key Words: NFDM/SMP, physicochemical properties

483 Impact of calcium reduction on the functional properties of milk protein concentrate 80. C. Marella*, A. Kommineni, P. Salunke, A. Biswas, and L. E. Metzger, *Midwest Dairy Foods Research Center, Dairy Science Department, South Dakota State University, Brookings.*

Ultrafiltration (UF)/Diafiltration (DF) are utilized in production of Milk protein concentrates (MPC). The UF process allows passage of soluble components such as lactose and some minerals. Previous research has demonstrated that partial removal of calcium from the product during UF process affects the functional properties of MPC. The objective of the present research was to determine the effect of calcium reduction as a result of CO_2 injection on functional properties of MPC. Three replicates of CO_2 injected reduced-calcium MPC and 3 replicates of control MPC were produced, using different lots of skim milk for each replicate. All the MPCs were stored at room and elevated temperatures for 2 mo. Solubility was measured at 20°C and at 4°C (cold solubility). Insolubility indices were also measured on 5% protein solutions. Heat stability of 5% protein solutions and viscosities of 5 and 10% protein solutions were also determined. Reduced-calcium MPC had a solubility of ~97% on d 1 and there was no significant loss ($P > 0.05$) in solubility during 60 d storage at room temperature and at 40 C. In contrast, the control MPC had a solubility of 91% at d 1 and significant reduction in solubility was observed during 60 d storage at 40 C. The significantly ($P < 0.05$) higher solubility of the reduced calcium MPC at d 1 indicates the calcium may play a role in protein aggregation during manufacturing. Reduced-calcium MPC also had a cold solubility of 92% while the control MPC had 74%. Insolubility indices were correlated with solubility data at room and cold temperatures and a model was developed for predicting solubility by measuring insolubility index. Reduced-calcium MPC had significant ($P < 0.05$) differences in heat stability and viscosity when compared with the control MPC. The present study quantified the effect of various levels of calcium reduction on functional properties of MPC powders.

Key Words: MPC, calcium reduction, solubility

484 Impact of retentate preheating on the functionalities of milk protein concentrate. L. Rupp*[1], M. Molitor[2], and J. A. Lucey[1,2], *[1]University of Wisconsin-Madison, Department of Food Science, Madison, [2]Wisconsin Center for Dairy Research, Madison.*

Processing conditions can influence the properties and functionalities of milk protein concentrate 80 (MPC80). Characteristics of nonfat dry milk are well known to be affected by pre-heating of the concentrate before spray drying, however it is not known how MPC powders are affected by heat treatment before drying. Increased levels of protein denaturation could affect foam stability, solubility and powder storage properties. Ultra- and diafiltered retentate (25% TS) was heated to 50, 60, or 70°C for 9 min immediately before spray drying. Outlet air temperatures were adjusted to maintain similar moisture contents. Four trials were conducted and fat contents in the powders were 2.8, 2.8, 2.0 and 1.4, respectively. Viscosity of the retentate, powder particle size, foam stability, foam overrun, and foam yield stress (5% wt/wt, pH 7, 20-min whipping time) of MPC80 were analyzed. The powders were stored at 30°C and tapped bulk density and solubility were determined every 30 d for 6 mo. Due to the lower viscosity of the concentrate at increased temperatures, the droplets produced during atomization caused significantly ($P < 0.05$) smaller powder particles. Foam stability and % overrun of the powders were extremely variable, ranging from 104 to 1041 s and 397 to 847%, respectively. Only powders with a low fat content (≤2%) were able to form stable foams, confirming that residual fat inhibits foaming. Foaming experiments are ongoing. Bulk density decreased during storage time but was not significantly affected by

pre-heating temperatures. Solubility slightly declined in all powders over time but pre-heating to 70°C for 9 min did not negatively affect solubility. It has been suggested that fat could shield powder particles from water during the rehydration process causing poor wettability, but no differences in solubility were found in powders with elevated fat contents. It was concluded that under the conditions we investigated, pre-heating of the concentrate before drying has no major effect on MPC80 properties.

Key Words: milk protein concentrate, processing, functionality

485 Interactions between acidified dispersions of milk proteins with dextran or dextran sulfate. U. Pachekrepapol*, D. Horne, and J. Lucey, *University of Wisconsin-Madison, Madison.*

Exopolysaccharides (EPS) produced by some starter cultures are often used to modify yogurt texture. Our goal was to study the effect of neutral and negatively charged EPS on acidified milks to better understand the possible interaction mechanisms. Acidified milks were used to better simulate yogurt conditions. Dextran (DX; MW 2×10^6 Da) and dextran sulfate (DS; MW 1.4×10^6 Da) were used as model examples of neutral and negatively charged EPS, respectively. Reconstituted skim milk (5–20% TS, w/w) was acidified to pH 4.4, 4.6, 4.8 or 4.9 at ~0°C (to prevent gelation) by addition of 3 *N* HCl. DX or DS was added to acidified milks to give concentrations of 0–2% (w/w) and 0–1% (w/w), respectively. Milks were observed for possible phase separation after storage at 0°C for 1 and 24 h. Any gelation of milk systems was determined by frequency sweep. The type of interactions between caseins and DX/DS was investigated by total carbohydrate analysis of supernatants from phase separated samples. At 5.0–7.5% TS, phase separation of milks occurred even without DX or DS addition due to destabilization of caseins in acid conditions. At higher milk solids content, phase separation was only detected after 24 h when DX or DS was added. Phase separation occurred when 1.5–2.0% DX was added to milk with >7.5% TS, or when 0.7–1.0% DS was added to milk with 10.0 to 12.5% TS. Similar results were observed at all pH levels. Gelation occurred with the addition of 1.5–2.0% DX or 0.4–1.0% DS to milk containing high TS (≥10%). Based on carbohydrate analysis of supernatants, we believe that DX interacted with milk proteins through a type of depletion flocculation mechanism, while DS appeared to interact via electrostatic type interactions with milk proteins. This study helps to better understand how different types of EPS interact with milk proteins, which should improve our control of cultured products made with these EPS-producing strains.

Key Words: dextran, dextran sulfate, depletion flocculation