945 Renneting properties of milk containing high molecular weight oat β–glucan. N. Sharafbafi*[1], S. M. Tosh[2], M. Alexander[1], and M. Corredig[1], [1]*University of Guelph*, *Guelph, Ontario, Canada*, [2]*Agriculture Agri-Food Canada*, *Guelph, Ontario, Canada*.

The effect of concentration and molecular structure of high molecular weight oat β–Glucan (BG) on renneting properties of concentrated skim milk gels were investigated. Incorporation of BG (0.15, 0.3, 0.6, and 0.9% w/w in permeate) into twice-concentrated skim milk resulted in bulk phase separation of gelling systems as shown by reduction in turbidity parameter (1/l*) and diffusion coefficient using diffusing wave spectroscopy (DWS). However, by controlling the kinetics of gelation and phase separation (using shear in renneted milk before BG addition), it was possible to create casein networks with entrapped BG. $CaCl_2$ was added to reduce time of gelation (TG), and increase textural properties, where high concentrations of BG (≥0.6%) resulted in weakening of protein gel network. The effects of shear and the presence of $CaCl_2$ on microstructure and rheological behavior of the renneted gels containing BG were monitored using DWS combined with small deformation rheology. In addition, BG distribution in the rennet gel network was observed by differential staining technique, (Calcofluor and Rhodamine B, for BG and protein, respectively) using confocal laser scanning microscopy. The results showed that the onset of protein interactions, illustrated by the turbidity parameter, and the aggregation point, measured by the diffusion coefficient, were strongly affected by increase in BG concentration. BG-containing gels exhibited a significantly lower elastic modulus (G′) compared with their control counterparts ($P \leq 0.05$). Increase in BG concentration delayed the TG, and reduced gel firmness due to the non-interacting nature of the BG polymer. In contrast, the addition of $CaCl_2$ reduced the TG and produced a firmer gel in both control and BG added samples. BG addition could improve the texture and nutritional value of calorie-reduced cheeses, whose hard texture has traditionally been a barrier to their production.

Key Words: beta-glucan, gelation, rheology

946 Interactions of milk proteins with tea polyphenols. S. Haratifar*, G. Paliyath, and M. Corredig, *University of Guelph*, *Ontario, Canada*.

Few reports are available on the effects of polyphenols when present in milk. A recent study has claimed that the presence of milk decreases the content and the bioavailability of polyphenols during in vitro digestion (Cilla et al., Food Chemistry, 2009). However, little attention has been paid to the interactions occurring between casein micelles and polyphenols. The objectives of this study were to observe the impact of the protein/polyphenol interaction on the functional properties of milk such as enzyme renneting as well as observing the impact on the tea polyphenol bioavailability. The molecular details of the interactions between tea polyphenols and milk proteins were quantified using reverse phase C18 HPLC. Tea polyphenols strongly interact with casein micelles and result in low recoveries especially at lower concentrations of polyphenols, but it does not necessarily cause low bioavailability. This was confirmed also by measuring in vitro digests. The effect of the interactions of different concentrations of tea polyphenols on rennet induced aggregation of milk was studied. The experiments were carried out using a controlled stress rheometer at a constant strain of 0.01 and frequency of 1 Hz at 30°C. A frequency sweep test was run after the gelling of the samples until 80min to determine the frequency dependence of the elastic (G′) and viscous modulus (G″) of the gels. The gelation point was determined as the onset of the increase in the G′. The results showed that at low concentrations of tea polyphenols (<0.25mg/ml, i.e., below saturation of the casein micelles), the G′ modulus increased similarly to that of control milk (35 min ± 5). At higher concentrations, the polyphenols not only delayed the gelling point of milk to 60 min ± 4, but they also affected the structure formation, as could be noted by a lower G′ of the mixture compared with milk. These experiments clearly identify the need for a better understanding of the effect of tea polyphenols on the functionality of casein micelles, before milk can be used as an appropriate platform for delivery of bioactive compounds.

Key Words: polyphenols, interactions, gelling

947 Anticarcinogenic properties of milk fat globule membrane. R. Zanabria*[1], A. M. Tellez[1,2], M. Griffiths[2,1], and M. Corredig[1], [1]*University of Guelph*, *Guelph, ON, Canada*, [2]*Canadian Research Institute for Food Safety (CRIFS)*, *Guelph, ON, Canada*.

Milk fat globule membrane (MFGM) comprises a tri-layer mixture of glycoproteins, phospholipids and enzymes which protects fat globules from coalescence and enzymatic degradation. Though present in small amounts, MFGM is the main source of polar lipids in milk (65%) and it is one of the major components of buttermilk, the by-product of butter manufacture. Objective of this work was to determine the effect of MFGM on the proliferation of a human adenocarcinoma cell line. Milk was collected using a catheter from healthy animals to minimize bacterial contamination and lipopolysaccharide (LPS) presence, and the cream separated by centrifugation. MFGM fractions were isolated washing the cream twice with endotoxin free water and consecutive freeze-thawing and ultracentrifugation. The bioactivity of MFGM isolate on the HT-29 cell line was tested after verifying LPS-absence using the Chromogenic endpoint test. Two different methods were employed to test the MFGM effect on cell proliferation. The BrdU colorimetric test revealed a dose-dependent DNA synthesis decrease in exponentially growing cells exposed to 10 μg of MFGM protein/mL. Up to 53% inhibition was measured after 72h when 100 μg of MFGM protein/mL was used. The results were corroborated using the Sulforhodamine B proliferation assay. In the latter, the amount of MFGM required to produce the same effect almost doubled (200 μg MFGM protein/mL achieved a 57% reduction) after 48h incubation. When cells were similarly treated with commercially available anticarcinogenic compounds (0.1mM/L melphalan and 20 μmol/ L N-Acetyl-D-sphingosine) the reduction in cell growth was 25 and 40% respectively; hence, showing the potential bioactivity capacity of the raw MFGM fractions. Though the study of the mechanism whereby untreated MFGM exerts its anticarcinogenic activity is still undergoing, the results indicate that MFGM isolates have an inhibitory effect on colon cancer cells, most likely through the extracellular signaling pathways. Analyses are in progress to evaluate apoptosis and/or differentiation as possible causes for these properties along with the effect of milk processing over the MFGM bioactivity.

Key Words: milk fat globule membrane, anticarcinogenic, bioactivity

948 Gelation properties of casein micelles during combined renneting and mesophilic bacterial fermentation: Effect of concentration by ultrafiltration. E. Salvatore*[1,2], M. Alexander[2], A. Pirisi[1], and M. Corredig[2], [1]*Agris Sardegna, Dipartimento per la Ricerca nelle Produzi-*

oni Animali, *Olmedo, Italy*, [2]*Department of Food Science, University of Guelph*, *Guelph, Ontario, Canada*.

The objective of this study was to determine the effect of concentration of milk by ultrafiltration on the rheological and chemical properties of combined cultured and rennet milk gels. Pasteurized skim milk (1X; control) with ≈3.7% of total protein was concentrated by ultrafiltration to produce retentates with protein levels of ≈7.4% (2X), and ≈11.1% (3X). All samples were acidified with a mesophilic lactic culture (0.1 g/L), renneted with liquid rennet at a final concentration of 0.00296 IMCU/mL, and incubated at 30°C. Acidification was monitored by recording the pH continuously over the gelation period, and the development of the gel structure was observed by means of small deformation rheology and diffusing wave spectroscopy (DWS). Furthermore, the levels of soluble Ca^{++} were determined during incubation period. The gelation time, defined as the point when the loss tangent (tan δ) = 1, was between 105 and 109 min, corresponding to a pH value of ≈6.5, and was not significantly different among the samples ($P > 0.05$). When measured by DWS, the gelation point was almost superimposable with that found in the rheological measurements. After gelation, the value of G′ showed a significant increase up to pH 5.64, 5.92, 6.18 for 1X, 2X and 3X respectively, and these values were significantly different among treatments ($P < 0.05$). Significant differences ($P < 0.05$) were also found in the pH at maximum value of tan δ. The values of soluble Ca^{++} suggested that the variations between samples were due to the different rates of release of Ca^{++} from the casein micelles. The results clearly show the details of the changes occurring during a mixed coagulation process and allow for a better understanding of the physical and chemical processes that happen during the making of quark-type cheeses.

Key Words: milk gels, rheological properties, light scattering

949 Production of α-lactalbumin enriched concentrate from serum whey. C. Marella*, P. Salunke, L. E. Metzger, and K. Muthukumarappan, *Midwest Dairy Foods Research Center, South Dakota State University*, *Brookings*.

Whey proteins are known for their valuable functional, nutritional and therapeutic properties. Bovine α-Lactalbumin (α-LA) has high homology to human α-LA and has well documented therapeutic uses. Hence development of α-La concentrate with reduced levels of β-lactoglobulin (β-LG) is of high interest to manufacturers of infant formula and whey protein based therapeutic formula. In production of α-LA enriched WPC from cheese whey, the purity of α-LA in the final product is heavily influenced by the presence of glycomacropeptide. Serum whey produced by microfiltration of milk is largely absent in glycomacropeptide. Production of α-LA enriched concentrate from serum whey should result into higher purity and yield. The objective of the present study was to develop α-LA enriched concentrate from serum whey. Wide pore Ultrafiltration experiments were conducted using four (30, 40, 100 kD polyvinylidene fluoride and 300 kD polyethersulfone) membranes and three levels of operating pressure (138, 207 and 276 kilo Pascal (kPa)). In the process serum whey was concentrated to a volume reduction (VR) of 5 and 10. Purity, yield of α-LA and α-LA/ β-LG ratio were used as the parameters indicative of process efficiency. At VR of 5, purity of α-LA obtained in the permeate stream ranged from 52 – 96% while the yield of α-LA ranged from 15-55%. At VR of 10, there was a marginal decrease of 3-7% in purity and 20 – 35% increase in yield of α-LA. For separation of α-LA from serum whey there appears to be an optimum operating pressure. From the present results, it appears that 207 kPa pressure is optimum resulting into a 10-25% higher yield when compared to the yield obtained at other pressures used in this study. The results from this study will be helpful in production of highly purified α-LA enriched concentrate from serum whey. Regardless of the membrane used in this study, use of 207 kPa operating pressure resulted in α-La enriched product with purity ranging from 52 – 96%.

Key Words: α-lactalbumin, wide pore ultrafiltration, serum whey

950 Evaluation of correlations between chemical compositions and sensory properties in Turkish Set-type yogurts. Z. Guler[1] and Y. W. Park*[2], [1]*Mustafa Kemal University*, *31034 Antakya, Hatay, Turkey*, [2]*Fort Valley State University*, *Fort Valley, GA*.

Food quality of yogurt is affected by many factors, including levels of titrable acidity, free fatty acid, aroma compounds, nutritional values, and sensory properties. Ten most popular brands of commercial Turkish set-type yogurts were collected from retail outlets in Hatay, Turkey to determine correlations between chemical compositions and sensory properties of the products. Free fatty acids (FFA) and volatile compounds (VC) were analyzed using a GC-MS (Agilent GC model 6890) and MS (Agilent Mass Selective Detector 5973 N; Palo Alto, CA, USA). Columns used for FFA and VC separation were DB-FFAP-column (30 m × 0.25mm id × 0.25μm film thickness) and HP-INNOWAX capillary column (30 m × 0.32mm id × 0.25μm film thickness), respectively. Intensities and overall acceptability of sensory attributes were measured on 4-point and 9-point hedonic scales. The results revealed that increased volatile compounds (acetaldehyde, acetic acid) and acidity attributed to sour flavor, resulting in decreased overall acceptability of the yogurts. Aromatic volatiles such as 2-nonanone (fruity, musty), 2-tridecanone (fruity, green) and ethyl acetate (fruity) were negatively correlated, whereas diacetyl, C4 to C12 FFA and texture were positively correlated with overall acceptability. 2-Nanonane was negatively correlated with atypical flavor, since ketones having higher carbon numbers are responsible for heated milk flavor. Butanoic (rancid, cheesy), hexanoic (pungent, sour), octanoic (waxy, goaty), decanoic (rancid, fatty) and dodecanoic (fatty) acids were positively correlated with overall acceptability and formation of the specific aromatic flavors of set-type Turkish yogurts. Yogurt flavor intensity appeared to be closely related to titratable acidity, acetic acid, C4 to C10 content, ratio of acetaldehyde to diacetyl, and to a lesser extent to fat and protein contents.

Key Words: Turkish yogurt, chemical composition, sensory property