Emulsification is a key processing step during the manufacture of dairy beverages. Inadequate emulsification negatively impacts the shelf-life of beverage due to the development of coalescence, flocculation and creaming. Soy lecithin is commonly used to stabilize food emulsions. Recently, consumers identify soy lecithin as an undesirable ingredient, and beverage processors are actively exploring alternatives for soy lecithin. This study focuses on evaluating the effect of lecithin on the stability of emulsions prepared by ultrasonication. Emulsions were manufactured by mixing whey protein concentrate (8%), maltodextrin, and sucrose (25%); vegetable oil (4%) and soy lecithin added at different concentrations (0, 3, and 6%). The mixture was emulsified by ultrasonication using an acoustic intensity of either 342.5 ± 5.8, 443.6 ± 7.5, or 524 ± 8.9 kJ m⁻² s⁻¹. After emulsification, the beverages were stored at 4°C, and the stability was evaluated weekly during 3 weeks. The stability of the ultrasound emulsions was evaluated in terms of particle size, gel electrophoresis, rheological behavior, and confocal laser scanning microscope. Overall, the application of ultrasound results in a bimodal distribution of particle ranging from 310 to 748 nm. The lowest range of distribution (270 ± 10.8 nm) was observed in those emulsions treated at the highest intensity (524 ± 8.9 kJ m⁻² s⁻¹). Interestingly, the mean particle size of those samples without lecithin increased during storage from 520 to 750 nm. CLSM images indicated aggregation of proteins during storage as well as larger oil droplet on samples treated at 342.5 ± 5.8 kJ m⁻² s⁻¹ and 0% lecithin concentration. The rheological analysis revealed that all samples displayed a distinctive viscoelastic region. The linear segment was significantly (*P < 0.05) longer in the emulsion formulated with soy lecithin (6%) and treated at 524 ± 8.9 kJ m⁻² s⁻¹. In general, the combined effect of soy lecithin and ultrasonication yielded a stronger gel and shear-thinning behavior. The application of ultrasound seems to functionalize whey protein-based emulsifiers via processing and compositional parameters that enhance interactions between ingredients.

Key Words: ultrasound, lecithin, emulsion


What makes a skim milk powder (SMP) suitable for use in recombined ultra-high-temperature (UHT) milk and/or evaporated milk (EM) applications? Twenty SMP samples manufactured in Canada, Europe, New Zealand and the United States, and intended for UHT or EM use in Southeast Asia, were characterized and used in EM and UHT milk model systems that were tested over 6 mo of storage. The goal was to compare the performance of various origin SMP. Compositionally all the SMP samples met CODEX requirements. Some manufacturers standardized protein levels, while others did not. SMP protein ranged from 32.7 to 37.4% m/m (as is), moisture 3.5 to 4.4% and fat 0.6 to 1.5%. There was minimal variation across the samples in pH, titratable acidity, solubility index, viscosity, bulk density, scoured particles, hygroscopicity, and water activity. Whey protein nitrogen index (WPNI) values were indicative of heat treatment type. Heat coagulation time (HCT) at 140°C varied greatly between the samples (6.5 to 31.6 min). Correlation between HCT and WPNI was 0.57; so WPNI does not appear to be a good predictor of HCT stability. The SMPs’ color was similar, although there was slightly more yellow (b*) in the powders from NZ. The microbial analysis revealed supplier-specific (not origin) differences between the samples. Aerobic spores (S) were measured using a heat shock of 80°C/12min and heat resistant spores (HRS) 100°C/30min. Mesophilic S and HRS were low. Large variations were seen in thermpophilic (T) aerobic plate counts, S and HRS; and 11 and 16 SMP samples (EU, NZ, US origin) had low T-S and T-HRS < 300 cfu/g respectively. In the UHT application, all samples withstood the heat treatment without gelling or excessive browning. After storage, minor differences were observed between the samples. In the EM application, one sample gelled after heating, and varying degrees of sedimentation were observed after processing and during storage. Six EM samples (CA, NZ, US origin) performed well throughout the 6 mo shelf life, exhibiting only minor phase separation. Our results show that different origin SMP samples were similar across many parameters with differences in performance being supplier rather than country-specific.

Key Words: skim milk powder, UHT

201 Electrical resistance tomography for monitoring the rehydration characteristics of high-protein dairy powders. K. S. Babu* and J. Amamcharla, Kansas State University, Manhattan, KS.

Electrical resistance tomography (ERT) is a novel, robust, and low-cost method offering non-invasive and remote sensing. The objective of this study was to develop a method to characterize the rehydration behavior of milk protein concentrate (MPC) powders using ERT in 2 configurations (circular sensor and linear probe). To validate the method, 2 lots of fresh MPC85 and MPC90 powders were procured from a commercial manufacturer. Focus beam reflectance measurement (FBRM) was used as a reference method to follow rehydration characteristics. To evaluate the rehydration characteristics, MPC powders were reconstituted to 5% (wt/wt) total solids at room temperature and the rehydration characteristics of MPC powders were monitored for 30 min using ERT. MPC dissolution was characterized in terms of overall mean conductivity, the area under the mean conductivity curve, and equilibrium dissolution time from the ERT data. Particle count changes from FBRM revealed that MPC90 had more resistance to dispersing in water. As the dissolution time proceeded, mineral ions and proteins are released and consequently increased the overall conductivity as observed by both the sensing planes. Both the configurations were able to effectively capture the differences in the dissolution of MPC85 and MPC90 powders. As the protein content increased, the particle dispersion rate decreased and, consequently, a decrease in mean conductivity and reduction in the area were observed, indicating a reduction in solubility. For the circular sensor configuration, MPC85 and MPC90 showed the maximum conductivity of 0.20 and 0.16 ms/cm, respectively. Whereas, for the linear probe configuration MPC85 and MPC90 showed the maximum conductivity of 0.16 and 0.13 ms/cm, respectively. Both the configurations showed a significant difference (*P < 0.05) in the maximum conductivity of MPC85 and MPC90. Overall, the ERT can be a robust and low-cost method to characterize the dissolution behavior of high-protein dairy powders.

Key Words: electrical resistance tomography, milk protein concentrate powders, rehydration

202 Investigating the suitability of acetic whey in the manufacture of cornichon pickles. O. Ozturk, S. Cebeci, O. Yemis, A. C. Mehmetoglu, and M. Ozturk*, Sakarya University, Food Engineering Department, Sakarya, Turkey.

The production of Greek-style yogurt has dramatically increased in recent decades worldwide, which lead to increased production of acid whey. Unlike whey, acid whey still has little or no economic value and handling acid whey is still a problem for the Greek yogurt manufacturers. In this study, suitability of acid whey in the production of cornichon pickle production was investigated. Pickles were manufactured with fermentation (F) and pasteurization (P) methods with either acid whey (A) or vinegar
The effect of total milk protein, casein, and whey protein ingestion on blood glucose and insulin in rats. 

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High-protein dairy products may reduce postprandial blood glucose and lead to the transient increase of insulin. The ingredients used in high-protein dairy products may include total milk protein (TMP), casein (CN) and whey protein (WP). However, their direct effect on insulin and BG remains unclear. Our objective was to investigate the acute effect of commercial TMP, micellar CN and WP isolates on BG and insulin response in rats. We hypothesized that the magnitude of insulin and BG response would depend on the type of protein. Six male Wistar Han rats with jugular vein catheters and vascular access buttons were used in a randomized crossover. After 6h daylight fasting, each rat was gavaged with 350 mg/3 mL of either TMP, CN, WP or glucose (G) reflecting a human dosage of 10g calculated based on allometric scaling. Each rat received all treatments in random order with a 48h in between. Blood was collected at 0, 15, and 30min for insulin measured with Ultra-Sensitive Rat Insulin ELISA, and at 0, 15, 30, 60, 90, and 120min for glucose measured with HemoCue 201 Glucose Analyzer. The data were analyzed with 2-way RM ANOVA followed by Tukey-Kramer post hoc test. There was an effect of treatment (P < 0.0002), time (P < 0.0001) and a treatment by time interaction (P < 0.0001) on BG over 120min. At 15min TMP, CN and WP, and at 30min CN and WP led to reduced BG compared with G (P < 0.05). At 30min, BG was lower after WP compared with CN (P < 0.05). There was an effect of treatment on BG area under the curve (AUC) over 120min (P = 0.001). All protein treatments resulted in a lower BG AUC compared with G (P < 0.05). There was an effect of treatment (P = 0.02), time (P < 0.0001) and treatment by time interaction (P < 0.0001) on insulin over 30min. At 15min, only TMP and CN but not WP led to reduced insulin compared with G (P < 0.05). There was an effect of treatment on insulin AUC over 30min (P = 0.006). All protein treatments resulted in a lower insulin AUC compared with G (P < 0.05). In conclusion, although TMP, CN and WP follow a similar pattern in their effect on BG and insulin, they demonstrate distinct properties at 15 and at 30 min after ingestion.

Key Words: milk proteins, blood glucose, insulin

204 Milk protein fractions in liquid and solid matrices and their sensory perception. E. MacEachern, Y. Xu, P. Kathirvel, and B. Luhovyy*, Mount Saint Vincent University, Halifax, NS, Canada.

Milk protein fractions (MPF) possess multiple biological activities and can be used in functional dairy products. The current trend among health-conscious consumers is to select products with a lower sugar content and free of artificial sweeteners and flavors. Our objective was to explore the sensory characteristics of MPF isolates solubilized in milk or water, or in a solid matrix without any sweeteners or flavors. We hypothesized that the sensory characteristics of MPF will differ in each matrix. Three randomized, double-blind crossover studies with adults (19–65 y) were conducted. The following 10% (wt/vol) MPF were tested: whey protein isolate by ion exchange (WPI-IE), whey protein isolate by membrane filtration (WPI-MF), glycomacropeptide (GMP), α-lactalbumin (ALA), micellar casein (CN), and milk protein isolate (MPI). In study 1, 40 adults (20 males, 24.4 ± 5.2SD y; 20 females, 24.2 ± 3.5SD y) tested MPF in whole milk. In study 2, 44 adults (22 males, 30.5 ± 9.8SD y; 20 females, 26.6 ± 8.0SD y) tested MPF in water. In study 3, 40 adults (20 males, 26.3 ± 5.3SD y; 20 females, 26.2 ± 5.3SD y) tested freeze-dried whole milk MPF. Acceptability of taste, flavor, mouthfeel, and aftertaste were measured using the 9-point hedonic scale. Sweetness, bitterness, saltiness, astringency was assessed using a 100-mm visual analog scale. Statistical analysis was performed with Friedman’s test. In study 1 the mean hedonic scores were between 3.4 and 6.0. There was an effect of treatment on taste, flavor, mouthfeel, aftertaste, sweetness, bitterness, saltiness, and astringency (P < 0.05). Taste, flavor, mouthfeel, and aftertaste for ALA was higher compared with MPI, GMP, and CN (P < 0.05). In study 2 the mean hedonic scores were between 2.5 and 5.1. Taste and flavor for GMP were lower compared with other treatments except CN (P < 0.05). In study 3 the mean hedonic scores were between 3.9 and 4.8, however there was no effect of a treatment on hedonic scores and astringency. WPI-IE, WPI-MF, ALA, and GMP were sweeter than CN and MPI (P < 0.05). In conclusion, MPF have different sensory characteristics that can be modulated by a food matrix and potentially improved using small to moderate amounts of natural sweeteners and flavoring agents.

Key Words: milk proteins, hedonic, sensory