Student Travel Award Recipient

Evaluate the Effect of Industrial Thermal Treatments on the Enzymatic Release of N-Glycans from Milk Glycoprotein

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Milk oligosaccharides are indigestible carbohydrates proven to positively influence the shaping of the gut microbiota. Because N-glycans are structurally similar to milk oligosaccharides, they may potentially promote the growth of beneficial strains of bifidobacteria. Preliminary results show a strain-specific prebiotic selectivity of N-glycans after release from bovine whey proteins using a recently discovered Endo-β-N-acetylglucosaminidase (EndoBI-1) enzyme. Hence, there is strong potential for the recovery of N-glycans after dairy processing for subsequent use as a selective prebiotic ingredient in formulations together with bovine milk oligosaccharides. Industrial heat treatments conventionally used on bovine milk (pasteurization and sterilization) may affect whey glycoproteins by unfolding the globular structures differently, potentially modifying the degree of enzymatic release of N-glycans. In this study, we investigated the effects of High Temperature Short Time (HTST: 72°C for 15 sec) and Ultra High Temperature (UHT: 135°C for 3 sec) on the enzymatic release of N-glycans from bovine colostrum glycoproteins. Samples were heat treated using a continuous Microthermics pilot-scale HTST/UHT pasteurizer. Nano-Liquid Chromatography-Chip-Quadrupole-Time-of-Flight Mass spectrometry (Nano-LC-Chip-Q-TOF MS) was used to profile and annotate N-glycans. This work is the first to evaluate the effects of heat treatments on N-glycans release and to demonstrate that HTST represents the ideal combination of time and temperature to maximize the release of all N-glycans classes (neutral fucosylated, neutral non-fucosylated, and sialylated N-glycans) using EndoBI-1. In contrast, the UHT treatment did not favor the enzymatic release of N-glycans. This result might due to unfavorable enzyme accessibility or possible damage to glycoproteins structure due to increased denaturation. Based on these results, we propose that HTST might induce protein unfolding in ways that favor enzymatic accessibility to the N-glycosylation sites and achieve a higher abundance of N-glycans released compared with UHT.