

Interrelations between chemical changes in lactose-free UHT milk

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Lactose free milk is an important dairy alternative for lactose intolerants. However, lactose-free ultra-high temperature (UHT) milk has a shorter shelf life (6 months) than conventional UHT milk (9 months), which challenges export and product distribution for the food industry, as well as sensory qualities in relation to consumers. The shorter shelf-life is linked to a higher reactivity of the lactase generated galactose and glucose as substrate for the Maillard reaction compared to lactose. Moreover, lactase preparations with different purities may differently affect the Maillard reaction. Furthermore, proteolytic activities in lactose-free milk can lead to bitter peptide formation and, in pathways either involving Maillard reactions or not, may also lead to protein cross-links and aggregation. These process-linked changes can contribute to accelerated product deterioration in lactose-free UHT milk. Therefore, the overall goal of this project is to improve shelf-life and quality of lactose-free UHT milk. In the study, three new lactase enzymes, which differ in purities and activities, will be characterized. Different lactase enzymes will be added to UHT-treated whole milk, either pre- or post-hydrolysis. The milk samples will be stored for up to one year at either 25 or 35 °C. Mass spectrometry and different protein analytical methods will be used to investigate proteolytic activities, Maillard reaction, cross-links, aggregate formation and inter-relations between these chemical changes. To study the Maillard reaction and process induced cross-links in relation to aggregation, a new mass spectrometry (MS) single step method in MRM mode using Triple Q MS has been developed to quantify markers of these reactions (furosine, N-carboxymethyllysine (CML), N-carboxyethyllysine (CEL), lysinoalanine (LAL) and lanthionine (LAN)).