Influence of Cooling Rate on Goat's Cream Crystallization

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Crystallization and melting properties of triacylglycerols (TG) within goat's milk fat globules (GMFG) of cream are investigated by X-ray diffraction as a function of temperature (XRDT) coupled with high-sensitivity differential scanning calorimetry (DSC), using synchrotron radiation and Microcalix. The polymorphic behavior of GMFG was monitored at different cooling rates between 3 and 0.1 °C/min from 50 °C to -8 °C and during their subsequent melting at 1 °C/min. Quenching of GMFG at -20 and 4 °C was also examined to determine the metastable polymorphic forms of GMFG. At intermediate cooling rates, unstable crystalline varieties are formed in the dispersed state. TG's GMFG crystallize, from about 17.5 °C under two different lamellar structures, with double-chain length (2L) packing of 45 Å and triple-chain-length (3L) stacking of 69, 35 and 23 Å which are correlated to two overlapped exothermic peaks recorded by DSC. Depending on the cooling rate, at least 5 crystalline subcell species are observed at wide angles, a, sub a, two b' and one b. Subsequent heating at 1 °C/min shows numerous structural rearrangements before final melting at 34 °C. All these data are compared to those obtained at slow cooling (0.1 °C/min) showing a relative stability of the structures formed. Comparison of thermal and structural properties of Anydrous goat's milk fat **(1, 2)** with Goat's cream shows that TG crystallization is delayed and more disordered in emulsion. This complex crystallization behavior might have important consequences on textural and rheological properties as well as on the flavor evolutions of goat's milk-based food (especially cheese) through the lipolysis reactions.

Keywords: Goat's cream; Polymorphism; triacylgycerols; X-ray diffraction; differential scanning calorimetry; cooling rates.

References

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