

# The influence of the health of the cow on milk micelles

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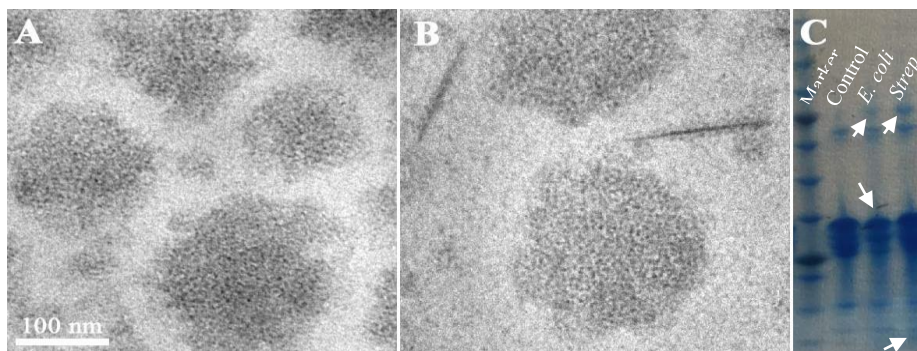
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Bovine milk contains nutrients needed for the growth and development of the calf. The milk functions as a resource of lipids, proteins, amino acids, vitamins and minerals. Protein in bovine milk contains 80% caseins such as  $\alpha$ -s<sub>1</sub>-casein ( $\alpha$ <sub>s1</sub>CN),  $\alpha$ -s<sub>2</sub>-casein ( $\alpha$ <sub>s2</sub>CN), beta-casein ( $\beta$ CN), and kappa-casein ( $\kappa$ CN), and 20% whey proteins as  $\alpha$ -lactoglobulin,  $\beta$ -lactoglobulin and blood bovine albumin. About 95% of the casein proteins in milk exist as colloidal particles (~ 250 nm in diameter), known as Casein Micelles (CM) [1]. Various models have been proposed for the CM structure. Generally, it is accepted that  $\alpha$ <sub>s1</sub>CN,  $\alpha$ <sub>s2</sub>CN and  $\beta$ CN are embedded within the micelle interior, while the majority of  $\kappa$ CN is displayed on the surface, forming a so-called “hairy layer” [2].

To understand factors affecting the milk micelles, we study fresh milk samples as well as the structure and properties of isolated caseins [3] and the interactions between different caseins.

Isolated  $\kappa$ CN creates classical (surfactant-like) micelles, as well as amyloid-like fibrils. In milk, however,  $\kappa$ CN fibrillization is inhibited by the association of all the caseins [3]. Another factor known to affect the quality of the milk and its products, which are determined by the amounts of every component in the milk, the structure and the size of the CMs and the size of the fat globules, is the health of the cow. In the present work we examine the influence of bacteria infection on the structure of CM (Figure 1, panels A and B [5]). Significant differences are noted in the structure of CMs and the composition of milk infected by bacteria compared with uninfected milk. Some of the differences are associated with the specific type of bacteria[4]. Structurally, disassembly of the colloidal milk micelles is found in some conditions, as well as fibrillization [6]. Differences in the protein composition are also noted (Figure 1, panel C).



**Figure.1:** (A) Cryo-TEM image of Casein Micelles (CM) in milk from a healthy cow. (B) Cryo-TEM image of CM with  $\kappa$ CN “needles” in milk from an infected cow. (C) SDS PAGE of milk proteins from a healthy cow and from infected cows.

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