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Focus on Milk Fat Globule Membrane Proteins from Goat Milk

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Fat is present in milk as droplets of triglycerides surrounded by a complex membrane deriving from the mammary epithelial cell and called the Milk Fat Globule Membrane (MFGM). In-depth proteomic studies have been published for bovine MFGM proteins. However, to date, only sparse studies exist on MFGM proteins from non-cow milks. The objective of this study was thus to investigate the protein composition of the goat Milk Fat Globule Membrane. MFGM proteins from goat milk were separated by 6% and 10% SDS-PAGE and Coomassie or Periodic Acid / Schiff (PAS) stained. Most of MFGM proteins (mucin-1, fatty acid synthase, xanthine oxidase, butyrophilin, lactadherin and adipophilin) already described in cow milk were identified in goat milk using peptide mass fingerprinting. A prominent difference between the cow and the goat species was demonstrated for lactadherin. Indeed, we have shown that lactadherin from goat milk appears as a single polypeptide chain in 6% SDS PAGE whereas two polypeptide chains are easily identified in cattle. In addition, goat MFGM proteins were subjected to 1D-LC-MS/MS (one dimensional gel coupled to tandem mass spectrometry) analysis. 25 µg MFGM proteins were separated in 10% SDS-PAGE and Coomassie stained. The lane was divided in twenty slices and each slice was digested by trypsin and subjected to LC/MS/MS analysis. This approach led us to identify - with at least two unique peptides (Bos Taurus Database)- more than 160 proteins associated with the goat Milk Fat Globule Membrane. Interestingly, integrative analysis of MFGM-associated proteins using DAVID Bioinformatics Resources demonstrated that identified biological processes are not only connected with lipid metabolic processes or exocytosis-related biological processes, but also with G-protein receptor signaling pathway, translation, or regulation of apoptosis, as previously demonstrated for MFGM proteins from bovine milk. These findings may help in the understanding of lipid droplet formation in the goat species, where an apocrine mechanism for milk secretion is hypothesized.