

## **Anti-inflammatory and Immunomodulating potential of Extracellular Vesicles from Animal Milk**

Milk extracellular vesicles (mEVs) are emerging as powerful mediators of immune regulation and inflammation control, with significant implications for both human and animal health. They are capable of crossing biological barriers and maintaining cargo integrity even in harsh environments like the gastrointestinal tract. mEVs have shown the ability to interact with various cell types, including fibroblasts, macrophages, intestinal epithelial, and vascular endothelial cells, facilitating widespread biodistribution and modulating innate and adaptive immunity. Recent studies highlight the therapeutic potential of bovine mEVs in treating inflammatory bowel diseases (IBD), such as Crohn's disease and ulcerative colitis, by reducing cytokine production, oxidative stress, and restoring gut homeostasis. In livestock, their antimicrobial and immunomodulatory properties offer promising alternatives to antibiotics, with potential applications in mastitis and enteritis, contributing to reduced antimicrobial resistance and improved animal welfare. Despite their potential, the clinical application of mEVs is hindered by preservation challenges. While storage at  $-80^{\circ}\text{C}$  maintains vesicle integrity, it is impractical for routine use. Developing a stabilization method that preserves mEVs at ambient temperature without affecting their function is crucial to enable their use in both clinical and agricultural settings, in line with the One Health approach.