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A New Frontier in Sustainable Dairy Innovation While Enhancing Health

Whey protein phospholipid concentrate (WPPC), a coproduct of whey protein isolate production, has long been underutilized—primarily relegated to low-value uses like animal feed. But this paper makes a compelling case for repositioning WPPC as a nutrient-rich, functional ingredient for next-generation dairy foods. The authors highlight WPPC's rich content of bioactive compounds, including milk fat globule membrane (MFGM) proteins and polar lipids, which offer health benefits such as immune modulation, brain development support, and anti-inflammatory effects.

Recent analyses show that WPPC contains significantly higher levels of key MFGM proteins—like GLYCAM-1, lactadherin, and xanthine oxidase—and phospholipids like phosphatidylcholine and sphingomyelin, compared to milk. These bioactives mirror those found in human milk, making WPPC especially promising for use in infant formula, functional foods, and medical nutrition.



Functionally, WPPC can serve as a clean-label emulsifier, egg replacer, or fat substitute in foods like ice cream, caramels, and baked goods. Economic modeling showed that replacing eggs with WPPC in cake recipes could cut ingredient costs by up to 9%, making it attractive to commercial bakers.

However, some challenges still remain, including limited processing methods for the extraction of individual bioactives. The takeaway? WPPC represents a valuable opportunity for the dairy industry to provide a high-value, health-enhancing ingredient—but realizing this potential will require both technological innovation and a clear, sustained value proposition for food manufacturers.

Inflammatory Bowel Disease: Can Lactoferrin Help?



Lactoferrin is known for its antimicrobial, antiviral, antifungal, and antiparasitic properties, along with its ability to modulate immune responses and enhance gut barrier integrity. A recent review looked at the therapeutic potential of this iron-binding protein found in milk and various bodily fluids, in the context of inflammatory bowel diseases (IBDs) such as Crohn's disease and ulcerative colitis. Bovine-derived lactoferrin (bLF) has been granted GRAS (Generally Recognized As Safe) status and is already incorporated into foods like infant formula and supplements. Studies show that LF can be beneficial in conditions of gut inflammation due to several overlapping mechanisms:

- Supports intestinal barrier health by promoting epithelial cell growth, decreasing cell death, and enhancing the expression of tight junction proteins.
- Modulates immune responses by binding to LF receptors on intestinal and immune cells, suppressing pro-inflammatory cytokines (e.g., TNF- α , IL-6) and boosting anti-inflammatory cytokines (e.g., IL-10).
- Exerts antimicrobial and antiviral effects through both direct microbial disruption and immune system stimulation, with specific activity against *Clostridium difficile*, *Candida albicans*, rotaviruses, and even parasites.
- Reduces intestinal inflammation and tissue damage in animal models of colitis by limiting cytokine production, enhancing mucosal repair, and altering gut microbial composition.
- Protects against systemic inflammation in LPS-induced models by inhibiting key inflammatory signaling pathways (NF- κ B, MAPK), preserving gut architecture, and lowering circulating TNF- α levels.

Despite promising preclinical results, clinical evidence in humans is still limited. The review emphasizes the need for well-controlled human trials to assess the safety, dosage, and efficacy of LF as an adjunct treatment for chronic intestinal inflammation. Further studies should also explore:

- How LF survives digestion and distributes in the gut.
- Its influence on gut microbiota composition and metabolic activity.
- The identification and characterization of active LF-derived peptides.
- Improved formulations (e.g., encapsulation) to protect LF from gastrointestinal degradation.

LF also functions as a biomarker of intestinal inflammation, with fecal levels correlating with disease severity due to neutrophil infiltration. Overall, while LF is not a replacement for standard therapies, it shows considerable promise as a complementary approach to support gut health in individuals with IBD.

Blais. Explor Med. 2025;6:1001330.

Long Covid Improvements with Lactoferrin, Co Q10 and Echinacea

The global impact of SARS-CoV-2 has extended beyond acute infection, with many individuals experiencing lingering symptoms known as long COVID (LC), often persisting for 12 weeks or more. While the underlying mechanisms remain unclear, accumulating evidence points to persistent cellular stress and mitochondrial dysfunction. In this study, a COVID-19 pseudovirus model was used to simulate acute cellular changes relevant to long COVID. ACE2-expressing 293T cells infected with the pseudovirus showed a marked buildup of ferrous ions within mitochondria, followed by their release into the cytosol. This iron imbalance triggered excessive reactive oxygen species (ROS) production and led to significant mitochondrial dysfunction.

To assess potential nutritional interventions, lactoferrin, coenzyme Q10 (Q10), and Echinacea purpurea extract (EPE) were tested. All three compounds significantly reduced ferrous ion accumulation and mitochondrial ROS levels, helping to restore mitochondrial function. High-performance liquid chromatography (HPLC) analysis revealed that EPE was particularly rich in caffeic acid, which may contribute to its strong protective effects. These findings suggest that nutritional strategies incorporating lactoferrin, Q10, and EPE may help mitigate mitochondrial damage and oxidative stress associated with post-viral cellular changes, offering a potential approach for managing long COVID symptoms at the cellular level.

Chen et al. Life(2025):15(6), 980

Therapeutic Effects of Whey Protein Plus Probiotic in Colitis



Combined supplementation with whey protein (0.2 g per kg body weight) and *Lactobacillus rhamnosus* GG (8 log CFU/day) was shown to reduce the severity of colitis in a dextran sulfate sodium (DSS)-induced mouse model. C57BL/6J mice were divided into four groups: healthy controls, colitic mice without treatment, colitic mice receiving whey protein alone, and colitic mice receiving both whey protein and the probiotic. Mice given whey protein—either alone or in combination—experienced less weight loss, maintained healthier colon structure, and showed lower disease activity scores. Histological analysis further indicated that the group receiving both whey protein and the probiotic had significantly reduced inflammatory cell infiltration in the colon. Assuming the mouse model reflects aspects of human disease, these results suggest that whey protein, particularly when combined with a probiotic, may help manage colitis symptoms by modulating inflammation and immune responses without relying on pharmaceutical interventions.

Ascanio et al. International Dairy Journal(2025):106336.

MFGM Formulations Enhance Stability and Immune Effects of DHA and Lutein

Incorporating bioactive lipids like DHA and lutein into foods is difficult due to their poor water solubility and chemical instability. This study evaluated milk fat globule membrane (MFGM)-based delivery systems for their ability to stabilize these lipids and preserve their biological activity, comparing them to conventional bile salt-based controls. Lipid analysis revealed a richer polar lipid profile in MFGM formulations. In immune response assays using THP1-Lucia™ NF-κB cells, the MFGM-lutein formulation significantly suppressed NF-κB activation by up to 69% at higher concentrations, with no signs of cytotoxicity. MFGM-DHA also reduced NF-κB activation, but only when co-formulated with lutein—suggesting lutein may help protect DHA from oxidation. Control formulations failed to show similar bioactivity and were cytotoxic. These results support the use of MFGM as a promising vehicle for delivering immunomodulatory lipids and improving their stability in functional food applications.

Señoráns et al. Eur Food Res Technol(2025).

Ascanio et al. International Dairy Journal(2025):106336.