

Medication Analysis Report (Practitioner Version)

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Medication: lactoferrin

Drug Class: Lactoferrin is classified as an iron-binding glycoprotein and immunomodulatory agent. Therapeutically, it functions as a nutritional supplement, antimicrobial protein, and immunomodulator. It belongs to the transferrin family of iron-binding proteins.

Analysis Confidence: 0.75/1.00

Pharmacology

Mechanism of Action

Lactoferrin exerts multiple mechanisms at the molecular level: (1) Iron sequestration - binds ferric iron (Fe^{3+}) with high affinity ($K_d \sim 10^{-20} \text{ M}$), depriving pathogens of essential iron for growth; (2) Direct antimicrobial activity - binds to lipopolysaccharides (LPS) on bacterial cell walls causing membrane disruption and increased permeability; (3) Antiviral effects - binds to heparan sulfate proteoglycans and viral particles, blocking cellular entry of viruses; (4) Immunomodulation - interacts with immune cells via specific receptors (LRP1, intelectin-1), modulating cytokine production (decreases IL-6, $\text{TNF-}\alpha$, increases IL-10); (5) Anti-inflammatory action -

inhibits NF- κ B pathway activation and reduces oxidative stress; (6)
Promotes beneficial gut microbiota by selective antimicrobial activity favoring bifidobacteria growth.

Pharmacokinetics

- **Absorption:** Oral bioavailability of intact lactoferrin is low (approximately 1-5% in adults) due to gastric acid degradation and proteolytic digestion in the gastrointestinal tract. In neonates and infants, absorption is higher (up to 60%) due to presence of specific lactoferrin receptors in the intestinal epithelium and lower gastric acidity. Peak plasma concentrations are not well-established due to limited systemic absorption. Most biological effects occur locally in the gastrointestinal tract. Enteric-coated formulations may improve stability.
- **Metabolism:** Orally administered lactoferrin undergoes extensive proteolytic degradation in the gastrointestinal tract by pepsin, trypsin, and other digestive enzymes, producing bioactive peptides (lactoferricin, lactoferrampin). These peptides retain some antimicrobial and immunomodulatory properties. Metabolism does not involve hepatic cytochrome P450 enzymes. Small amounts of intact lactoferrin that are absorbed may be metabolized by tissue proteases or recycled via receptor-mediated endocytosis.
- **Elimination:** Primary route of elimination is through fecal excretion of unabsorbed protein and peptide fragments following gastrointestinal degradation. Minimal renal excretion occurs due to low systemic absorption. Any absorbed lactoferrin or peptides are likely eliminated through normal protein catabolism pathways and renal filtration of small peptides.
- **Half-Life:** The elimination half-life of orally administered lactoferrin has not been precisely determined due to extensive gastrointestinal degradation and minimal systemic absorption. Endogenous plasma

lactoferrin has an estimated half-life of approximately 10-20 minutes. Gastrointestinal transit time (2-4 hours in small intestine) is more relevant for oral supplementation effects.

Clinical Use

Approved Indications

1. No FDA-approved therapeutic indications. Lactoferrin is available as a dietary supplement and food ingredient (Generally Recognized as Safe - GRAS status)
2. Used as a component in infant formulas to approximate human milk composition
3. Approved as a food additive in various countries for nutritional fortification

Off-Label Uses

1. Prevention and treatment of necrotizing enterocolitis in preterm infants
2. Reduction of late-onset sepsis in neonates
3. Treatment of iron deficiency anemia (as iron carrier)
4. Management of inflammatory bowel disease symptoms
5. Prevention of common cold and upper respiratory infections
6. Adjunctive treatment for *Helicobacter pylori* eradication
7. Management of dry eye syndrome (topical ophthalmic use)
8. Support for immune function in immunocompromised patients
9. Treatment of acne vulgaris (topical)
10. Prevention of antibiotic-associated diarrhea
11. Management of chronic hepatitis C

12. Adjunctive cancer therapy support

Dosing

Standard Dosing:

As a dietary supplement: 100-300 mg orally once or twice daily. For neonatal sepsis prevention: 100-200 mg orally once or twice daily. For iron deficiency: 100 mg twice daily with meals. For immune support: 250-500 mg daily. For gastrointestinal conditions: 200-400 mg twice daily. Dosing varies widely based on indication and product formulation. Optimal dosing has not been established through rigorous clinical trials for most applications.

Dose Adjustments:

- **Renal Impairment:** No specific dose adjustment required. Due to minimal systemic absorption and renal elimination, lactoferrin supplementation does not require modification in renal impairment. Use with standard dosing.
 - **Hepatic Impairment:** No specific dose adjustment required. Lactoferrin does not undergo hepatic metabolism via cytochrome P450 enzymes. Use with standard dosing in hepatic impairment.
 - **Pediatric:** Neonates and infants: 100-200 mg daily divided into 1-2 doses. Children: 100-250 mg daily. Pediatric dosing should be based on clinical indication and body weight when used off-label.
 - **Geriatric:** No specific adjustment required. Standard adult dosing may be used. Consider starting at lower end of dosing range.
 - **Pregnancy Lactation:** Pregnancy Category: Not assigned (dietary supplement). Generally considered safe as it is a natural component of human milk. Lactation: Safe and compatible with breastfeeding as lactoferrin is naturally present in breast milk at high concentrations.
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Safety Profile

Adverse Effects

Drug-Drug Interactions

Moderate Interactions (5)

Fluoroquinolone antibiotics (ciprofloxacin, levofloxacin, moxifloxacin):

Decreased fluoroquinolone bioavailability by up to 50-90%, potentially resulting in subtherapeutic antibiotic levels and treatment failure

Tetracycline antibiotics (doxycycline, minocycline, tetracycline):

Reduced tetracycline absorption and serum concentrations, potentially compromising antimicrobial efficacy

Levothyroxine:

Decreased levothyroxine absorption leading to reduced thyroid hormone levels and potential hypothyroid symptoms or loss of thyroid control

Bisphosphonates (alendronate, risedronate, ibandronate):

Markedly decreased bisphosphonate bioavailability (up to 60% reduction), potentially reducing bone mineral density benefits

Levodopa/Carbidopa:

Reduced levodopa absorption and decreased plasma concentrations, potentially worsening Parkinsonian symptoms or causing motor fluctuations

Minor Interactions (5)

- Antacids (calcium carbonate, magnesium hydroxide, aluminum hydroxide): Possible minor reduction in lactoferrin or iron bioavailability, though clinical significance is uncertain
 - Proton pump inhibitors (omeprazole, pantoprazole, esomeprazole): Potentially decreased iron bioavailability from lactoferrin, though lactoferrin has multiple functions beyond iron delivery
 - H2 receptor antagonists (ranitidine, famotidine): Minor potential reduction in iron absorption, though overall clinical impact is likely minimal
 - Zinc supplements: Potential minor reduction in absorption of either mineral when taken simultaneously in high doses
 - Calcium supplements: Possible minor decrease in iron absorption when high-dose calcium is co-administered
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Food & Lifestyle Interactions

No significant food interactions identified.

Environmental Considerations

No significant environmental considerations identified.

Evidence-Based Recommendations

Monitoring Requirements

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For Medical Professional Use Only

Evidence Quality: MODERATE

DISCLAIMER:

This analysis is for research and educational purposes only. It provides critical analysis of medical literature and evidence-based information but does **not** constitute medical advice, diagnosis, or treatment recommendations.

Always consult qualified healthcare professionals

for medical decisions, treatment plans, and health-related questions. The information presented here should not replace professional medical judgment or be used as the sole basis for healthcare choices.

Key Limitations:

- Medical knowledge evolves rapidly; information may become outdated
- Individual health situations vary significantly
- Not all studies are equal in quality or applicability
- Risk-benefit assessments must be personalized
- Drug interactions and contraindications require professional evaluation

This analysis aims to inform and educate, not to direct medical care. When in doubt, seek professional medical guidance.