Precision Microbial Cartography

A Visual Synthesis of the 2023 WGO Global Guidelines on Probiotics and Prebiotics

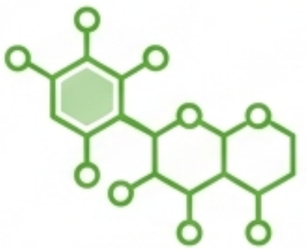
Definitive Clinical Reference for Evidence-Based Gastrointestinal Interventions.

The ‘-Biotic’ Lexicon

PROBIOTICS

Live microorganisms that, when administered in adequate amounts, confer a health benefit on the host.

Note: Excludes traditionally fermented foods without controlled human trials.



PREBIOTICS

A selectively fermented ingredient that results in specific changes in the composition and/or activity of the GI microbiota.

Examples: Oligofructose (FOS), Inulin, GOS, Lactulose

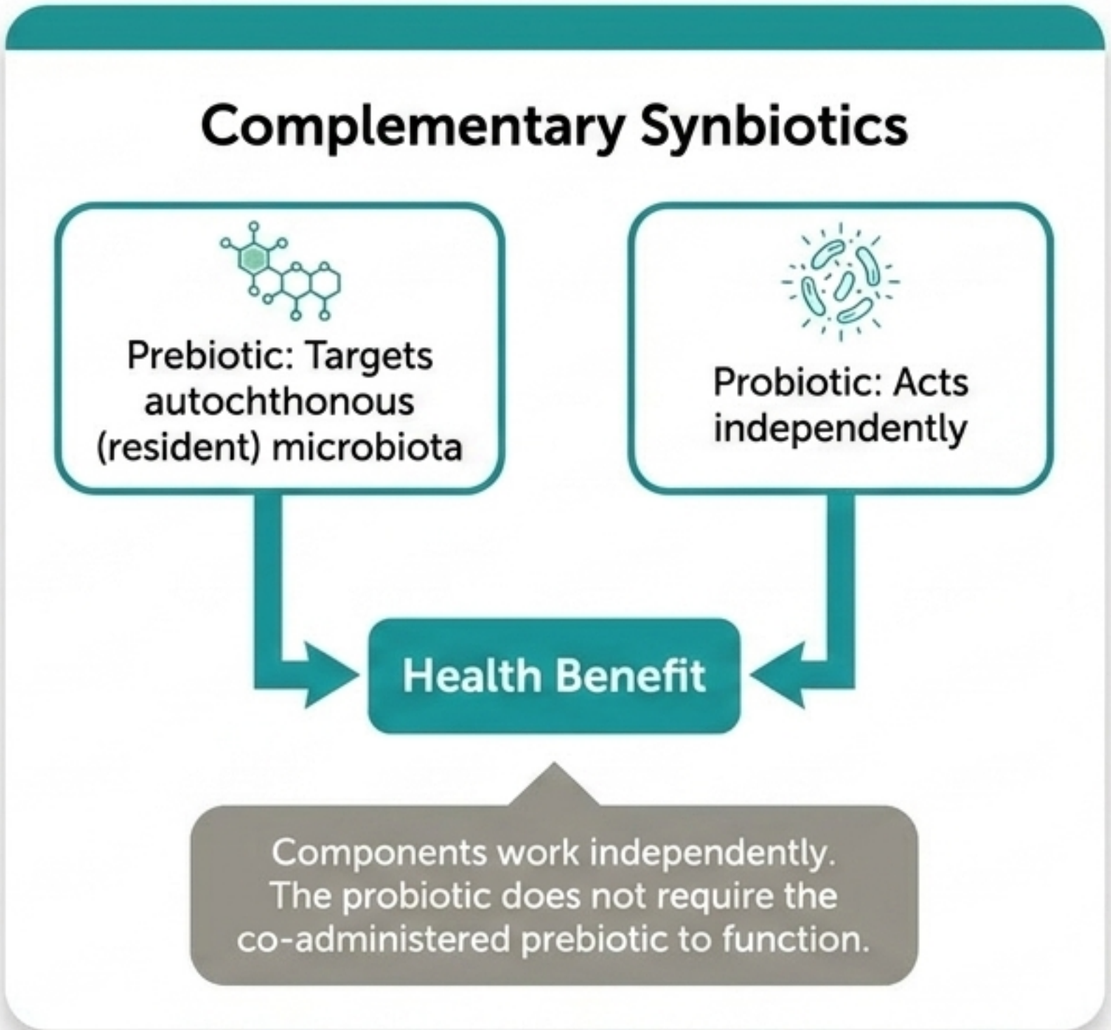
SYNBIOTICS

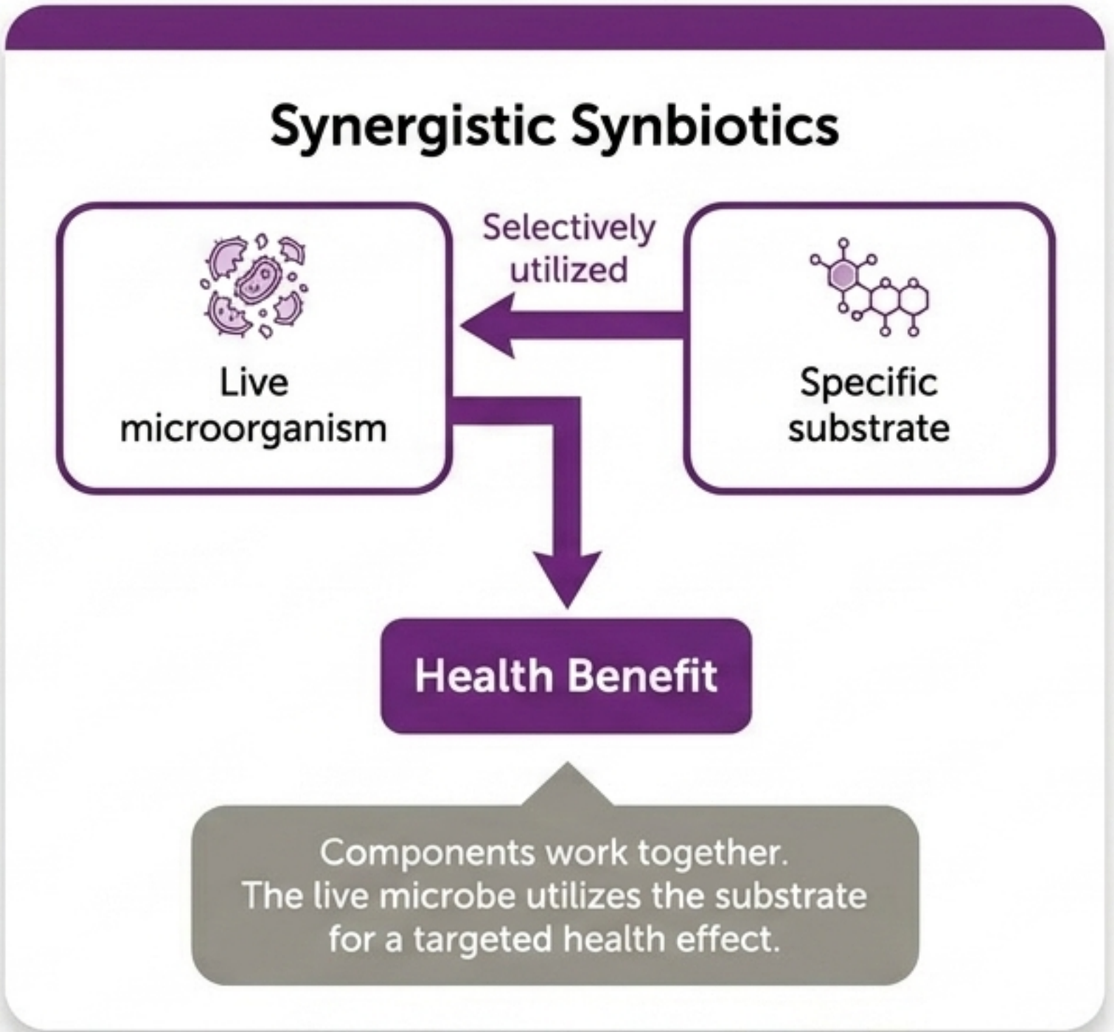
A mixture comprising live microorganisms and substrate(s) selectively utilized by host microorganisms.

POSTBIOTICS

A preparation of inanimate microorganisms and/or their components that confers a health benefit.

The Evolution of Synbiotics: Complementary vs. Synergistic





The Biological Theater: Human Intestinal Microbiota

Stomach and Duodenum

< 10^3 cells per gram of contents

Acid, bile, and pancreatic secretions suppress microbes. Phasic propulsive motor activity impedes stable colonization.

Flora: Mainly lactobacilli and streptococci.

Jejunum and Ileum

10^4 to 10^7 cells per gram

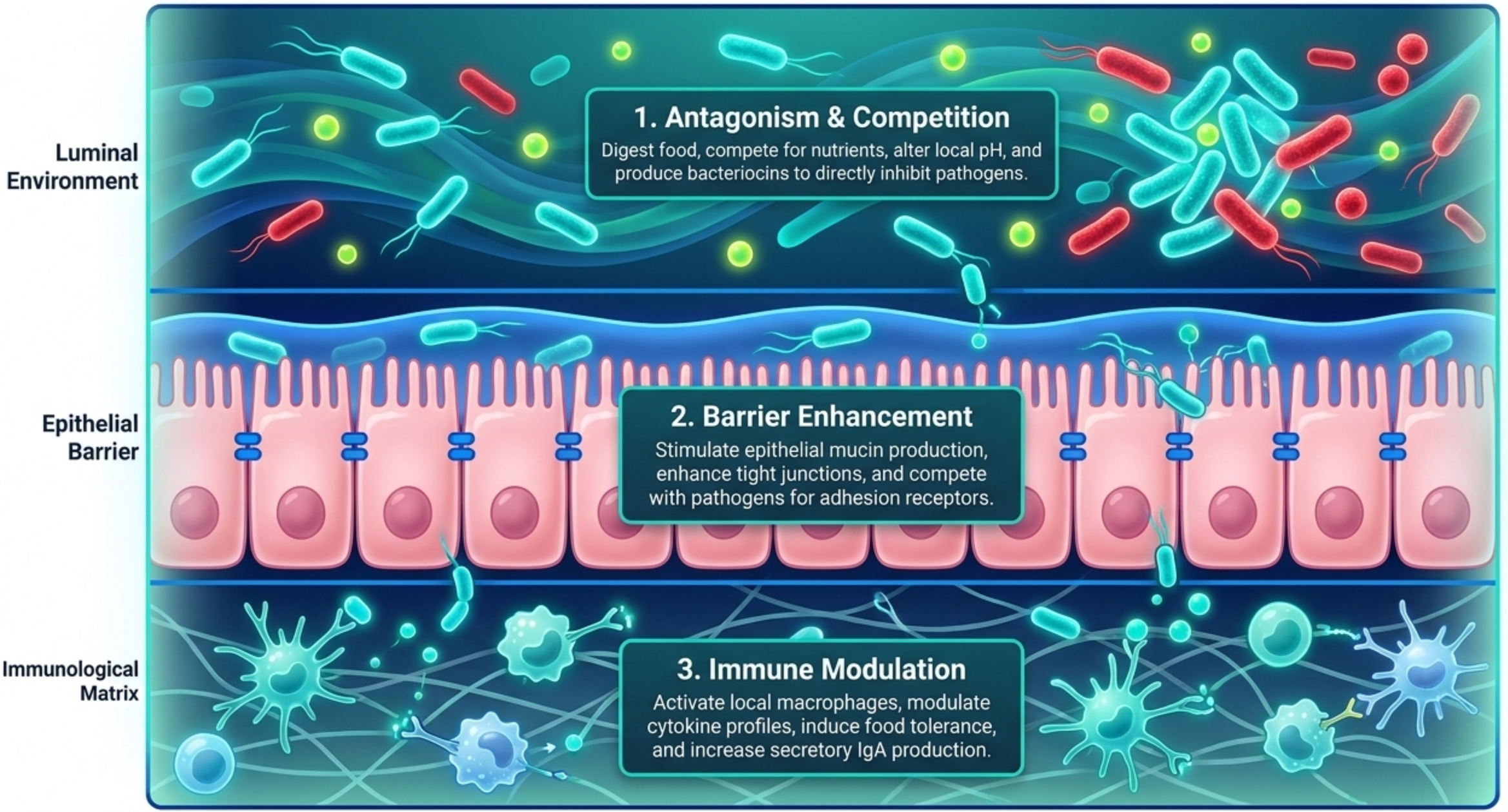
Density progressively increases from the jejunum to the distal ileum.

Large Intestine

Up to 10^{12} cells per gram

Over 40 trillion total bacterial cells. Heavily populated by anaerobes (Firmicutes and Bacteroidetes account for >90%). **Symbiotic relationship fostering immune induction.**

The Mechanism Triad: How Probiotics Modulate the Host



The 2020 Taxonomy Translation: The *Lactobacillus* Breakup

23 new genera were defined to address the wide diversity of microbes previously grouped under *Lactobacillus*.

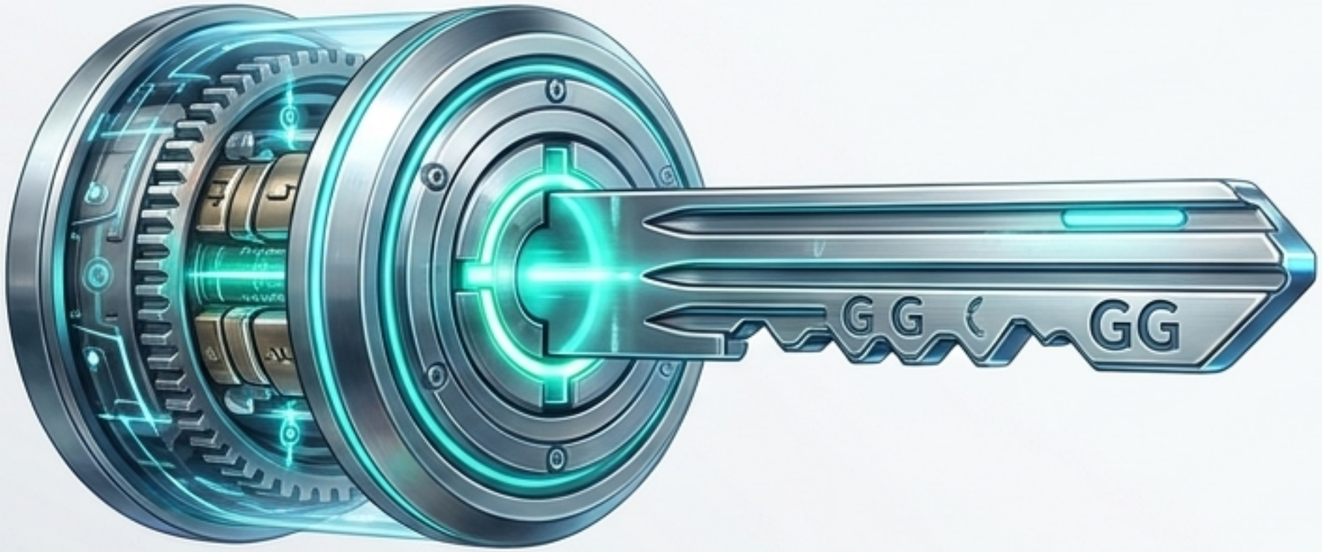
OLD TAXONOMY *(Lactobacillus sensu lato)*	NEW TAXONOMY
Lactobacillus casei	**Lacticaseibacillus casei**
Lactobacillus paracasei	**Lacticaseibacillus paracasei**
Lactobacillus rhamnosus	**Lacticaseibacillus rhamnosus**
Lactobacillus plantarum	**Lactiplantibacillus plantarum**
Lactobacillus brevis	**Levilactobacillus brevis**
Lactobacillus salivarius	**Ligilactobacillus salivarius**
Lactobacillus fermentum	**Limosilactobacillus fermentum**
Lactobacillus reuteri	**Limosilactobacillus reuteri**

Retained Nomenclature

L. acidophilus, *L. gasseri*, *L. crispatus*, *L. johnsonii*, *L. helveticus*, *L. helveticus*, and *L. delbrueckii* subsp. *bulgaricus* retain the *Lactobacillus* genus.

The Principle of Strain-Specific Precision

Saying **“take a probiotic for gut health”** is as **scientifically vague** as saying **“take a pill for sickness.”** Clinical efficacy is inextricably linked to the precise strain and dose.



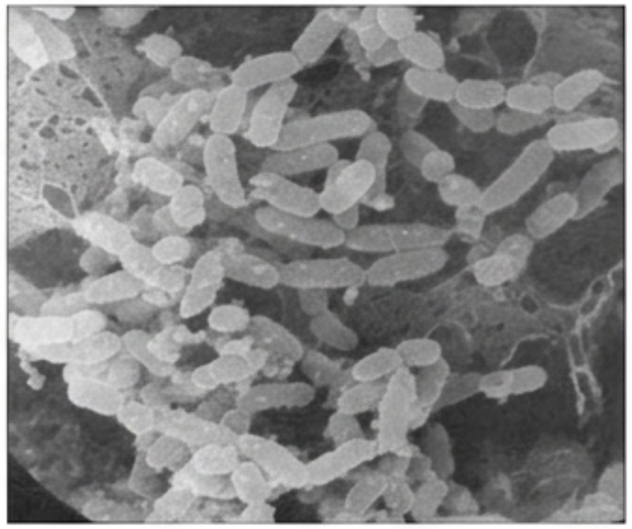


Figure: Electron micrograph of *L. salivarius* 118.

The Anatomy of a Probiotic

Genus: *Lacticaseibacillus* (The Family) → **Species:** *rhamnosus* (The Individual) → **Strain Designation:** GG (The Specific Genetic Key) → **Result:** A highly specific clinical mechanism (e.g., ATCC 53103 LGG).

Callout: Meta-analyses combining different strains are only valid if shared mechanisms of action are proven. Otherwise, evidence must remain rigorously strain-specific.

The Product and Regulatory Landscape

Foods & Meal Replacements	Dietary Supplements	OTC Drugs / Natural Health Products	Prescription Drugs
Target: Generally healthy populations. **Allowable Claims:** **Allowable Claims:** "Improves or maintains health." Mentions of disease or illness are strictly prohibited.	**Format:** Tablets, capsules, freeze-dried sachets. **Allowable Claims:** General health maintenance. Quality depends entirely on the manufacturer (potency, purity, identity).	**Target:** People needing to prevent or treat mild disease (e.g., Canada's specialized category). **Allowable Claims:** Labeled for use in managing mild medical conditions.	**Target:** Patients needing to treat or prevent specific diseases. **Allowable Claims:** Treats or prevents explicit disease states. Subject to stringent pharmaceutical standards.

Reading the Dashboards: The Evidence Gauge

Based on the Oxford Centre for Evidence-Based Medicine (CEBM) 2011 Levels.

Level 5	Level 4	Level 3	Level 2	Level 1
Mechanism-based reasoning (In vitro/animal).	Case-series, case-control, or historically controlled studies.	Supported by a single randomized controlled trial (RCT).	Randomized trials with consistent effect, without systematic review.	Systematic review of randomized trials. The gold standard.

Note: *Levels may be graded downward for study quality/imprecision, or upward for massive effect sizes. Dashboards ahead feature only positive trials for specific strains at specific doses.*

Adult Clinical Dashboard: Diarrheal Diseases

Antibiotic-Associated Diarrhea (AAD) Prevention

LOE 1

Strain: *Saccharomyces boulardii* CNCM I-745
Dose: 5 x 10^9 cfu or 250 mg, twice daily.

(Systematic Reviews)

AAD Prevention

LOE 1

Strain: *Lacticaseibacillus rhamnosus* GG
Dose: 10^10 cfu, twice daily.

(Systematic Reviews)

C. difficile-Associated Diarrhea Prevention

LOE 2

Strain: *Saccharomyces boulardii* CNCM I-745
Dose: 10^9 cfu or 250 mg, twice daily.
Outcome: Primary prevention

H. pylori Eradication (Coadjuvant Therapy)

LOE 2

- *S. boulardii* CNCM I-745
- *B. animalis* subsp. *lactis* Bb12 + *L. rhamnosus* GG

Outcome: Increases eradication rates by reducing therapy-related side effects, improving patient compliance. (Does not directly eradicate *H. pylori* alone).

Adult Clinical Dashboard: Irritable Bowel Syndrome (IBS)

Insight: Reductions in bloating, flatulence, and global pain relief are consistent findings, but efficacy remains strictly strain-specific.

Global IBS Symptoms & Quality of Life

LOE 2

Strain: *Bifidobacterium bifidum* MIMBb75
Dose: 1 x 10^9 cfu, once daily.

Note: Heat-inactivated MIMBb75 also alleviates symptoms.

Severity of Abdominal Pain and Bloating

LOE 2

Strain: *Lactiplantibacillus plantarum* 299v (DSM 9843)
Dose: 1 x 10^10 cfu, once daily.

Global Assessment Improvement

LOE 2

Strain: *Bifidobacterium infantis* 35624
Dose: 1 x 10^10 cfu, once daily.

Prebiotic Intervention (Persistence of symptoms)

LOE 2

Ingredient: Galactooligosaccharides (GOS)
Dose: 3.5 g daily.

Adult Clinical Dashboard: IBD & Liver Disease

Inflammatory Bowel Disease (IBD)

Ulcerative Colitis (Maintenance of Remission)

LOE 2

Strain: *Escherichia coli* Nissle 1917
Dose: 5 x 10^10 viable bacteria, twice daily.

Pouchitis (Treatment & Maintenance)

LOE 2

Strain: 8-strain mixture (*L. plantarum*, *L. casei*, *L. acidophilus*, *L. bulgaricus*, *B. infantis*, *B. longum*, *B. breve*, *S. thermophilus*).
Dose: 1800 billion bacteria daily.

Liver Disease

Hepatic Encephalopathy (Prophylaxis & Recovery)

LOE 1

Ingredient: Lactulose (Prebiotic)
Dose: 45–90 g daily.

Nonalcoholic Fatty Liver Disease (NAFLD)

LOE 3

Intervention: Multiple specific Synbiotics and multi-strain mixes.
Outcome: Shows evidence for improving aminotransferases, HOMA-IR, and steatosis scores.

Adult Clinical Dashboard: Constipation & Diverticular Disease

Functional Constipation (Prebiotic Baseline)

LOE 1

Intervention: Inulin and oligofructose

Dose: 12 g/day

Effect: Maintenance of normal defecation / defecation / increased stool frequency.

Functional Constipation (Probiotic)

LOE 2

Strain: *Limosilactobacillus reuteri* DSM 17938

Dose: 1 x 10^8 cfu, twice daily.

Effect: Improvement of defecation frequency and symptoms.

Uncomplicated Symptomatic Diverticular Disease

LOE 2

Strain: *Lacticaseibacillus casei* subsp. DG

Dose: 2.4 x 10^10 cfu, once daily.

Effect: Improvement in symptoms.

Pediatric Clinical Dashboard: Diarrheal Diseases & NEC

Section 1: Acute Gastroenteritis & AAD

LOE 1

Strains: *L. rhamnosus* GG (>=10^10 cfu/day) | *S. boulardii* CNCM I-745 (250–750 mg/day)
Effect: Reduces duration of diarrhea, length of hospitalization, and stool output.

Section 2: Nosocomial (Hospital-Acquired) Diarrhea

LOE 1

Strain: *L. rhamnosus* GG
Dose: At least 10^9 cfu/day, for hospital stay duration.

Section 3: Necrotizing Enterocolitis (NEC) in Preterm Neonates

LOE 1

Insight: Probiotics reduce the risk of NEC and all-cause mortality (NNT = 20 to prevent one death). Supported by massive meta-analyses of >10,000 neonates.
Strains: *L. rhamnosus* GG | Mix of *B. infantis* BB-02, *B. lactis* BB-12, *S. thermophilus* TH-4.

Pediatric Clinical Dashboard: Infantile Colic

Management of Active Colic

LOE 1 *Limosilactobacillus reuteri* DSM 17938

Dose: 10^8 cfu/day for at least 21 days.

Effect: Reduced crying/fussing time specifically in breastfed infants (role in formula-fed is less clear).

Alternative: *B. lactis* Bb12 (10^9 cfu/day) **LOE 2**

Prophylactic Prevention

LOE 1 *Limosilactobacillus reuteri* DSM 17938

Dose: 10^8 cfu/day, given to newborns each day for 90 days.

Effect: Reduced crying time in BOTH breast-fed and formula-fed infants.

⚠ **Note:** Evidence does NOT currently support the use of probiotics as a general group for childhood Functional Abdominal Pain Disorders (FAPD), demanding targeted strain use

The Future is Targeted

"The era of the generic "daily probiotic" is giving way to pnecision microbial interventions. Efficacy is not a class effect; it is a microscopic lock-and-key."

1. Demand Strain Specificity

Always match the precise strain designation (e.g., GG, DSM 17938) and dosage to the desired clinical outcome.

2. Respect the Taxonomy

Utilize the 2020 genus classifications to better understand the distinct biological capabilities of the microbial tools in your arsenal.

3. Follow the Evidence

Rely on Oxford CEBM Level 1 and 2 evidence to integrate probiotics into standard protocols for Diarrhea, IBS, and severe pediatric indications like NEC.