



A REVIEW ON LACTOBACILLUS BACTERIA

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Abstract

The genus *Lactobacillus* consists of Gram-positive, non-spore-forming, lactic acid-producing bacteria that inhabit human and animal mucosal surfaces and fermented foods. Increasingly studied as probiotics, lactobacilli have been associated with benefits for gut health, metabolic and immune regulation, and prevention of gastrointestinal disorders. At the same time, emerging evidence highlights strain-specific differences in efficacy, and raises safety concerns (e.g., bacteremia) in immunocompromised hosts. This review summarizes the taxonomy, physiology, mechanisms of action, clinical evidence and safety considerations of *Lactobacillus*. It also identifies gaps in the literature and proposes directions for future research.

Introduction

The human microbiome has emerged as a major frontier in health research. Among the many commensal bacterial genera, *Lactobacillus* holds a prominent position due to its long-standing use in fermented foods and as probiotic supplements. Originally classified under a large heterogeneous genus, recent phylogenomic revisions have split many former *Lactobacillus* species into new genera—but for simplicity in this review we refer broadly to “lactobacilli” [6] [PubMed](#)

The genital/urinary tract, gastrointestinal tract, and oral cavity all contain lactobacilli. They undergo metabolic biotransformations, change the immune system, produce lactic acid, and competitively exclude pathogens. In recent years, their use has expanded to include immunomodulation, metabolic disorders (obesity, type 2 diabetes), and gastrointestinal health (diarrhoea, antibiotic-associated diarrhoea). However, the complications increase with our understanding: host context, dosage, strain specificity, and safety considerations are all crucial. This review aims to synthesize current knowledge on lactobacilli: their biology and taxonomy, mechanisms of beneficial effect, evidence from human and animal studies, and safety/tolerance issues.

Review of Literature

Taxonomy and Physiology

Historically, the genus *Lactobacillus* encompassed a large variety of species; a recent taxonomic revision described 23 novel genera and a new *Lactobacillus* genus. [6] [PubMed](#)

Lactobacilli are Gram-positive, non-spore-forming rods (or coccobacilli), fermentative (homo- or hetero-

fermentative) producing lactic acid as the major end product. They thrive in acidic environments, often tolerate low pH, and produce antimicrobial substances (bacteriocins) and H_2O_2 in some cases.

Pre-clinical Evidence

Gastrointestinal disorders

Meta-analysis has shown that prophylactic single-strain *Lactobacillus* supplementation during antibiotic therapy appears to reduce the risk of antibiotic-associated diarrhoea. [2] [NCBI](#) Studies for *Helicobacter pylori* eradication suggest adjunctive use of *lactobacilli* may improve eradication rates and reduce side-effects (though not uniformly across all strains).

Metabolic and cardiovascular health

Lactobacilli have been evaluated for weight management, lipid–metabolism modulation and cardiovascular risk reduction. A review found promise in lowering metabolic-dysfunction markers but highlighted heterogeneity and limited high-quality trials. [3] [Functional food center](#)

Oral/periodontal health

A recent systematic review examined the effect of *lactobacilli* on the periodontal pathogen *Porphyromonas gingivalis*. Some strains (e.g., *L. Brevis*) showed antimicrobial potential in vitro/animal models and limited clinical trials. [7] [Springer Link](#)

Neurodegenerative/gut-brain interface

A systematic review of *Lactiplantibacillus plantarum* (formerly *L. Plantarum*) in neuro-degenerative diseases reported improvements in motor/cognitive symptoms in animal models and few human trials—but results remain preliminary. [City Drive](#)

Safety and Adverse Events

While *lactobacilli* are generally regarded as safe for the healthy population, there are documented cases of *lactobacillus*-associated bacteremia and sepsis—especially in severely immunocompromised hosts, ICU patients, or via central venous catheters. [4] [Pubmed+1](#) A review highlighted that few probiotic strains (e.g., *L. Rhamnosus* GG, *L. Plantarum*, *L. Paracasei*) were directly linked via molecular identification to bloodstream isolate [MDPI](#)

Gaps in the Literature

- **Strain specificity:** benefits appear highly strain- and dose-dependent; generalising across “*lactobacilli*” is problematic.
- **Long-term outcomes:** the majority of studies are short-term, have small numbers and thus are generally performed on healthy, rather than diseased, subjects.
- **Mechanism of action elucidated in man:** the elucidation of mechanisms is performed in vitro and in animal models but there are limitations to the extrapolation of these mechanisms to man.

- **Host-microbiota interactions:** the effects of baseline microbiota composition on the response to lactobacilli is much less well investigated.
- **Safety in populations at risk:** more data is required in populations at risks such as infants, the immunocompromised and those with significant co-morbidity.

Discussion

The body of evidence for lactobacilli supports their role as beneficial commensal/probiotic organisms under many circumstances—but the picture is mixed and nuanced. On one hand, their mechanisms—acidification, antimicrobial secretion, immunomodulation and metabolic impacts—provide plausible biological bases for health-effects. On the other hand, clinical translation has been uneven. For example, the meta-analysis on antibiotic-associated diarrhoea suggests a protective effect of Lactobacillus supplementation.[2] [NCBI](#) However, heterogeneity in strain, dosage and patient population limits firm conclusions. Similarly, for metabolic health (weight, lipids) the review by Williams et al. found encouraging associations but emphasised the need for more randomized controlled trials.[3] [Functional food center](#)

The oral health/periodontal data are still emerging, and while in vitro results show that certain lactobacilli can inhibit P. Gingivalis, more human trials are necessary to confirm efficacy and safety.[7] [Springer Link](#) The neurodegenerative-disease angle is intriguing—suggesting the gut–brain axis as a route of intervention—but remains largely preclinical at present. [City Drive](#)

Safety must not be overlooked. Although rare, lactobacillus-associated bloodstream infections have occurred in immunocompromised individuals. Thus, blanket “safe for all” assumptions are inappropriate; host context and product strain matters.[4] [Pubmed+1](#)

From a translational perspective, for lactobacilli to move from promising adjuncts to mainstream therapeutic tools, concerted efforts are needed: well-powered, strain-specific randomized trials in defined patient populations; standardized reporting of dosage/viability/delivery; and long-term follow-up for safety and efficacy. Furthermore, mechanistic human studies linking microbiome changes, metabolite shifts and clinical outcomes will enhance credibility.

In the Indian context (e.g., in Secunderabad/Telangana), where fermented foods and traditional probiotic practices exist, there may be opportunities to integrate locally appropriate lactobacillus-based interventions—but regulatory, quality-control and indigenous strain research must be developed.

Conclusion

In conclusion, (in a wide meaning) Lactobacillus genus were bacteria with a highly prospective in the probiotic and therapeutic field. Their features and functioning fit beautifully with diverse areas of health: gut health, immunoregulation, metabolism and homeostasis—and potentially even neurological health. But the evidence base—while becoming more robust—remains uneven.

Key points are:

The benefits are strain-specific: all lactobacilli are not equal.

The clinical evidence looks promising, but it is mostly in small studies or preliminary

The safety is good in healthy subjects but cautions should be exercised in high-risk populations.

Further work needs to focus on standardized strain characterization, rigorous human trials

They are valuable to clinicians, nutritionists and researchers—but they are not panaceas. Fermented foods may be beneficial for consumers and a range of probiotics characterised strains may also offer benefits—but these should come with clear strain labels/viability data/clinical evidence.

Ultimately, lactobacilli are an important player in the new field of microbiome science and human health—but their best use will require quality science, context and caution in interpreting it.

References

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