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Blautia Producta - An Emerging Multifunctional Probiotic and Its Therapeutic Potential

Shu-xia Song[1,2], Xiao-yan You[1,2]*

[1]*Henan Engineering Research Center of Food Microbiology, College of food and bioengineering, Henan University of Science and Technology, Luoyang 471023, China*

[2]*National Center of Technology Innovation for Synthetic Biology, Tianjin Institute of Industrial Biotechnology, Chinese Academy of Sciences (CAS), Tianjin 300308, China*

***Corresponding author:** Xiaoyan You, Henan Engineering Research Center of Food Microbiology, College of food and bioengineering, Henan University of Science and Technology, Luoyang 471023, China
National Center of Technology Innovation for Synthetic Biology, Tianjin Institute of Industrial Biotechnology, Chinese Academy of Sciences (CAS), Tianjin 300308, China

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Introduction

Blautia producta, a strictly anaerobic gut commensal bacterium within the Firmicutes phylum, has emerged as a functionally versatile member of the intestinal microbiota. While initially characterized as a core constituent of mammalian gut ecosystems, recent studies reveal strain-specific therapeutic potential in metabolic, neurological, and oncological pathologies through metabolite-driven mechanisms (Xu et al., 2023; Zhang et al., 2023). In this mini-review, we briefly reviewed the current evidence on how *B. producta* influences host health through specific metabolites and immunomodulatory pathways, and discuss challenges and opportunities for its clinical translation.

The role in diseases: from laboratory to clinical

Metabolic regulation is one of the distinguishing features of *B. producta*. Through large-scale screening of 2,250 enterobacterial strains, Xu et al. found that *B. producta* secretes 12-methylmyristic acid (12-MMA), which significantly reduces lipid accumulation and improves glucose metabolism by activating the G-protein-coupled receptor GPR120 in mice fed a high-fat diet (Xu et al., 2023). This finding suggests that specific bacterial-derived fatty acids may have hitherto under-recognized regulatory roles in metabolic diseases and provides new perspectives for developing novel lipid-lowering therapies based on microbe-host metabolic interactions. In diabetic models, Yang et al. demonstrated that berberine up-regulates hepatic low-density lipoprotein receptors through enrichment of *B. producta*, thereby reducing serum cholesterol levels (Y. N. Yang et al., 2022). Furthermore, *B. producta* shows synergistic effects with dietary inulin in enhancing acetic acid production, which significantly ameliorates hepatic steatosis and fibrosis. This microbiota-acetic acid-free fatty acid receptor 2 (FFAR2) molecular circuit improves insulin sensitivity and prevents non-alcoholic fatty liver disease (NAFLD) and non-alcoholic steatohepatitis (NASH) development (Aoki et al., 2021). However, contradictory evidence suggests context-dependent effects: M. Yang et al. (2023) reported that Western diet may promote inflammation through activation of the GPR119/TAK1 pathway by *B. producta* and 2-oleoylglycerol. These contrasting findings underscore the strain-specific functionality of *B. producta* and the importance of host dietary context in determining its metabolic impacts.

The role of *B. producta* in neuroinflammation provides novel insights for Parkinson's disease (PD) treatment. Liu et al. found significantly reduced abundance of *B. producta* in the intestines of PD patients. Experimental supplementation with *B. producta* inhibited the RAS-NF-κB inflammatory pathway via butyrate production, reducing microglial activation and protecting dopaminergic neurons (J. Liu et al., 2024). This mechanism effectively alleviated motor dysfunction in animal models, highlighting the therapeutic potential of gut-brain axis interventions targeting specific bacterial species. The immunomodulatory function of *B. producta* in colorectal cancer (CRC) has attracted considerable attention.

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Zhang et al. demonstrated that *B. producta* works synergistically with *Ruminococcus gnavus* to degrade lysoglycerophospholipids, which otherwise inhibit $CD8^+$ T-cell activity, thereby enhancing tumor immunosurveillance (Zhang et al., 2023). This effect depends on the metabolic activity of intestinal tissue-resident bacteria and provides a mechanistic basis for microbial therapy in CRC. Regarding chemoresistance, metagenomic analysis by Huang et al. revealed that *B. producta* occupies a central position in microbial network remodeling between good responders (GR) and poor responders (PR) to treatment (Huang et al., 2023). Alterations in its abundance or association patterns may directly influence treatment resistance. The abundance profile of *B. producta* could potentially serve as a biomarker for predicting responses to neoadjuvant chemoradiation therapy (nCRT) in rectal cancer patients, suggesting possibilities for targeted microbiome interventions to optimize treatment outcomes.

Safety and probiotic potential

Safety assessment is critical for the clinical translation of *B. producta* as a probiotic. Genomic analysis by Liu et al. demonstrated that *B. producta* DSM 2950 lacks virulence genes, and acute toxicity tests showed no adverse effects in mice, supporting its potential as a food or pharmaceutical additive (X. Liu et al., 2021).

Various application strategies for *B. producta* are emerging. Its metabolites, such as butyrate, can be used directly or enhanced through dietary interventions. For instance, Li et al. (2024) showed that zinc supplementation ameliorates cholestatic liver injury by increasing p-coumarate production specifically through enrichment of *B. producta* populations. For monitoring therapeutic interventions, advanced detection methods such as Graphene Field Effect Transistor (gFET)-based specific aptamer sensors now enable accurate quantification of *B. producta* in complex microbial communities containing thousands of bacterial species (Xing et al., 2024). This technology facilitates real-time monitoring of microbiome changes during therapeutic interventions and could enhance both clinical applications and basic research on *B. producta*.

Conclusion

Despite promising therapeutic potential, translating *B. producta* research into clinical applications faces critical challenges: strain-specific metabolic variations necessitating standardized screening platforms; complex host-microbiome interactions requiring personalized intervention approaches; and limited clinical evidence predominantly from animal models. Future research should integrate multi-omics technologies to characterize *B. producta*'s regulatory networks in disease-specific microenvironments and explore synergies with existing therapies such as immune checkpoint inhibitors. This versatile member of the intestinal microbiota demonstrates roles in metabolic, neurological, and oncological conditions through metabolic products and immunomodulatory mechanisms, with its favorable safety profile and bioengineering amenability making it a promising probiotic candidate. Advancing to clinical implementation requires interdisciplinary collaboration addressing strain heterogeneity and host-microbe interaction complexity, potentially yielding precision microbial therapies for various chronic diseases.

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