CARPATHIAN JOURNAL OF FOOD SCIENCE AND TECHNOLOGY

journal homepage: **http://chimie-biologie.ubm.ro/carpathian_journal/index.html**

Review article

FOOD-DERIVED GARLIC POLYSACCHARIDES AS EMERGING FUNCTIONAL INGREDIENTS: STRUCTURE, MICROBIOTA–IMMUNITY INTERACTIONS, AND HEALTH IMPLICATIONS

Rimsha Umar[1], Komal Arif[2], Sadia Malik[3], Syed Tahaa Munawar[4], Muhammad Sibt-e-Abbas[1]✉, Rabiya Riaz[5], Xianjiang Ye[6], Muhammad Atiq Ashraf[7], Burhan Khalid[8], Muhammad Moeid Khan[6], Talha Riaz[6]✉

[1]Department of Food Science and Technology, MNS-University of Agriculture, Multan, Pakistan
[2]Institute of Microbiology, University of Agriculture, Faisalabad, Pakistan
[3]Department of Botany, Rawalpindi Women University, Rawalpindi, Pakistan
[4]National Institute of Food Science and Technology, University of Agriculture, Faisalabad, Pakistan
[5]Department of Chemistry, Government College Women University, Faisalabad, Pakistan
[6]College of Food Science and Technology, Huazhong Agricultural University, Wuhan, China
[7]College of Horticulture and Forestry Sciences, Huazhong Agricultural University, Wuhan, China
[8]College of Plant Science and Technology, Huazhong Agricultural University, Wuhan, China
✉Corresponding Author: Email: sibte.abbas@mnsuam.edu.pk, talhariaz2844@gmail.com

https://doi.org/10.34302/crpjfst/2025.17.4.10

Article history:
Received:
September 17th , 2025
Accepted:
December 19th , 2025
Published
December 30th, 2025

Keywords:
Garlic polysaccharide;
Oligosaccharide;
Structure–function relationship;
Gut microbiota;
Metabolic health;
Prebiotic.

Abstract. Garlic polysaccharides (GPs) are emerging as important non-sulfur bioactives that complement the well-studied organosulfur compounds of Allium sativum. With diverse structures and molecular weights, GPs exert antioxidant, anti-inflammatory, immunomodulatory, and metabolic benefits that are increasingly linked to their role as prebiotic substrates for gut microbiota. This review consolidates recent advances in the extraction and structural characterization of GPs and examines how their physicochemical features shape fermentability, microbial enrichment, and production of metabolites such as short-chain fatty acids, bile acids, and tryptophan derivatives. These microbiota-derived signals, together with direct immune modulation by specific GP fractions, underpin improvements in mucosal barrier function, systemic immunity, and metabolic outcomes in preclinical models of obesity, diabetes, fatty liver disease, and atherosclerosis. By integrating structure–function relationships with microbiota–immunity interactions, we outline the dual role of GPs as prebiotics and immunonutrients, and compare their actions with those of established dietary polysaccharides. Current limitations include methodological variability, lack of standardized structural reporting, and scarce clinical validation. Future directions call for multi-omics approaches, personalized nutrition strategies, and well-designed human trials to translate the promising microbiota–immune mechanisms of GPs into functional food and therapeutic applications.