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Gastrointestinal biotransformation of phytochemicals: Towards futuristic dietary therapeutics and functional foods

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ABSTRACT

Background: Gastrointestinal (GI) microbiome is a highly diverse and intricate symbiotic ecosystem that offers a multitude of metabolic and adaptive benefits to the host. Diverse phytochemicals consumed as vegetarian diet or taken as food supplements are metabolized intensely in the GI tract and provide a range of nutritional and dietary therapeutic benefits. Insights into the gut microbial-biotransformation and plant-based therapeutics with reference to the diet and their interaction with the host offers development of futuristic dietary therapeutics that could boost the efficacy of nutraceuticals and plant-based formulations for human health.

Scope and approach: This review provides insights into the gut microbial biotransformation of selective predominant dietary phytochemicals and the biological activities of the produced metabolites. It emphasizes the potential of GI microbes as probiotics or microbial food additives to improve utilization of plant-based diets, and enhance the bioavailability and bioactivities of phytochemicals.

Key findings and conclusions: Vital and pro-health activities of plant metabolites produced as a result of gut microbial biotransformation emphasize the use of gut microbiota as novel probiotic candidates. The inferences summed up in the report could pave the way to develop potential probiotics to increase the efficiency of plant-based therapeutics towards enabling human hosts to cope with metabolic, inflammatory, proliferative, infectious and non-infectious diseases. We believe that the obtained and acquired new knowledge as discussed here has implications to develop dietary therapeutics that could steer the functioning of gut microbiota towards boosting host's nutritional and immunomodulatory efficiency.

1. Introduction

Herbal teas, beverages, and botanicals are rich sources of plant-origin nutraceuticals such as polysaccharides, carotenoids, saponins, phenolic acids, tannin-polyphenols, terpenoids, and alkaloids among others (Braune & Blaut, 2016; Feng et al., 2015). The role of plant metabolites in relation to nutrition and health is an interesting area of research for nutritionists, botanists, dieticians, and microbial ecologists. Evidences are scarce on the vital role of secondary phytometabolites in fundamental life processes of the plants; they seemingly assist in defense and interaction of the plant with its environment (Anstett, Cheval, D'Souza, Salminen, & Johnson, 2019). Phytochemicals possess potent bioactivity and produce diverse molecular responses in prokaryotic and eukaryotic animal cell by modulating several biological processes including cell cycle, metabolism, protein synthesis, stress response, energy metabolism, and cell senescence.

Gut microbiota interact with, and transform the complex plant metabolites, and improve their absorption from the intestine into the

Abbreviations: GI, gastrointestinal; CVDs, cardiovascular diseases; LPS, lipopolysaccharide; RRR, Berberine; dhBBR, dihydroberberine.

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