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Microbiome, probiotics and neurodegenerative diseases: deciphering the gut brain axis.

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Abstract

The gut microbiota is essential to health and has recently become a target for live bacterial cell biotherapies for various chronic diseases including metabolic syndrome, diabetes, obesity and neurodegenerative disease. Probiotic biotherapies are known to create a healthy gut environment by balancing bacterial populations and promoting their favorable metabolic action. The microbiota and its respective metabolites communicate to the host through a series of biochemical and functional links thereby affecting host homeostasis and health. In particular, the gastrointestinal tract communicates with the central nervous system through the gut-brain axis to support neuronal development and maintenance while gut dysbiosis manifests in neurological disease. There are three basic mechanisms that mediate the communication between the gut and the brain: direct neuronal communication, endocrine signaling mediators and the immune system. Together, these systems create a highly integrated molecular communication network that link systemic imbalances with the development of neurodegeneration including insulin regulation, fat metabolism, oxidative markers and immune signaling. Age is a common factor in the development of neurodegenerative disease and probiotics prevent many harmful effects of aging such as decreased neurotransmitter levels, chronic inflammation, oxidative stress and apoptosis—all factors that are proven aggravators of neurodegenerative disease. Indeed patients with Parkinson's and Alzheimer's diseases have a high rate of gastrointestinal comorbidities and it has been proposed by some that the management of the gut microbiota may prevent or alleviate the symptoms of these chronic diseases.

KEYWORDS: Gut microbiota; Gut-brain-axis; Neurodegeneration; Oxidative stress; Probiotics; Short-chain fatty acids

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