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Nutritional modulation of the intestinal microbiota; future opportunities for the prevention and treatment of neuroimmune and neuroinflammatory disease[☆]

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Abstract

The gut–brain axis refers to the bidirectional communication between the enteric nervous system and the central nervous system. Mounting evidence supports the premise that the intestinal microbiota plays a pivotal role in its function and has led to the more common and perhaps more accurate term gut–microbiota–brain axis. Numerous studies have identified associations between an altered microbiome and neuroimmune and neuroinflammatory diseases. In most cases, it is unknown if these associations are cause or effect; notwithstanding, maintaining or restoring homeostasis of the microbiota may represent future opportunities when treating or preventing these diseases. In recent years, several studies have identified the diet as a primary contributing factor in shaping the composition of the gut microbiota and, in turn, the mucosal and systemic immune systems. In this review, we will discuss the potential opportunities and challenges with respect to modifying and shaping the microbiota through diet and nutrition in order to treat or prevent neuroimmune and neuroinflammatory disease.

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Contents

1. Introduction	2
2. The gut–microbiota–brain axis	2
3. Gut microbiota and neurotrophic factors	3
4. The gut microbiota, mucosal immunity and neuroinflammation	4
5. Neuroimmune and neuroinflammatory diseases associated with alterations of the gut microbiota.	4

Abbreviations: 4EPS, 4-ethylphenylsulfate; 5-HT, 5-hydroxytryptamine; AD, Alzheimer's disease; ASD, autism spectrum disorder; BDNF, brain-derived neurotrophic factor; CA, catecholamines; CD, Crohn's disease; CNS, central nervous system; DHA, docosahexaenoic acid; EAE, experimental autoimmune encephalomyelitis; ENS, enteric nervous system; EPA, eicosapentaenoic acid; FEP, first-episode psychosis; GABA, gamma-aminobutyric acid; GI, gastrointestinal; HIV, human immunodeficiency virus; IBS, irritable bowel syndrome; IL, interleukin; ME, myalgic encephalomyelitis; MIA, maternal immune activation; MS, multiple sclerosis; NMDA, N-methyl-D-aspartate; PD, Parkinson's disease; RRMS, Relapsing–remitting MS; SCFAs, short-chain fatty acids; TNF- α , tumor necrosis factor-alpha; Tregs, regulatory T cells; vA, vitamin A; vD, vitamin D

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