

How Gut Microbes Influence The Brain?

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Abstract

We all get initial dose of microbes from mother; they multiply and the grown-up human body contain in a range of 30 to 40 trillion in numbers. During their life cycle they produces many chemicals some are beneficial to the host and others are harmful. Once the gut-brain axis is established the microbial products in the gut start influencing the brain. Hundreds of neuro-chemicals produced by the gut microbes regulate basic physiological processes as well as mental processes such as learning, memory and mood. Dysbiosis and inflammation of the gut are responsible for anxiety and depression which are prevalent in society today.

Keywords: Microbes; Dysbiosis; Neurotoxicity; Prebiotics

Introduction

Gut microbes are part of the system which unconsciously regulating person's behavior depending on the composition of the type of microbes [1] the enteric nervous system that regulates our gut is often called the body's "second brain." This "second brain." can take part in neurochemistry but not in wisdom as brain is involved. This extensive network is very efficient and vigilant; by using the same chemicals and cells as the brain to help in digestion and also send massages to alert the brain when something is wrong [2]. In addition to above mentioned functions, gut microbes also produce hundreds of neuro-chemicals that the brain uses to regulate basic physiological processes as well as mental processes such as learning, memory and mood. [3]. For example, serotonin, most important neurotransmitter, about 90 is produced by gut bacteria. Serotonin plays important role in regulating both mood and GI activity. Increasing evidence has associated gut microbiota to both gastrointestinal and extra-gastrointestinal diseases. Several mental illnesses, such as anxiety and depression which are prevalent in society today are caused by Dysbiosis and inflammation of the gut [4]. Recent investigations indicate that the gut microbiome and brain are connected. The gut microbes largely impact on cognitive function and fundamental behavior patterns, such as social interaction and stress management [5] Experimental evidence suggests that gut

microbiota has an important role in bidirectional interactions between the gut and the nervous system;. It interacts with central nervous system by regulating and influencing neuro-endocrine systems associated with stress response, anxiety and memory function. In the absence of microbes, underlying neurochemistry is very much altered [6]. The human gut microbes influence the brain health in the following ways: Bacteria present in the gut stimulate directly afferent neurons of the enteric nervous system (ENS) which send signals via the vagus nerve to the brain [7]. They produce hormones and neurotransmitters that are identical to those produced by neuro-endocrine system. Bacterial receptors for these hormones influence microbial growth and virulence [8] even beneficial metabolites such as short-chain fatty acids may exert neurotoxicity. Structural bacterial components such as lipopolysaccharides provide low-grade tonic stimulation of the innate immune system [9]. Excessive stimulation due to bacterial dysbiosis, small intestinal bacterial overgrowth, or increased intestinal permeability may produce systemic and/or central nervous system inflammation [10]. Bacterial proteins may cross-react with human antigens to stimulate dysfunctional responses of the adaptive immune system [11]. The gut microbes shape the architecture of sleep and stress reactivity of the hypothalamic-pituitary-adrenal axis. They influence clinically and therapeutically relevant to a range of disorders, including alcoholism, chronic fatigue syndrome, fibromyalgia, and restless

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legs syndrome. Their role in multiple sclerosis and the neurologic manifestations of celiac disease is established. Nutritional tools for altering the gut microbiome therapeutically include changes in diet, probiotics, and prebiotics [12] (Figure 1).

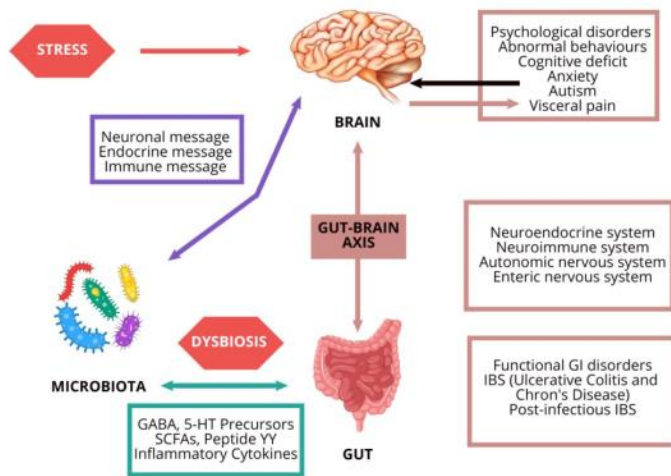


Figure 1: A schematic representation of the microbiota-gut-brain axis.

An abnormal microbiota associated with a disrupted gut barrier and the activation of the mucosal immune system leads to the release of inflammatory mediators and other neuroactive molecules into the systemic circulation from where they reach the brain and result in changes in cognition and behavior. Alternately, central stimuli, such as stress, can disrupt mucosal immunity, the gut microbiota and gut barrier function and lead to gut dysfunction. Note: bidirectional nature of the relationships between the gut, the microbiota and the brain. [13]. Diet and lifestyle factors, including poor sleep quality, alcohol consumption and inactivity, can harm the gut bacteria [14]. Alternatively, living a healthy lifestyle characterized by regular physical activity, low stress and a variety of whole foods is the best way to ensure healthy gut microbes. More so by eating fresh fruits without added sugars and other additives and including whole grains and legumes in the diet which are rich in fiber will add enough healthy bacteria in the gut. By including probiotic-rich foods such as plain yogurt in the daily diet also promote healthy bacteria in the gut. These are some suggestions for a healthier gut and in turn improved mood.

References

1. Dinan TG, Stilling RM, Stanton C, Cryan JF. Collective unconscious: how gut microbes shape human behavior. *J Psychiatric Res.* 2015; 63: 1-9.
2. Rao M, Gershon MD. The bowel and beyond: the enteric nervous system in neurological disorders. *Nature reviews Gastroenterology Hepatology.* 2016; 13: 517-28.

3. Dicks LM. Gut bacteria and neurotransmitters. *Microorganisms.* 2022; 10: 1838.
4. Nagao-Kitamoto H, Kitamoto S, Kuffa P, Kamada N. Pathogenic role of the gut microbiota in gastrointestinal diseases. *Intestinal Res.* 2016; 14: 127-38.
5. Carabotti M, Scirocco A, Maselli MA, Severi C. The gut-brain axis: interactions between enteric microbiota, central and enteric nervous systems. *Annals of gastroenterology: quarterly publication of the Hellenic Society Gastroenterology.* 2015; 28: 203.
6. Ma Q, Xing C, Long W, Wang HY, Liu Q, Wang RF. Impact of microbiota on central nervous system and neurological diseases: the gut-brain axis. *J Neuroinflammation.* 2019; 16: 1-4.
7. Breit S, Kupferberg A, Rogler G, Hasler G. Vagus nerve as modulator of the brain-gut axis in psychiatric and inflammatory disorders. *Frontiers in Psychiatry.* 2018; 9: 44.
8. Abedi E, Hashemi SM. Lactic acid production-producing microorganisms and substrates sources-state of art. *Heliyon.* 2020; 6: 04974.
9. Silva YP, Bernardi A, Frozza RL. The role of short-chain fatty acids from gut microbiota in gut-brain communication. *Frontiers in endocrinology.* 2020; 11: 508738.
10. Collins SM, Bercik P. The relationship between intestinal microbiota and the central nervous system in normal gastrointestinal function and disease. *Gastroenterology.* 2009; 136: 2003-14.
11. Zheng D, Liwinski T, Elinav E. Interaction between microbiota and immunity in health and disease. *Cell Res.* 2020; 30:492-506.
12. Galland L. The gut microbiome and the brain. *J Medicinal food.* 2014; 17: 1261-72.
13. Quigley EM. The gut-brain axis and the microbiome: clues to pathophysiology and opportunities for novel management strategies in irritable bowel syndrome (IBS). *J Clinical Med.* 2018; 7: 6.
14. Conlon MA, Bird AR. The impact of diet and lifestyle on gut microbiota and human health. *Nutrients.* 2014; 7: 17-44.