

The Microbiota-Gut-Brain Axis: Role in Alzheimer's Disease

Krupa Prashant Churi, Vedangi Gandre

ALTE University, Tbilisi, Georgia

Background

Alzheimer's is a progressive brain disorder mostly in older adults causing cognitive decline. The Microbiota-Gut-Brain Axis is a recent discovery as a cause of AD along with build-up of A β plaques, tau protein hyperphosphorylation, neurofibrillary tangle accumulation. This axis acts as a two-way communication system allowing the gut to influence via neural, endocrine, immune, and metabolic signalling. The theory has been researched as a possible target for drug development because of the profuse evidence linking the gut microbiota to the onset of AD.

Objective

To investigate the contribution of the key players of Microbiota-Gut-Brain Axis in relation to Alzheimer's disease pathogenesis and treatment.

Method

A thorough literature review has been conducted to study the impact of gut microbiota on development of neurocognitive symptoms in AD. Articles were selected from PubMed, Google Scholar, Research Gate, and Science Direct and all articles were restricted from the year 2019 to 2024.

Findings

Research indicates that alterations in the bacterial makeup of the digestive tract, particularly a decrease in Firmicutes and an increase in Bacteroidetes species, may have an impact on brain activity. Certain microbial secretory products, such as lipopolysaccharides and short-chain fatty acids, play antagonistic effects on neuroinflammation. Neurotransmitter production and signalling in vagus nerve and the enteric nervous system, involved in controlling both brain-based cognitive behaviour and the physiological processes of the stomach can be influenced by microbial neurotransmitters and neuroactive metabolites. The preservation of host homeostasis also heavily depends on the intestinal epithelial barrier and the blood-brain barrier's functioning. Other key participants include microglia and astrocytes, which produce proinflammatory cytokines and engage in phagocytosis, causing neuroinflammation and provoking onset of symptoms.

Conclusion

Recent preclinical research on humans and animals suggests that dysbiosis in the gut microbiota plays a major role in AD progression. As a result, modifying these factors has potential as a therapeutic and preventative strategy to reduce symptoms or slow the disease's course.

Keyword

Alzheimer's disease, Microbiota-Gut-Brain Axis, Microglia, Neuroinflammation