Dietary fiber deficiency causes cognitive impairment and synapse loss via the microbiota

Hongli Shi
Xing Ge
Xi Ma
Mingxuan Zheng
Xiaoying Cui
Wei Pan
Peng Zheng
Xiaoying Yang
Peng Zhang
Minmin Hu
Tao Hu
Renxian Tang
Kuiyang Zheng
Xu-Feng Huang
Yinghua Yu

Video Byte

Keywords: dietary fiber deficiency, cognition, gut microbiota, short-chain fatty acids, SFCAs, gut-brain axis, Microbiome, microglia, cognitive impairment, cognitive decline, fiber intake, hippocampus, synaptic loss, dietary fiber, dietary fibre, neurodegenerative disease, gut microbiota-hippocampal axis, gut microbes, dementia, nutritional strategy

Posted Date: March 1st, 2022

DOI: <https://doi.org/10.21203/rs.3.rs-1405908/v1>

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Abstract

Nutrient-poor diets can increase the risk of neurodegenerative diseases such as Alzheimer's, and diets poor in fiber are widespread, especially in industrialized nations. However, whether fiber deficiency—which alters the gut microbiota—impairs cognition through the gut–brain axis remains unclear. To find out, researchers recently analyzed mice fed a fiber-deficient diet for 15 weeks. Compared to normal mice, the fiber-deficient mice exhibited cognitive impairment and were unable to complete typical activities like nest organization. In addition, the synapses in the brain area regulating cognitive function were damaged, and neuroinflammation occurred. Immune cells called microglia (indicated by Iba1) engulfed synapses (indicated by PSD-95) in the fiber-deficient mice. Furthermore, the fiber-deficient mice exhibited gut microbiota disruption that was associated with, and possibly responsible for, the cognitive deficits. Within the mouse gut, fiber deficiency compromised the intestinal barrier, leading to changes such as mucus thinning. It also reduced the production of short-chain fatty acids (SCFAs), which were confirmed to be critical links between gut microbiota disruption and cognitive impairment. Although human studies are needed, the findings suggest that fiber deficiency impairs brain function and suggest that increasing fiber intake might help reduce the risks of cognitive decline and neurodegenerative diseases.