The Use of Probiotic Supplements To Improve Symptoms of Alzheimer’s Disease

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**Abstract:**

Alzherimer’s disease has been a growing concern in elderly patients in recent years. There are many factors that have been linked to Alzheimer's disease such as inflammation, oxidative stress, and disruption of gastrointestinal microbiota. Probiotic supplements were proposed as a solution to improve cognitive, and cellular functions in patients with Alzheimer's disease. It was found that after a 90 day period of dietary probiotic supplements containing fermented milk and kefir grains subjects with Alzheimer's disease seemed to improve with their cognitive dysfunction, as well as the levels of reactive oxygen species in their systems.

**Introduction:**

Alzheimer’s disease is a type of dementia that is characterized by memory loss and cognitive deficit (National Institute on Aging). Deaths due to neurodegenerative diseases have been on the rise in recent years. When considering physiological causes of deaths it was discovered that those who died of Alzheimer’s had abnormal clumps called amyloid plaques in their brain (National Institute of Aging). Further research has found that these amyloid plaques formed due to an excess of free radicals in the brain, also known as oxidative stress (Butterfield and Boyd-Kimball 2018). Oxidative stress occurs when the cells in the body are subjected to an increased amount of superoxides. These superoxides, also known as reactive oxygen species (ROS), originate from normal cellular processes that occasionally leak electrons from transport chains (Cooke et al. 2003). ROS are created in response to injury and are often found at sites of inflammation which is a strong contributor to neurodegenerative diseases (Barnes, Fouquerel, Opresko 2019). Multiple small exposures over a long period of time, or one large exposure has been shown to cause significant damage. Oxidative stress has been linked to degenerative diseases like Alzheimer's and cancer, and plays an important role in the aging process overall (Poetsch 2020). The type of damage found in those who have died of Alzeimer’s disease is presented as glycation end products, nitration, free carbonyls, and many more (Smith et al. 2000). Due to the severity of the damages incurred, oxidative DNA damage and repair has been a large area of study since its discovery, particularly its correlation to Alzheimer’s.

**Recent Progress:**

Much of the recent progress on the effects of oxidative DNA has been done in tandem with studies on how to prevent, or alleviate symptoms of Alzheimer’s disease. One study suggested probiotic supplements as a solution to Alzheimer's disease (Ton et al. 2020). The study proposed that dietary supplements composed of fermented milk and kefir grains could improve cognitive and metabolic functions in patients with Alzheimer's disease. Previous studies confirmed that there seems to be a connection between disturbances in gastrointestinal microbiota and neurodegenerative diseases (Ton et al. 2020). The probiotic supplements would help by relieving inflammation and oxidative stress. There were many mechanisms used to test its effectiveness: participants took cognitive assessments before and after supplementation, blood samples were also taken to analyze cellular components related to Alzheimer's disease. ROS levels were quantified using flow cytometry to measure species like superoxide anion, hydrogen peroxide, peroxynitrite/ hydroxyl radical, and nitric oxide. Other cellular components such as mitochondrial membrane potential, and cell cycle analysis were measured using flow cytometry. After 90 days there seemed to be cognitive improvement in the participating subjects based on how well they did on the cognitive assessments. There are also improvements in the amount of ROS found in participating subjects. Blood samples after the 90 day period found a decrease in superoxide anion, hydrogen peroxide, peroxynitrite/ hydroxyl radical. However, there was an increase in nitric oxide. A decrease in inflammation and blood cell damage was also noted in their findings (Ton et al. 2020). All of these results lead to the conclusion that a probiotic supplement can alleviate symptoms of Alzheimer’s disease by improving the state of the gut microbiome.

**Discussion:**

There have been many studies completed to find ways to reverse the effects, or prevent the damage Alzheimer's disease causes in elderly patients. However, there hasn't been much study on how probiotics could improve cognitive and cellular processes in Alzheimer's disease patients. Ton and company's study gave a simple solution to a complex problem. Much of the focus on Alzheimer’s studies have been on the amyloid plaques seen in the brain, and what can be done to prevent them from forming (Smith et al. 2000). While the probiotics only seemed to alleviate symptoms, it provides a new pathway for research. There were a few limitations to the study such as having a very small subject group, and no control group. However, this study in particular shows promising evidence to improve such symptoms, and could serve as a topic of study in future cases despite its limitations. Performing a case study with a larger group, and well defined control/ experimental parameters are the only way to know for certain how significant these results are.

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