The composition of the gut microbiome affects symptoms of depression

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ABSTRACT

Depression is a serious psychiatric disorder that affects approximately 1 in 25 people worldwide, and recent research suggests that the composition of your gut microbiome could play a role in the symptoms. Specific species of bacteria are more reduced (or abundant) in the gut microbiota of patients with major depressive disorder (MDD) than in healthy individuals. Taking prebiotics/probiotics and other forms of treatment are effective in altering the gut microbiome in a way that alleviates depression-like symptoms. In patients with depression, the composition of gut microflora is altered, which can affect specific brain functions that play a role in MDD. Based on the evidence, altering the gut microbiome holds promise as an alternate treatment for depression.

INTRODUCTION

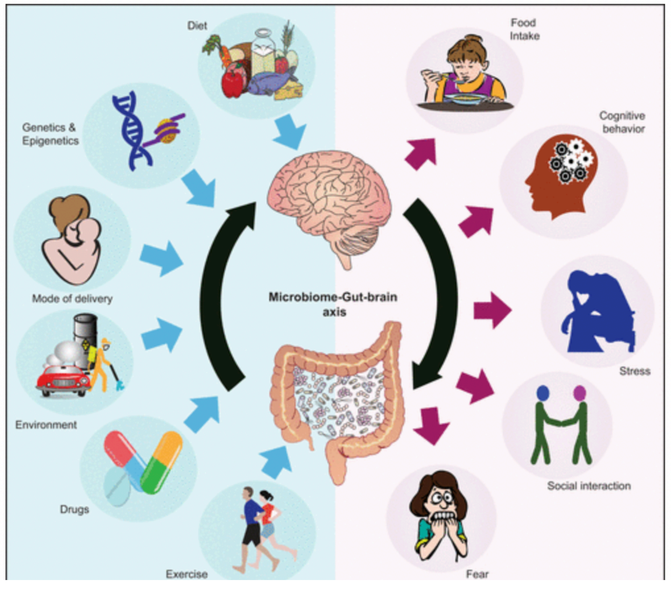

Figure 1: Effects of microbiota-gut-brain-axis (Cryan et al. 2019)

- Major depressive disorder (MDD) one of the most common mental illnesses worldwide; symptoms include: sadness, hopelessness, irritability, low motivation, change in sleep, loss of appetite, etc.
- Common antidepressants have many adverse side effects
- Microbiota-gut-brain-axis (MGBA): the bidirectional communication system between the gastrointestinal (GI) tract and the central nervous system (CNS)
- Altering the composition of the gut microflora can lessen feelings of depression

EFFECTS ON BRAIN ACTIVITY

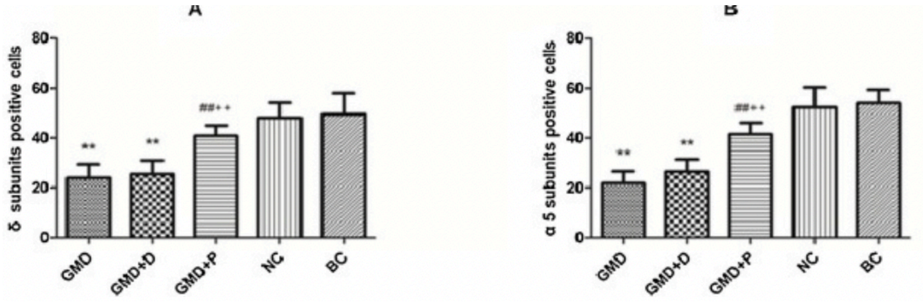

Figure 3: Amounts of GABA-A receptors expressed in the CA3 area of hippocampus. A). δ subunit expression. B). α5 subunit expression. (Liang et al. 2017).

- Gamma-aminobutyric acid (GABA) deficits reported to be implicated in the development of depression
- Rats fed ampicillin-Na to establish symbiosis of intestinal flora
- Juvenile rat microbiota disturbances induced chronic depression, memory loss and reduced the expression of GABA-A receptor α5 and δ subunits

ALTERNATIVE TREATMENT OPTIONS

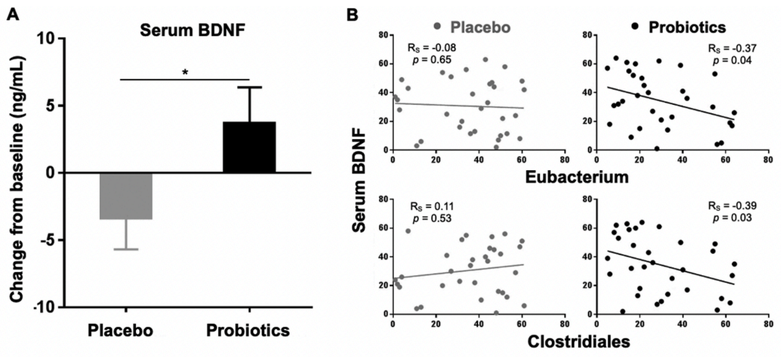

Figure 4: A). Probiotics group showed increased levels of serum BDNF. B). lines show the relationship between relative abundance of shifted gut bacteria after probiotic supplementation and the level of serum BDNF (Kim et al. 2021)

- Brain-derived Neurotropic Factor (BDNF): a neurotropic factor that supports differentiation, maturation, and survival of neurons in the nervous system (Bathina et al. 2015).
- Probiotic supplementation alters the composition of the gut microbiome, which increases mental flexibility, reduces stress scores, and increases BDNF production (Kim et al. 2021)

COMPARING MICROBIOTA COMPOSITION

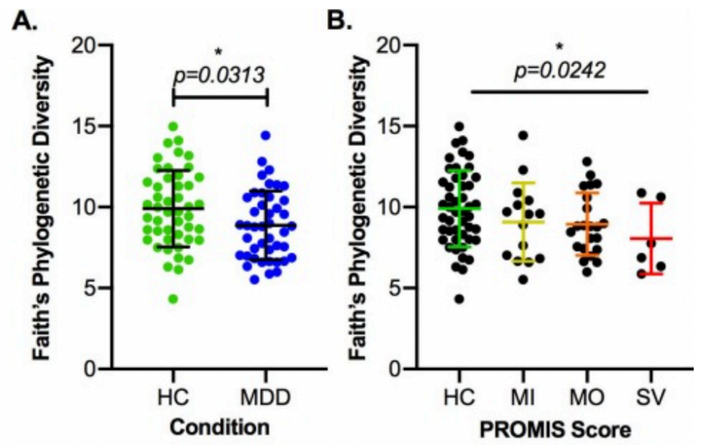

Figure 2: A). Faith's Phylogenetic Diversity (FPD) comparison between the microbiota composition in the gut in healthy controls (HC) and MDD patients. B). FPD comparison between HC, mild (MI), moderate (MO), and severe (SV) depression based on PROMIS depression scores (Lai et al. 2022).

- An increased intestinal microbial diversity and metabolites are considered to be directly related to one's health (Lai et al. 2022)
- Low counts of *Faecalibacterium* in MDD patients – potentially protective bacteria (Valles-Colomer et al. 2019, Liu et al. 2020)

SYNTHESIS

- Focusing on fixing issues in the gut microbiome is a potentially safer and more accessible treatment option for MDD
- MDD patients have a different composition of bacteria in the gut that could be worsening symptoms of depression
- Supplementation of beneficial bacteria via prebiotics and probiotics show promise to lessen feelings of depression

REFERENCES

Bathina, Siresha, and Undurti N Das. 2015. Brain-derived neurotrophic factor and its clinical implications. Archives of medical science vol. 11: 1164-78.

Kim S, Cha L, Sim M, Jung S, Chun WY, Baik HW, Shin D. 2020. Probiotic supplementation improves cognitive function and mood with changes in gut microbiota in community-dwelling older adults: A randomized, double-blind, placebo controlled, multicenter trial. Journals of Gerontology: Biological Sciences 76(1): 32-40.

Lai J, Li A, Jiang J, Yuan X, Zhang P, Xi C, Wu L, Wang Z, Chen J, Lu J, et al. 2022. Metagenomic analysis reveals gut bacterial signatures for diagnosis and treatment outcome prediction in bipolar depression. Psychiatry Research 307: 114326.

Liang L, Zhou H, Zhang S, Yuan J, Wu H. 2017. Effects of gut microbiota disturbance induced in early life on the expression of extrasynaptic GABA-A receptor 5 and subunits in the hippocampus of adult rats. Brain Research Bulletin 135: 113-119.

Liu RT, Rowan-Nash AD, Sheehan AE, Walsh RFL, Sanzari CM, Korry BJ, Belenky P. 2020. Reductions in anti-inflammatory gut bacteria are associated with depression in a sample of young adults. Brain, Behavior, and Immunity 88: 308-324.

Valles-Colomer M, Falony G, Darzi Y, Tigchelar EF, Wang J, Tito RY, Schiweck C, Kurilshikov A, Joossens M, Wijmenga C, et al. 2019. The neuroactive potential of the human gut microbiota in quality of life and depression. Nature Microbiology (4): 623-632.