Quest International Journal of Medical and Health Sciences – [Online]

EDITORIAL

Gut microbiota to treat depression: A ray of hope

Bedanta Roy[1*], Sellaiah S. Pillay[2]

Corresponding author:

[1]Dr. Bedanta Roy, Ph.D., Associate Professor, Department of Physiology [ORCID]
Email: bedanta.roy@gmail.com

[2]Prof. Dato' Dr. Sellaiah S. Pillay, AMP; DPMP
MBBS; M.MED Radiology; FAMM
Dean & Consultant Radiologist [ORCID]

[1,2]Faculty of Medicine, Quest International University, No. 227, Plaza Teh Teng Seng (Level 2), Jalan Raja Permaisuri Bainun, 30250 Ipoh, Perak Darul Ridzuan, Malaysia

Information about the article:

Published online: July 1, 2023

Publisher

Quest International University (QIU), No.227, Plaza Teh Teng Seng (Level 2), Jalan Raja Permaisuri Bainun, 30250 Ipoh, Perak Darul Ridzuan, Malaysia

e-ISSN: 2636-9478

Depression is a mood disorder characterized by a continual sense of unhappiness and a lack of enthusiasm. The shared features of all depressive disorders involve feelings of sadness, emptiness, or irritability associated with physical and mental alterations that greatly impact an individual's daily life and capacity to function. [1] Depression imposes a significant financial burden on both families and society. Substantial evidence indicates a significant rise in depression among the general population. Major depressive disorder (MDD) is a highly debilitating mental condition that impacts more than 35 million individuals globally. [2]

Commonly used antidepressant drugs have side effects like indigestion and stomach aches, diarrhoea or constipation, loss of appetite, dry mouth, drowsiness and sleep problems, and sexual dysfunctions. Discontinuation of the medication is a common problem because of the side effects. [3]

The trillions of microorganisms housed in human intestinal tracts, encompassing bacteria, viruses, archaea, and fungi, contribute to human well-being. Recent research has revealed the gut microbiome's influence on different organs, including the brain. Microbial imbalance in the intestinal tract causes stress, obesity, anxiety, depression, autism spectrum disorder (ASD), Alzheimer's disease, and Parkinson's disease. The potential involvement of gut microbiota in the development of MDD is gaining popularity in recent years. The gut microbiota significantly impacts growth, brain development, immunity, intestinal mucosal barrier, nutrition, and behaviour. [4, 5]

Antibiotics are associated with an increased risk of depression because of the decreased population and diversity of gut microbiota. Additionally, an unhealthy diet and environmental factors are closely linked to a higher occurrence of depression. [6]

Evidence from studies involving the transfer of gut microbiota from patients suffering from depression to germ-free mice confirmed this close relationship because the animal developed depression-like behaviour. [4] This influence is believed to occur primarily via the hypothalamic–pituitary–adrenal (HPA) axis, inflammatory responses, and modulation of Brain-derived neurotrophic factor (BDNF) levels. Gut microbiota causes the proliferation of gram-negative bacteria triggering the release of higher levels of immunogenic lipopolysaccharide (LPS), successively producing a leaky gut and the presence of endotoxins in the bloodstream. It stimulates the HPA axis, increases the cortisol level, causes an inflammatory reaction, increases the levels of Interleukin-1β (IL-1β), interleukin-6 (IL-6), and TNF-α

and decreases interleukin (IL)-1 receptor antagonist, IL-4, IL-10, IL-11, and IL-13, leading to peripheral inflammation and ultimately leads to depression. [4] Recent research showed that IL-1β and IL-6 levels are higher, whereas IL-4 and IL-10 were comparatively lower in patients suffering from depression. [7]

BDNF is a neurotrophin that regulates neurons' and synapses' growth and plasticity. Hippocampal volume is correlated with Serum BDNF levels. Depressive patients have lower levels of BNDF, which interferes with neurogenesis. It is proposed that intestinal microorganisms modify the neurotransmitter function by modulating a specific pathway, such as the kynurenine pathway or actions associated with the fatty acid availability in the neurones. [8]

Although antidepressants such as monoamine oxidase inhibitors, tricyclic antidepressants, selective serotonin reuptake inhibitor (SSRI), serotonin and norepinephrine reuptake inhibitor (SNRI), and mirtazapine, are widely used for the treatment of depression, 30% of the patients are resistant to any treatment. A ray of hope lies in treating with probiotics. *Lactobacillus* spp., *Bifidobacterium* spp., *Akkermansia* spp., *Clostridium* spp., and *Enterococcus* spp. have been experimented to treat depression in clinical studies. Probiotics are resistant to bile, digestive enzymes from the stomach, pancreas, and gall bladder, stick to the intestinal epithelial cells and subsequently reduce the adhesion of pathogenic bacteria. [9] A recent meta-analysis on probiotics in adults shows promising therapeutic potential to ease depression when administered for a period of more than two months at a dosage of >10 × 10^9 colony-forming units. [10]

It is crucial to discover more probiotic strains that are both safe and efficient for treating depressive symptoms and their associated conditions. Public awareness to treat depression with gut microbiota should be promoted. Gaining a clearer understanding of the relationship between gut microbiota and depression has enough potential to enhance our ability to prevent and treat depression effectively.

Regards,

Dr. Bedanta Roy, Ph.D. Associate Professor, Department of Physiology, Faculty of Medicine, QIU
Editor-in-Chief, Quest International Journal of Medical and Health Sciences

Prof. Dato' Dr. Sellaiah S. Pillay, AMP; DPMP
MBBS; M.MED RADIOLOGY; FAMM
Dean & Consultant Radiologist, Faculty of Medicine, QIU
Co-Editor-in-Chief, Quest International Journal of Medical and Health Sciences

1.7.2023

Keywords
Disorder, intestinal, probiotics, microbiota, patients

Competing interests
None declared.

Publisher's Note
QIU remains neutral with regard to jurisdictional claims in published maps and institutional affiliations. The publisher shall not be legally responsible for any types of loss, actions, claims, proceedings, demand, or costs or damages whatsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

References
1. Cassano P, Fava M. Depression and public health. J Psychosom Res 2002;53:849–57. https://doi.org/10.1016/s0022-3999(02)00304-5
2. COVID-19 Mental Disorders Collaborators. Global prevalence and burden of depressive and anxiety disorders in 204 countries and territories in 2020 due to the COVID-19 pandemic. Lancet 2021;398:1700–12. https://doi.org/10.1016/S0140-6736(21)02143-7
3. Wang S-M, Han C, Bahk W-M, Lee S-J, Patkar AA, Masand PS, *et al*. Addressing the side effects of contemporary antidepressant drugs: A comprehensive review. Chonnam Med J 2018;54:101–12. https://doi.org/10.4068/cmj.2018.54.2.101
4. Zheng P, Zeng B., Zhou C., *et al*. Gut microbiome remodeling induces depressive-like behaviors through a pathway mediated by the host's metabolism. Mol Psychiatry. 2016;21:786–796.
5. Roy B. Gut microbiota: Enemy inside the obese. J Biomed Sci 2018;4:9–10. https://doi.org/10.3126/jbs.v4i2.21315
6. Pouranayatihosseinabad M, Bezabih Y, Hawrelak J, Peterson GM, Veal F, Mirkazemi C. Antibiotic use and the development of depression: A systematic review. J Psychosom Res 2023;164:111113. https://doi.org/10.1016/j.jpsychores.2022.111113
7. Ling Z, Cheng Y, Chen F, Yan X, Liu X, Shao L, *et al*. Changes in fecal microbiota composition and the cytokine expression profile in school-aged children with depression: A case-control study. Front Immunol 2022;13:964910. https://doi.org/10.3389/fimmu.2022.964910

8. Maqsood R, Stone TW. The gut-brain axis, BDNF, NMDA and CNS disorders. Neurochem Res 2016;41:2819–35.
9. Mazloom K, Siddiqi I, Covasa M. Probiotics: How effective are they in the fight against obesity? Nutrients 2019;11:258. https://doi.org/10.3390/nu11020258
10. Musazadeh V, Zarezadeh M, Faghfouri AH, Keramati M, Jamilian P, Jamilian P, *et al*. Probiotics as an effective therapeutic approach in alleviating depression symptoms: an umbrella meta-analysis. Crit Rev Food Sci Nutr 2022:1–9. https://doi.org/10.1080/10408398.2022.2051164