REVIEW PAPER

Volume - 14 | Issue - 10 | October - 2024 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Biotechnology

GUT TO MIND: HARNESSING PROBIOTICS TO COMBAT ANXIETY AND INSOMNIA

Shruthi Sridhar Dept. of Biotechnology, Jyoti Nivas College, Autonomous, Bangalore, India

ABSTRACT Anxiety and insomnia are increasingly prevalent conditions that often co-occur, significantly affecting individuals' mental and physical well-being. Both disorders are linked to disruptions in the gut microbiome, which plays a crucial role in maintaining the gut-brain axis (GBA). The gut-brain axis is a bidirectional communication system connecting the gut and brain, and when disturbed, it can lead to mental health issues such as anxiety and insomnia. Probiotics, especially those present in fermented foods like yogurt and curd, have emerged as promising interventions for restoring a healthy microbiome-gut-brain (MGB) axis. These microorganisms support mental health by regulating emotional responses and improving sleep quality. This review discusses the relationship between the gut microbiota and mental health, with an emphasis on the potential of probiotics as a natural, accessible, and low-risk treatment for anxiety and insomnia, offering a safer alternative to pharmacological treatments.

KEYWORDS : Probiotics, Gut-Brain Axis, Anxiety, Insomnia, Fermented Foods

INTRODUCTION

Anxiety is a condition characterized by excessive worry and emotional distress, affecting more than one-third of the global population during their lifetime (Bandelow & Michaelis, 2015). Insomnia, characterized by difficulty falling asleep (onset insomnia) or maintaining sleep (maintenance insomnia), has also seen a significant rise over the past two decades (Calem et al., 2012). These conditions often coexist and may lead to severe cognitive and emotional disorders if left untreated (Staner, 2003). Despite the availability of pharmacological treatments, such as benzodiazepines and antidepressants, these drugs are associated with side effects and may not be suitable for long-term use (Nowell et al., 1997; Pollack et al., 2008).

Recent studies have highlighted the importance of gut microbiota in regulating emotional and cognitive health through the gut-brain axis (Carabotti et al., 2015). This discovery has paved the way for using probiotics, which are live microorganisms that confer health benefits, as a means of addressing anxiety, insomnia, and other related disorders (Clapp et al., 2017). Probiotics help restore the gut's microbial balance, positively impacting mental health and overall well-being (Jiang et al., 2018). This review focuses on the role of probiotics, especially those found in fermented foods such as yogurt and curd, in alleviating anxiety and insomnia by restoring the microbiome-gut-brain axis.

THE GUT-BRAIN AXIS AND ITS ROLE IN MENTAL HEALTH

The gut-brain axis (GBA) is a complex communication network linking the central nervous system (CNS) with the enteric nervous system (ENS), which governs the gastrointestinal tract. This bidirectional system enables the gut and brain to influence each other through neural, hormonal, and immunological pathways (Carabotti et al., 2015). The gut microbiome, which consists of trillions of microorganisms, plays a crucial role in the functioning of the GBA by influencing the brain's emotional and cognitive centers. Alterations in the gut microbiome, referred to as dysbiosis, can disrupt the GBA, leading to mental health disorders such as anxiety, depression, and insomnia (Jiang et al., 2018). Research shows that individuals with anxiety disorders often exhibit altered gut microbiota, characterized by an imbalance of beneficial and harmful bacteria (Li et al., 2018). Probiotics, particularly strains of Lactobacillus and Bifidobacterium, have shown promise in restoring this balance and improving mental health outcomes (Bravo et al., 2011).

PROBIOTICS AND THEIR ROLE IN MENTAL HEALTH

Probiotics are live microorganisms that confer health benefits when administered in adequate amounts (Clapp et al., 2017). They are typically found in fermented foods such as yogurt, curd, and kefir, or in supplements. Probiotic strains such as Lactobacillus acidophilus, Lactobacillus rhamnosus, and Bifidobacterium bifidum have been studied for their ability to modulate the gut microbiome and improve mental health (Balamurugan et al., 2014; Barrett, 2014). These beneficial microorganisms exert their effects by producing short-chain fatty acids (SCFAs), neurotransmitters like gamma-aminobutyric acid (GABA), and other bioactive compounds that influence brain function. GABA, in particular, is an inhibitory neurotransmitter that plays a key role in regulating anxiety and sleep (Barrett, 2014). Studies involving mice fed with Lactobacillus rhamnosus showed reduced anxiety and depression-related behaviors, highlighting the potential of probiotics to modulate emotional responses (Bravo et al., 2011).

Pharmacological treatments for anxiety and insomnia, such as benzodiazepines, selective serotonin reuptake inhibitors (SSRIs), and hypnotics, are commonly prescribed for short-term relief. While effective in alleviating symptoms, these drugs can lead to dependence and have side effects, particularly when used long-term (Pagel & Parnes, 2001; Nowell et al., 1997). Moreover, these medications often fail to address the underlying causes of anxiety and insomnia, such as gut dysbiosis (Pollack et al., 2008). In contrast, probiotics offer a safer and more natural solution by addressing the root cause—an imbalance in the gut microbiome. By promoting a healthy gut-brain connection, probiotics can alleviate anxiety and insomnia without the risk of long-term side effects associated with pharmacological treatments.

PROBIOTICS AND SLEEP

The relationship between gut microbiota and sleep patterns is an emerging area of research. Disruptions in the gut microbiome have been associated with circadian rhythm disturbances and sleep disorders, including insomnia (Li et al., 2018). Probiotic supplementation can help regulate sleep by restoring the balance of gut bacteria, which in turn positively affects the GBA (Jane et al., 2017). Probiotic-rich foods such as yogurt and curd are not only beneficial for gut health but have also been shown to improve sleep quality (Qin Xiang et al., 2018). Lactobacillus acidophilus, commonly found in yogurt, has demonstrated probiotic activity that enhances gut health and indirectly improves sleep (Ashrafuzzaman et al., 2015). Regular consumption of fermented foods has been linked to improved sleep initiation and maintenance, particularly in older adults (Kitano et al., 2014).

FERMENTED FOODS AS PROBIOTIC SOURCES

Curd and yogurt are two common fermented dairy products that serve as rich sources of probiotics. In many parts of the world, homemade curd is an affordable and accessible probiotic source (Balamurugan et al., 2014). It contains a variety of probiotic strains, including Lactobacillus acidophilus, Lactobacillus bulgaricus, Bifidobacterium bifidum, and Streptococcus thermophilus, which have been shown to support gut health and enhance the function of the MGB axis (Korpela et al., 2018). While commercial probiotic supplements are widely available, home-fermented foods like curd offer a natural and cost-effective alternative. These products not only restore the gut microbiota but also support mental health by improving sleep and reducing symptoms of anxiety and depression (Ruth & Foster, 2015).

CONCLUSION

Anxiety and insomnia are pervasive mental health issues that often coexist and significantly impair the quality of life. While pharmacological treatments remain the first line of defense, they come with notable limitations, particularly for long-term use. Emerging research points to the critical role of the gut microbiome in regulating mental health through the gut-brain axis, with probiotics offering a natural and effective means of restoring balance. Fermented foods, such as curd and yogurt, are rich in probiotic bacteria that help re-

establish the microbiome-gut-brain axis, improving both gut health and mental well-being. Given their affordability, accessibility, and minimal side effects, probiotics present a promising alternative or complementary approach to traditional pharmacological treatments for anxiety and insomnia.

REFERENCES

1. Bandelow, B., & Michaelis, S. (2015). Epidemiology of anxiety disorders in the 21st century. Dialogues in Clinical Neuroscience, 17(3), 327–335.
2. Calem, M., Bisla, J., Begum, A., Dewey, M., Bebbington, P. E., Brugha, T., & Stewart, R. (2012). Increased prevalence of insomnia and changes in hypnotics use in England over 15 years: analysis of the 1993, 2000, and 2007 National Psychiatric Morbidity Surveys. Sleep, 35(3), 377–384.
3. Staner, L. (2003). Sleep and anxiety disorders. Dialogues in Clinical Neuroscience, 5(3), 249–258.
4. Nowell, P. D., Mazumdar, S., Buysse, D. J., Dew, M. A., Reynolds, C. F., & Kupfer, D. J. (1997). Benzodiazepines and Zolpidem for chronic insomnia: A meta-analysis of treatment efficacy. JAMA, 278(24), 2170–2177.
5. Pollack, M., Kinrys, G., Krystal, A., et al. (2008). Eszopiclone coadministered with escitalopram in patients with insomnia and comorbid generalized anxiety disorder. Archives of General Psychiatry, 65(5), 551–562.
6. Carabotti, M., Scirocco, A., Maselli, M. A., & Severi, C. (2015). The gut-brain axis: Interactions between enteric microbiota, central and enteric nervous systems. Annals of Gastroenterology, 28(2), 203–209.
7. Clapp, M., Aurora, N., Herrera, L., Bhatia, M., Wilen, E., & Wakefield, S. (2017). Gut microbiota's effect on mental health: The gut-brain axis. Clinics and Practice, 7(4), 987.
8. Jiang, H.-Y., Zhang, X., Yu, Z.-H., Zhang, Z., Deng, M., Zhao, J.-H., & Ruan, B. (2018). Altered gut microbiota profile in patients with generalized anxiety disorder. Journal of Psychiatric Research, 104, 130–136.
9. Li, Y., Hao, Y., Fan, F., & Zhang, B. (2018). The role of microbiome in insomnia, circadian disturbance, and depression. Frontiers in Psychiatry, 9, 669.
10. Bravo, J. A., Forsythe, P., Chew, M. V., Escaravage, E., Savignac, H. M., Dinan, T. G., et al. (2011). Ingestion of Lactobacillus strain regulates emotional behavior and central GABA receptor expression in a mouse via the vagus nerve. Proceedings of the National Academy of Sciences USA, 108(38), 16050–16055.
11. Barrett, E. (2014). This article corrects: Gamma-Aminobutyric acid production by culturable bacteria from the human intestine. Journal of Applied Microbiology, 116, 1384–1386.
12. Morin, C. M., Bélanger, L., LeBlanc, M., et al. (2008). The natural history of insomnia: A population-based 3-year longitudinal study. Archives of Internal Medicine, 168(5), 447–453.
13. Jane, A. F., & Foster, J. A. (2017). Stress & the gut-brain axis: Regulation by the microbiome. Neurobiology of Stress, 7, 124–136.
14. Qin Xiang Ng, Christina Peters, Collin Yih Xian Ho, Donovan Yutong Lim, & Wee-Song Yeo. (2018). A meta-analysis of the use of probiotics to alleviate depressive symptoms. Journal of Affective Disorders, 228, 13–19.
15. Ashrafuzzaman, Md., Farhana, M., Javed, F., Ali, M., & Rahman, M. M. (2015). Optimization of probiotic activity of Lactobacillus acidophilus characterized from commercial yoghurt. International Journal of Biosciences, 94–99.
16. Kitano, N., Tsunoda, K., Tsuji, T., Osuka, Y., Jindo, T., Tanaka, K., & Okura, T. (2014). Association between difficulty initiating sleep in older adults and the combination of leisure-time physical activity and consumption of milk and milk products: A cross-sectional study. BMC Geriatrics, 14, 118.
17. Balamurugan, R., Chandragunasekaran, A. S., Chellappan, G., Rajaram, K., Ramamoorthi, G., & Ramakrishna, B. S. (2014). Probiotic potential of lactic acid bacteria present in homemade curd in southern India. The Indian Journal of Medical Research, 140(3), 345–355.
18. Korpela, K., Salonen, A., Vepsäläinen, O., Suomalainen, M., Kolmeder, C., Varjosalo, M., & de Vos, W. M. (2018). Probiotic supplementation restores normal microbiota composition and function in antibiotic-treated and in caesarean-born infants. Microbiome, 6(1), 182.
19. Ruth, A. L., & Foster, J. A. (2015). Gut-brain axis: Diet microbiota interactions and implications for modulation of anxiety and depression. Current Opinion in Biotechnology, 32, 35–41.
20. Pagel, J. F., & Parnes, B. L. (2001). Medications for the treatment of sleep disorders: An overview. Primary Care Companion to the Journal of Clinical Psychiatry, 3(3), 118–125.