Journal of Biomedical and Pharmaceutical Research
Available Online at www.jbpr.in
CODEN: - JBPRAU (Source: - American Chemical Society)
NLM (National Library of Medicine): ID: (101671502)
Index Copernicus Value 2023: 85.86
Volume 14, Issue 5; 2025, 15-20

ISSN (Online): 2279-0594
ISSN (Print): 2589-8752

Review Article

Mind Matters: Exploring the Vital Link Between Mental Health and Immune Resilience

Priyanka Mehta

Hansraj College, University of Delhi

Article Info: Received: 15-07-2025 / Revised: 27-08-2025 / Accepted: 28-09-2025
Corresponding Author: Priyanka Mehta
DOI: https://doi.org/10.32553/jbpr.v14i5.1360
Conflict of interest statement: No conflict of interest

Abstract:

The intricate relationship between mental health and immunity is increasingly recognized as vital to overall well-being. Mental health significantly influences immune function through complex interactions, forming the foundation of psychoneuroimmunology. Mental health disorders, such as stress, anxiety, and depression, can dysregulate immune responses by altering hormone levels, cytokine production, and immune cell activity. Chronic stress, for instance, can lead to prolonged inflammation and impaired immune surveillance, increasing vulnerability to infections and delaying healing processes. Conversely, a robust immune system supports mental health by reducing inflammation in the brain and promoting neuroplasticity, which is crucial for cognitive function and emotional resilience.

Psychoneuroimmunology explores these bidirectional relationships, emphasizing how psychological factors impact immune responses and vice versa. Interventions that promote mental well-being, such as cognitive-behavioral therapy and mindfulness practices, have shown promise in enhancing immune function by reducing stress-related inflammation and improving immune cell activity. Understanding these interconnected mechanisms is crucial for developing holistic health strategies that integrate mental health care with immune support, ultimately fostering resilience and optimizing overall health outcomes.

Keywords: psychoneuroimmunology, mental health, immunity, behavioral interventions

Introduction

Emotions and mental health play crucial roles in shaping overall health and immunity, intertwining psychological states with physiological responses in profound ways. Research has consistently demonstrated that emotional well-being significantly influences immune system function [1]. For instance, chronic stress, often associated with negative emotions like anxiety and depression, can lead to dysregulation of immune responses, making individuals more susceptible to infections and inflammatory diseases [2]. Furthermore, positive emotions and a resilient mental state have been linked to enhanced immune function and better health outcomes [3]. The stress response begins with the hypothalamus in the brain signaling the adrenal glands to release hormones, such as cortisol and adrenaline, which prepare the body for immediate action in what is commonly known as the "fight or flight" response [4]. These hormones mobilize energy reserves, increase heart rate, and sharpen focus, all crucial for dealing with acute threats [4]. However, chronic activation of the stress response can have detrimental effects on health. Prolonged exposure to elevated cortisol levels

suppresses the immune system, leading to decreased activity of lymphocytes and other immune cells, thereby compromising the body's ability to defend against pathogens [5]. Moreover, chronic stress induces a state of chronic inflammation characterized by increased levels of pro-inflammatory cytokines, which can contribute to the development of various diseases including cardiovascular diseases, diabetes, and autoimmune disorders [6]. On the other hand, studies have demonstrated that experiencing positive emotions can increase the production of immunoglobulins and other antibodies that play a crucial role in defending the body against infections [7]. Positive emotions have also been associated with lower levels of inflammatory markers in the body, which are implicated in various chronic diseases [8]. Furthermore, positive emotions can promote cardiovascular health by reducing heart rate and blood pressure, and they have been linked to better cardiovascular outcomes over time [9]. The field of psychoneuroimmunology has shed light on intricate pathways through which emotions, stress hormones, and neural signaling mechanisms impact immune cells and their activities, underscoring the bidirectional relationship between mental health and immunity [10]. Understanding these dynamics is pivotal for developing holistic health strategies that integrate psychological well-being with immune system resilience, promoting comprehensive wellness.

Interplay of brain functioning and immune responses

Importantly, the brain and immune system communicate bidirectionally through neural, endocrine, and immune pathways (Fig. 1). This crosstalk is mediated by neurotransmitters, hormones (e.g., cortisol), and immune molecules (e.g., cytokines), collectively termed the neuroimmune axis [11]. Cytokines, initially recognized for their immune regulatory roles, also influence brain function by modulating neurotransmitter release, neurogenesis, and synaptic plasticity. Conversely, neural signals can regulate immune responses, influencing inflammation and immune cell trafficking [12].

Neurotransmitters like norepinephrine and dopamine can modulate immune responses by binding to receptors on immune cells and influencing their activation and function [13]. For example, serotonin regulates immune cell proliferation and cytokine production, influencing inflammation and immune function [14]. Conversely, immune cells release cytokines such as interleukins and tumor necrosis factor, which can signal to the nervous system and affect neural activity, thereby regulating immune responses [15].

Hormones such as cortisol, produced during stress responses, can influence cytokine production and immune cell activity. For instance, cortisol inhibits the production of pro-inflammatory cytokines like interleukin-1(IL-1) and tumor necrosis factor-alpha (TNF-α), thereby dampening immune responses [16]. Hormones such as adrenaline and cortisol, which are released during stress responses, can affect neurotransmitter levels and neuronal activity, thereby influencing immune responses through the neuroendocrine axis [17]. Conversely, cytokines released by immune cells, such as interleukin-6 and interferons, can signal to the endocrine system, influencing hormone secretion and balance [18]. Chronic stress has been observed to induce significant immune responses in studies involving mice, where continuous exposure to stress triggers the release of inflammatory proteins. This reaction subsequently leads to impaired brain function and atrophy, contributing to depressive behaviors [19]. Furthermore, research indicates a bidirectional relationship between stress, depression, and immune system functionality. Chronic stress elevates cortisol levels, inhibiting the body's anti-inflammatory response and potentially increasing susceptibility to infections [20]. This state of low-grade chronic inflammation not only compromises immune defense but also predisposes individuals to metabolic disorders and, in severe cases, cancer [21]. Thus, stress and depression appear to

impact overall well-being by adversely affecting immune system regulation and fostering conditions favorable for disease development. Chronic inflammation, often characterized by elevated levels of pro-inflammatory cytokines such as interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF-α), has been implicated in the development and progression of depressive symptoms [22]. These cytokines can directly affect neurotransmitter metabolism and neuroplasticity in brain regions involved in mood regulation, such as the prefrontal cortex and limbic system [10]. Additionally, stress triggers the release of cortisol and activates the hypothalamic-pituitary-adrenal (HPA) axis, leading to increased inflammation and altering neurotransmitter levels, which contribute to depressive symptoms [23].

This bidirectional communication forms a crucial aspect of the neuroendocrine-immune axis, which regulates immune function in response to physiological and psychological challenges. Imbalances or dysregulation in this axis can lead to immune disorders, chronic inflammation, or susceptibility to infections, underscoring the intricate relationship between cytokines, hormones, and overall immune health. The integration of brain function and immune response is critical for adaptive behaviors, stress responses, and disease resilience. Understanding these interconnected mechanisms is essential for developing therapies targeting both neurological and immunological disorders, emphasizing the importance of interdisciplinary research to elucidate these intricate relationships further.

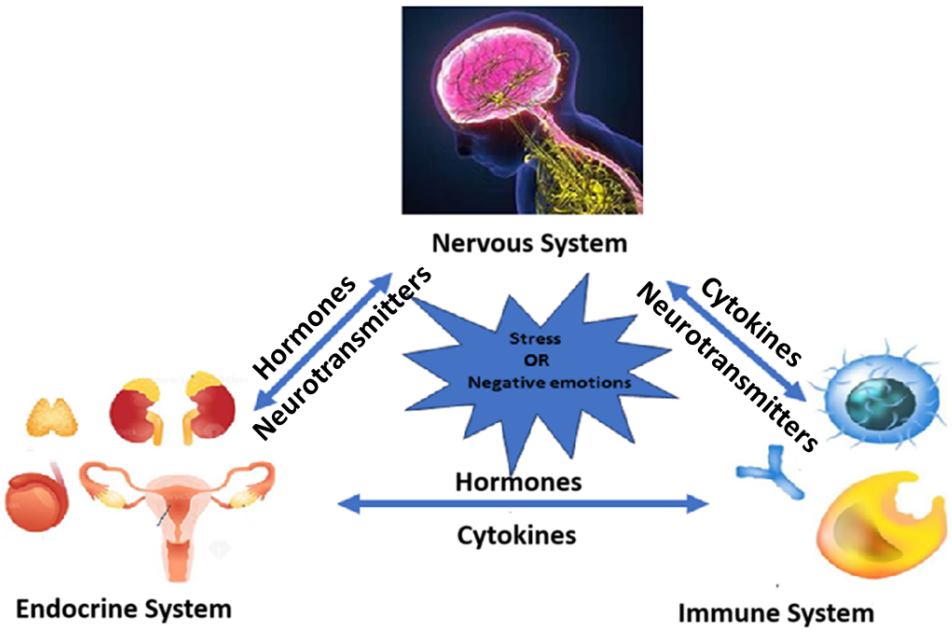

Figure 1: Neuro-endocrine-immune network (NEI)- Schematic representation of the neuro-endocrine-immune network illustrating bi-directional communication pathways between the nervous, endocrine, and immune systems. Arrows indicate signaling pathways and interactions crucial for maintaining homeostasis and responding to external stimuli.

Boosting immunity through behavioural interventions

Studies in psychoneuroimmunology reveals that immune regulation is intricately linked to adaptive responses within a complex system. Understanding these interactions between the brain and immune system provides profound insights into the mechanisms underlying health and disease, particularly concerning the impact of emotions and stress on health outcomes. The future of psychoneuroimmunological research

likely hinges on a comprehensive understanding of how stress affects human immune function and the clinical implications of psychosocial influences on immune responses. Studies underlines the significant role of behavioural interventions in enhancing immunity and improving health outcomes related to immune function. They highlight that social, neurocognitive, and behavioural factors play crucial roles in shaping immune processes.

Behavioural interventions have been shown to improve immunity through several mechanisms [24]. Firstly, these interventions, such as cognitive-behavioral therapy (CBT), meditation, and stress management techniques, reduce the activation of the hypothalamic-pituitary-adrenal (HPA) axis and the subsequent release of cortisol, a stress hormone known to suppress immune function [25]. By lowering stress levels, these interventions mitigate chronic inflammation and enhance immune response efficacy [26]. Additionally, practices like mindfulness meditation and yoga have been linked to increased activity in the parasympathetic nervous system, promoting relaxation and reducing sympathetic nervous system activation, which further supports immune function [27]. Moreover, behavioural interventions can improve overall health behaviors, such as sleep quality and physical activity, which are crucial for maintaining a robust immune system [28]. Overall, these interventions provide comprehensive support for immune health by addressing both psychological stressors and physiological responses that impact immunity.

Conclusion

The study underlines the intricate relationship between mental health and immune function, mediated by psychological factors such as stress, emotions, and coping mechanisms. These interactions operate through complex psychoneuroimmunological pathways that significantly influence health outcomes and disease susceptibility. The pivotal role of mental health interventions, including cognitive-behavioral therapies, mindfulness practices, and stress management techniques, is highlighted in enhancing immune resilience and overall well-being. Recent studies and meta-analyses suggest that these interventions effectively mitigate inflammation and improve immune system function, underscoring their potential therapeutic benefits in treating mental health issues associated with immune dysregulation. While direct causal links between specific mental health disorders like depression and inflammation require further exploration, the established correlation between psychological stress and inflammation underscores the importance of addressing mental health in comprehensive approaches to health promotion and disease prevention. Future research should continue to elucidate these relationships and develop targeted strategies that integrate mental health support with immune-enhancing interventions for optimal health outcomes.

Acknowledgements

Not applicable.

Authors Contributions

This review is authored solely by Dr. Priyanka Mehta. All content, analysis, and conclusions presented in this review reflect the individual work and perspectives of Dr. Priyanka Mehta.

Funding

No funding was received.

Availability of data and materials

Not applicable

Ethics approval and consent to participate

Not applicable.

Patient consent for publication

Not applicable.

References

1. Lasselin J, Alvarez-Salas E, Grigoleit JS. Well-being and immune response: a multi-system perspective. Current opinion in pharmacology. 2016 Aug 1;29:34-41.

2. Cohen S, Janicki-Deverts D, Miller GE. Psychological stress and disease. Jama. 2007 Oct 10;298(14):1685-7.
3. Pressman SD, Cohen S. Does positive affect influence health?. Psychological bulletin. 2005 Nov;131(6):925.
4. McEwen BS. Physiology and neurobiology of stress and adaptation: central role of the brain. Physiological reviews. 2007 Jul;87(3):873-904.
5. Cohen S, Janicki-Deverts D, Doyle WJ, Miller GE, Frank E, Rabin BS, Turner RB. Chronic stress, glucocorticoid receptor resistance, inflammation, and disease risk. Proceedings of the National Academy of Sciences. 2012 Apr 17;109(16):5995-9.
6. Dhabhar FS. Effects of stress on immune function: the good, the bad, and the beautiful. Immunologic research. 2014 May;58:193-210.
7. Brod S, Rattazzi L, Piras G, D'Acquisto F. 'As above, so below'examining the interplay between emotion and the immune system. Immunology. 2014 Nov;143(3):311-8.
8. Steptoe A, Hamer M, Chida Y. The effects of acute psychological stress on circulating inflammatory factors in humans: a review and meta-analysis. Brain, behavior, and immunity. 2007 Oct 1;21(7):901-12.
9. Kubzansky LD, Huffman JC, Boehm JK, Hernandez R, Kim ES, Koga HK, Feig EH, Lloyd-Jones DM, Seligman ME, Labarthe DR. Positive psychological well-being and cardiovascular disease: JACC health promotion series. Journal of the American College of Cardiology. 2018 Sep 18;72(12):1382-96.
10. Dantzer R, O'connor JC, Freund GG, Johnson RW, Kelley KW. From inflammation to sickness and depression: when the immune system subjugates the brain. Nature reviews neuroscience. 2008 Jan;9(1):46-56..
11. Wrona D. Neural–immune interactions: an integrative view of the bidirectional relationship between the brain and immune systems. Journal of neuroimmunology. 2006 Mar 1;172(1-2):38-58.
12. Kennedy RH, Silver R. Neuroimmune signaling: cytokines and the central nervous system. InNeuroscience in the 21st century: from basic to clinical 2022 Oct 18 (pp. 883-922). Cham: Springer International Publishing.
13. Franco R, Reyes-Resina I, Navarro G. Dopamine in health and disease: much more than a neurotransmitter. Biomedicines. 2021 Jan 22;9(2):109.
14. Roumier A, Béchade C, Maroteaux L. Serotonin and the immune system. InSerotonin 2019 Jan 1 (pp. 181-196). Academic Press.
15. Kipnis J. Multifaceted interactions between adaptive immunity and the central nervous system. Science. 2016 Aug 19;353(6301):766-71.
16. IJ E. Neuroendocrine regulation of IL-12 and TNF-alpha/IL-10 balance. Clinical Ann NY Acad Sci.. 2000;917:94-105.
17. Pondeljak N, Lugović-Mihić L. Stress-induced interaction of skin immune cells, hormones, and neurotransmitters. Clinical therapeutics. 2020 May 1;42(5):757-70.
18. Gionis D, Ilias I, Moustaki M, Mantzos E, Papadatos I, Koutras DA, Mastorakos G. Hypothalamic-pituitary-adrenal axis and interleukin-6 activity in children with head trauma and syndrome of inappropriate secretion of antidiuretic hormone. Journal of Pediatric Endocrinology and Metabolism. 2003 Jan;16(1):49-54.
19. Ramirez K, Fornaguera-Trías J, Sheridan JF. Stress-induced microglia activation and monocyte trafficking to the brain underlie the development of anxiety and depression. Inflammation-associated depression: Evidence, mechanisms and implications. 2017:155-72.
20. Chrousos GP. The stress response and immune function: clinical implications. Ann NY Acad Sci. 2000;917(8):38-67.
21. Karin M, Lawrence T, Nizet V. Innate immunity gone awry: linking microbial infections to chronic inflammation and cancer. Cell. 2006 Feb 24;124(4):823-35.

22. Kiecolt-Glaser JK, Derry HM, Fagundes CP. Inflammation: depression fans the flames and feasts on the heat. American Journal of Psychiatry. 2015 Nov 1;172(11):1075-91.
23. Pariante CM. Why are depressed patients inflamed? A reflection on 20 years of research on depression, glucocorticoid resistance and inflammation. European neuropsychopharmacology. 2017 Jun 1;27(6):554-9.
24. Shields GS, Spahr CM, Slavich GM. Psychosocial interventions and immune system function: a systematic review and meta-analysis of randomized clinical trials. JAMA psychiatry. 2020 Oct 1;77(10):1031-43.
25. Hinds JA, Sanchez ER. The role of the hypothalamus–pituitary–adrenal (HPA) axis in test-induced anxiety: assessments, physiological responses, and molecular details. Stresses. 2022 Mar 14;2(1):146-55.
26. Segerstrom SC, Miller GE. Psychological stress and the human immune system: a meta-analytic study of 30 years of inquiry. Psychological bulletin. 2004 Jul;130(4):601.
27. Thibodeaux N, Rossano MJ. Meditation and immune function: The impact of stress management on the immune system. OBM Integrative and Complementary Medicine. 2018 Dec;3(4):1-23.
28. Sejbuk M, Mirończuk-Chodakowska I, Witkowska AM. Sleep quality: a narrative review on nutrition, stimulants, and physical activity as important factors. Nutrients. 2022 May 2;14(9):1912.