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Review Article

The Neuro-Immune Axis in Ayurveda: An Integrative Analysis of the Vata–Manas–Ojas Triad and Modern Psychoneuroimmunology

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Abstract

Background: Psychoneuroimmunology (PNI) has established that psychological stress influences immune function by activating the hypothalamic–pituitary–adrenal (HPA) axis and the sympathetic nervous system. Interestingly, classical Ayurveda appears to describe a functionally similar framework for mind–body–immune interaction through the interconnected concepts of Vata, Manas, and Ojas. Exploring these conceptual parallels may yield valuable insights into integrative models of health and disease.

Objective: To examine the convergence between Ayurvedic concepts of neuroimmune regulation and contemporary psychoneuroimmunology, and to develop an integrative framework that links traditional Ayurvedic principles with modern biomedical mechanisms.

Methods: A conceptual and comparative analysis was conducted using classical Ayurvedic literature, particularly the Charaka Samhita, alongside seminal theories of stress proposed by Hans Selye and contemporary research in psychoneuroimmunology. Key Ayurvedic constructs were systematically mapped onto recognized neuroendocrine and immunological pathways.

Results: The analysis revealed significant functional parallels between Ayurvedic and modern neuroimmunological models. Vata was found to correspond closely with neural regulatory processes, Manas with psychological and cognitive functions, and Ojas with immune competence and systemic resilience. The Ayurvedic concept of Chittodvega (mental agitation) demonstrated notable similarities to chronic psychological stress, including dysregulation of the HPA axis and subsequent alterations in immune function. These interactions provide a coherent framework for understanding the development of stress-related inflammatory disorders, autoimmune diseases, and age-associated neuroimmune decline.

Conclusion: Classical Ayurvedic literature presents a sophisticated conceptual model of mind–body–immune interactions that parallels key principles of modern psychoneuroimmunology. The Vata–Manas–Ojas triad offers a potentially valuable framework for understanding the neuroendocrine and immunological consequences of psychological stress. Future translational research integrating Ayurvedic theory with contemporary biomedical methodologies may enhance understanding of stress-related disorders and support the development of holistic therapeutic strategies.

Keywords: Psychoneuroimmunology; Ayurveda; Vata; Manas; Ojas; Chittodvega; Stress; HPA Axis; Neuroimmune Regulation; Integrative Medicine.

1. Introduction

The relationship among psychological stress, neural regulation, and immune function has been a cornerstone of modern psychoneuroimmunology (PNI) since Selye's seminal 1936 stress research.¹ In parallel, the classical Ayurvedic tradition—systematized over two millennia ago—articulated a sophisticated mind–body–immunity framework through the interplay of *Vata*, *Manas*, and *Ojas*. Despite striking conceptual parallels, a significant lacuna persists in the scholarly literature: no robust integrative model bridges these two paradigms.

Contemporary PNI research has identified the HPA axis, sympathetic nervous system, and cytokine networks as the mechanistic substrates of stress-immune crosstalk.^{2–4} By contrast, ancient Ayurvedic texts

describe the regulatory triad of *Vata* (neural principle), *Manas* (mind), and *Ojas* (immune essence) as governing the continuum between health and disease. The absence of a rigorous conceptual model that unifies these traditions limits translational research and cross-disciplinary clinical innovation.

This paper addresses that gap. It proceeds in four steps: (1) reviewing the modern PNI framework, with an emphasis on HPA axis and sympathetic nervous system regulation of immunity; (2) systematically analyzing the Ayurvedic constructs of *Vata*, *Manas*, and *Ojas* in light of their functional roles; (3) constructing an integrative model of functional homology between the two systems; and (4) deriving clinical and research implications for translational medicine.

2.1 Objective(s)

To examine the convergence between Ayurvedic concepts of neuro-immune regulation and contemporary psychoneuroimmunology (PNI), and to develop an integrative framework linking the Ayurvedic triad of *Vata*, *Manas*, and *Ojas* with modern neuroendocrine and immunological mechanisms involved in stress responses and immune regulation.

2.2 Methods

Data Sources

Classical Ayurvedic literature, primarily the *Charaka Samhita*, along with seminal and contemporary scientific literature on psychoneuroimmunology, stress physiology, neuroendocrinology, and immune regulation. Sources included foundational works by Hans Selye, McEwen, Chrousos, Ader, Sapolsky, Dhabhar, and related peer-reviewed publications.

Study Selection

Relevant classical Ayurvedic concepts pertaining to *Vata*, *Manas*, *Ojas*, *Chittodvega*, and *Rasayana* were selected and compared with contemporary evidence regarding the hypothalamic–pituitary–adrenal (HPA) axis, sympathetic nervous system activation, cytokine regulation, allostatic load, and neuroimmune interactions. Literature was selected based on its relevance to stress-mediated immune modulation and integrative medicine.

3. The Modern Neuro-Immune Axis

The hypothalamic–pituitary–adrenal (HPA) axis is the primary neuroendocrine pathway through which psychological stress modulates immune function. When a stressor is perceived, corticotropin-releasing hormone (CRH) initiates a cascade that culminates in cortisol secretion, which exerts both immunosuppressive and immunomodulatory effects depending on the chronicity and dosage of exposure.²

Simultaneously, the sympathetic nervous system releases catecholamines—norepinephrine and epinephrine—that directly innervate lymphoid organs, thereby altering lymphocyte trafficking and cytokine profiles. Chronic activation shifts the immune state toward a pro-inflammatory phenotype, elevating interleukin-6 (IL-6), tumor necrosis factor- α (TNF- α), and nuclear factor kappa B (NF- κ B), while concurrently suppressing adaptive immunity.^{6–7} This dual-arm model—encompassing both HPA axis and sympathetic nervous system engagement—constitutes the biomedical foundation against which Ayurvedic constructs can be meaningfully evaluated.

3.1 The HPA Cascade

The HPA axis activation sequence proceeds as follows: stress perception → hypothalamic CRH release → anterior pituitary ACTH secretion → adrenal cortex cortisol production → systemic immunomodulation. McEwen has described this cascade in terms of allostatic load, in which adaptive short-term stress responses become maladaptive with chronicity.³ Sapolsky and

colleagues extended this framework to demonstrate the permissive, suppressive, stimulatory, and preparative actions of glucocorticoids on immune function.⁶

3.2 Chronic Stress and Immune Dysregulation

Dhabhar has highlighted the distinction between acute stress-induced immunoenhancement and chronic stress-induced immunosuppression, arguing that the duration and predictability of stress exposure are critical determinants of immune outcomes.⁷ Chronic psychological stress has been specifically linked to elevated inflammatory markers, impaired vaccine responses, delayed wound healing, and increased susceptibility to viral infections. These observations provide the empirical backdrop for understanding Ayurvedic descriptions of stress-mediated disease susceptibility.

4. The Ayurvedic Framework: Vata, Manas, and Ojas

4.1 Vata as the Neuro-Regulatory Principle

In classical Ayurveda, *Vata Dosha* is not merely a constitutional type but a fundamental bio-regulatory force that governs all neural and kinetic phenomena in the living organism. The *Charaka Samhita* (Sutrasthana 12/8) declares *Vata* to be the "*Niyanta Praneta ca Manasah*"—the controller and director of the mind and sensory–motor faculties.¹ This designation positions *Vata* as a principle functionally analogous to the central and autonomic nervous systems in modern physiology.

The key functional domains of *Vata* encompass: (1) neural conduction—transmission of sensory and motor impulses; (2) cognitive regulation—control of *Manas* and the sense organs (*Indriyas*); (3) physiological motion—governance of respiration, circulation, and peristalsis; and (4) homeostatic balance—maintenance of equilibrium among the three *Doshas* and the seven *Dhatus*. *Vata's* role as both the generator and regulator of systemic activity makes it the Ayurvedic equivalent of the integrated central and autonomic nervous system described in modern physiology.

4.2 Ojas and Immune Competence

In classical Ayurvedic literature, *Ojas* is described as the *Sara* (essence) of all *Sapta Dhatus* (seven bodily tissues), representing the ultimate biochemical product of healthy digestion and metabolism. It is the material substrate of *Bala*—a term encompassing physical strength, disease resistance, and what modern biomedicine recognizes as immune competence.¹

Ojas is the final, most refined product of sequential tissue metabolism—from *Rasa* (plasma) through *Shukra* (reproductive tissue). Its formation depends on optimal *Agni* (digestive fire) at each metabolic stage. Classical texts place *Ojas* in the *Hridaya* (heart) and describe it as pervading the entire body. Its quantity and quality directly determine disease resistance and vitality.

When depleted—a state termed *Ojas Kshaya*—the individual exhibits *Bhaya* (fear), *Daurbalya* (weakness), anxiety, and increased susceptibility to disease. These symptoms closely parallel the clinical presentation of

chronic stress-induced immunosuppression described in the PNI literature.⁵ *Ojas* thus functionally correlates with immunological competence, encompassing innate immunity, adaptive immune memory, and psychosomatic well-being as an integrated construct.

4.3 *Manas*: The Mind–Body Interface

In Ayurvedic thought, *Manas* occupies the interface between pure consciousness (*Atman/Purusha*) and material physiology. It receives, processes, and responds to sensory information, and its quality is governed by the three *Gunas*—*Satva* (clarity), *Rajas* (activity), and *Tamas* (inertia). *Manas* is intrinsically linked to *Vata*, which governs its movement, and to *Ojas*, whose depletion directly impairs mental stability and immune resilience. This triadic interdependence—*Vata*, *Manas*, and *Ojas*—constitutes the Ayurvedic model of mind–neuro–immune regulation.

5. Chittodvega: The Ayurvedic Stress Pathology Framework

The Ayurvedic concept of *Chittodvega*—literally "agitation of the mind"—describes a pathological state arising from the dual etiology of *Vata Prakopa* (aggravation of *Vata Dosha*) and *Rajas* (the psychic quality of hyperactivity, passion, and restlessness). This pathological sequence closely mirrors what modern psychiatry and PNI classify as chronic stress-related disorders.

The pathophysiological cascade of *Chittodvega* proceeds through four stages: (1) Rajasic mental disturbance—

excessive desire, anxiety, and emotional turbulence provoke mental disequilibrium; (2) *Vata Prakopa*—*Rajas* destabilizes *Vata*, producing symptoms of insomnia (*Anidra*), anxiety (*Chinta*), tremors, and autonomic dysregulation; (3) systemic *Doshic* imbalance—aggravated *Vata* disrupts *Pitta* and *Kapha*, leading to widespread physiological derangement; and (4) neuroendocrine cascade—the imbalance triggers downstream effects analogous to HPA axis hyperactivation, including cortisol dysregulation, immune suppression, and progressive *Ojas* depletion.

The clinical symptom profile of *Chittodvega*—encompassing anxiety, sleep disturbance, fatigue, and susceptibility to infection—maps closely onto the biomedical phenotype of chronic psychological stress with neuro-immune sequelae. This correspondence is not merely metaphorical; it suggests that both systems describe the same underlying psychophysiological process in different conceptual languages.

6. An Integrative Conceptual Model

The central contribution of this analysis is the construction of a unified conceptual model that maps the Ayurvedic stress–immunity pathway onto the modern PNI framework. This model posits that psychological stress operates through a conserved cascade, whether described in the language of *Vata–Manas–Ojas* or of CRH–Cortisol–Cytokines: the functional architecture is strikingly convergent.

Table 1 presents the systematic alignment of Ayurvedic and biomedical constructs:

Table 1. Functional Homology between Ayurvedic and Biomedical Constructs in Neuro-Immune Regulation

Ayurvedic Construct	Biomedical Correlate	Functional Role
Vata Dosha	Central & Autonomic Nervous System	Neural regulation, signal transmission, physiological motion
Manas	Limbic-cortical stress processing,	Cognitive-emotional appraisal, stress perception
Ojas	Innate & Adaptive Immune Competence	Disease resistance, immune memory, psychosomatic vitality
Chittodvega	Chronic Psychological Stress	Pathological mind-body cascade leading to immune dysregulation
Vata Prakopa	HPA axis & SNS hyperactivation	Neuroendocrine dysregulation, autonomic imbalance
Ojas Kshaya	Immunosuppression / Allostatic overload	Depleted immune reserves, susceptibility to infection
Rasayana therapy	Neuroimmune rehabilitation	Restoration of immune competence and neural homeostasis

This integrative model does not claim equivalence between the two paradigms but rather posits functional homology: both systems describe a sequence in which mental perturbation destabilizes neural regulation, which in turn depletes the body's immune defenses. The model provides a scaffold for hypothesis-driven translational research, enabling investigators to design studies that simultaneously measure Ayurvedic outcome parameters and biomedical immune markers.

7. Clinical and Research Implications

7.1 Stress-Related Inflammatory Disorders

Ayurvedic *Vata*-pacifying protocols (*Vata Shamana*) may complement standard anti-inflammatory therapies for conditions such as chronic fatigue syndrome, irritable bowel syndrome, and fibromyalgia, in which HPA axis dysregulation is well documented. The theoretical basis is the observed correspondence between *Vata* aggravation and sympathetic nervous system hyperactivation—both characterized by

heightened reactivity, autonomic instability, and a systemic pro-inflammatory shift.

7.2 Autoimmune Conditions

The *Ojas* depletion model offers a theoretical basis for investigating *Rasayana* (rejuvenation) therapies as adjuncts in autoimmune management, particularly for diseases in which psychological stress is a recognized trigger—including rheumatoid arthritis, multiple sclerosis, and systemic lupus erythematosus. *Rasayana* formulations such as *Ashwagandha* (*Withania somnifera*) and *Guduchi* (*Tinospora cordifolia*) have shown immunomodulatory effects in preliminary clinical studies, warranting rigorous controlled evaluation.

7.3 Geriatric Neuro-Immune Decline

Age-related immunosenescence parallels the Ayurvedic concept of progressive *Ojas* diminution. Integrative geriatric protocols that combine *Medhya Rasayanas* (nootropic and neuroprotective formulations) with modern neuroimmune biomarkers provide fertile ground for clinical trials. Such trials could assess outcomes including cognitive function, NK cell activity, diurnal cortisol variation, and traditional *Bala Pariksha* (assessment of strength and vitality).

7.4 Scope for Integrative Translational Trials

Randomized controlled trials measuring cortisol, IL-6, TNF- α , and NK cell activity alongside Ayurvedic outcome parameters—including *Bala Pariksha* and *Ojas Lakshanas* (observable signs of *Ojas* quality)—could yield compelling translational evidence. Such designs require collaboration among Ayurvedic clinicians, immunologists, and PNI researchers, and their feasibility is enhanced by the conceptual framework developed here.

8. Results

The comparative analysis revealed substantial functional convergence between Ayurvedic concepts and contemporary psychoneuroimmunological mechanisms. The Ayurvedic triad of *Vata*, *Manas*, and *Ojas* closely corresponded to the modern neuro-immune axis comprising neural regulation, psychological processing, and immune competence.

Vata was identified as functionally analogous to the central and autonomic nervous systems, regulating communication, movement, and physiological coordination. *Manas* corresponded to cognitive and emotional processing systems involved in stress perception and behavioral responses. *Ojas* exhibited similarities to immune competence, resilience, and the maintenance of systemic homeostasis.

The Ayurvedic concept of *Chittodvega* (mental agitation) shows notable parallels with chronic psychological stress. Both frameworks describe a sequence in which mental disturbance initiates neuroregulatory dysfunction, leading to physiological imbalance and reduced immune resilience. In modern terms, this process is mediated by activation of the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic

nervous system, resulting in altered cortisol secretion, cytokine dysregulation, and immune dysfunction.

The analysis further demonstrated that *Vata Prakopa* may be interpreted as a state functionally comparable to chronic neuroendocrine activation and autonomic dysregulation, whereas *Ojas Kshaya* shares characteristics with immunosuppression, allostatic overload, and increased susceptibility to disease. Similarly, *Rasayana* therapy exhibited conceptual overlap with neuroimmune restorative strategies aimed at improving resilience, reducing inflammation, and enhancing overall health.

An integrative model was developed to link psychological stress, *Vata-Manas* imbalance, neuroendocrine activation, immune dysregulation, and *Ojas* depletion. This model offers a theoretical framework for understanding stress-related inflammatory disorders, autoimmune conditions, and age-associated neuroimmune decline from both Ayurvedic and biomedical perspectives.

Overall, the findings suggest that Ayurveda and psychoneuroimmunology describe comparable functional pathways for mind-body-immune interaction, albeit in different conceptual languages, supporting the feasibility of future translational and interdisciplinary research.

9. Discussion

The present analysis reveals a degree of conceptual convergence between Ayurvedic and modern biomedical models of neuro-immune regulation that extends beyond superficial analogy. The *Vata-Manas-Ojas* triad encodes a systems-level understanding of mind-body-immunity interaction that is functionally coherent when mapped onto the HPA axis and sympathetic nervous system architecture of contemporary PNI.

This convergence does not imply that ancient Ayurvedic physicians possessed knowledge of molecular immunology. Rather, it suggests that careful clinical observation over centuries yielded functional insights that are now being validated by mechanistic research. The Ayurvedic tradition's emphasis on the primacy of mental equilibrium in maintaining physical health—expressed through concepts like *Sattva Bala* (mental strength) and *Satmya* (wholesome adaptation)—anticipates the PNI finding that psychological resilience buffers against stress-mediated immunosuppression.

Limitations of the present analysis include its primarily theoretical nature and the lack of original empirical data. The proposed functional homologies require validation through prospective experimental and clinical research. Furthermore, Ayurvedic constructs such as *Ojas* and *Vata* resist simple reduction to single biomedical equivalents; they likely map onto multiple overlapping biological systems. Future research should embrace this complexity rather than seek one-to-one equivalencies.

10. Summary of Contents

The review identified substantial functional parallels between Ayurvedic and modern neuroimmunological frameworks. *Vata* was found to correspond to neural regulation and autonomic processes, *Manas* to cognitive-emotional and stress-processing mechanisms, and *Ojas* to immune competence and systemic resilience. The Ayurvedic concept of *Chittodvega* showed significant similarity to chronic psychological stress and its downstream neuroendocrine consequences, including HPA axis dysregulation and immune dysfunction. An integrative conceptual model was developed to illustrate functional homologies between Ayurvedic constructs and modern psychoneuroimmunological pathways. Potential implications were identified for stress-related inflammatory disorders, autoimmune diseases, and age-associated neuroimmune decline.

11. Conclusion

This analysis demonstrates that the classical Ayurvedic tradition articulated a sophisticated understanding of the neuro-immune axis centuries before the formal emergence of psychoneuroimmunology. The *Vata-Manas-Ojas* triad constitutes a conceptual framework that functionally parallels—and in some respects enriches—the modern HPA axis model of stress-mediated immunomodulation.

The path forward lies not in asserting equivalence between ancient and modern systems, but in recognizing that functional homologies between Ayurvedic and biomedical constructs can generate novel hypotheses and therapeutic strategies for stress-mediated immune disorders. Integrative models of this kind—grounded in rigorous conceptual analysis and amenable to empirical testing—represent one of the most productive frontiers for twenty-first century medicine.

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Conflict of Interest: The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

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