

OJAS AND IMMUNE HOMEOSTASIS: AN INTEGRATIVE REVIEW OF AYURVEDIC PHYSIOLOGY, IMMUNOMETABOLISM AND SYSTEMS BIOLOGY

Ankita Sharma^{*1}, Mahendra Prasad², Bhanu Pratap Singh³, Afrin Mustafa Khicchi⁴

¹M.D. Scholar, Department of Kriya Sharir, NIA Jaipur.

²Professor, Department of Kriya Sharir, NIA Jaipur.

³Assistant Professor, Department of Kriya Sharir, NIA Jaipur.

⁴M.D. Scholar, Department of Kriya Sharir, NIA Jaipur.

Article Received on 15 June 2026,
Article Revised on 05 July 2026,
Article Published on 16 July 2026

<https://doi.org/10.5281/zenodo.21367645>

*Corresponding Author

Ankita Sharma

M.D. Scholar, Department of Kriya
Sharir, NIA Jaipur.



How to cite this Article: Ankita Sharma^{*1}, Mahendra Prasad², Bhanu Pratap Singh³, Afrin Mustafa Khicchi⁴ (2026). Ojas And Immune Homeostasis: An Integrative Review Of Ayurvedic Physiology, Immunometabolism And Systems Biology. World Journal of Pharmaceutical Research, 15(14), 623–634.

This work is licensed under Creative Commons Attribution 4.0 International license.

ABSTRACT

Ojas described in Ayurveda as the essence of all seven *Dhatus*, is regarded as the foundation of *Bala* (strength), *Vyadhikshamatva* (disease resistance), and overall physiological well-being. While *Ojas* has often been associated with immunity, its functions extend beyond immune defence to encompass vitality, tissue integrity, metabolic balance, and systemic resilience. Recent advances in immunometabolism and systems biology have enhanced the understanding of immune homeostasis as an integrated process involving metabolic, immune, and physiological networks. This review critically examines the classical concept of *Ojas* and explores its conceptual relationship with immune homeostasis, immunometabolism, and systems biology based on evidence from classical Ayurvedic texts and contemporary scientific

literature. Rather than equating *Ojas* with immunity, the review proposes that *Ojas* represents a broader physiological construct that contributes to maintaining health, resilience, and homeostasis, while highlighting the need for further interdisciplinary research to validate these conceptual associations.

KEYWORDS: Ayurveda, Oja, Immunity, Metabolism, Vyadhikshamatva.

INTRODUCTION

Health is increasingly recognized as a dynamic state of physiological equilibrium maintained through the coordinated interaction of multiple biological systems.^[1] In modern medicine, immune homeostasis refers to the balanced regulation of immune responses that ensures effective host defence while preventing excessive inflammation and maintaining tissue integrity. Growing evidence suggests that this balance is closely influenced by metabolic pathways and complex interactions among immune, endocrine, neural, and microbial systems, leading to the emergence of fields such as immunometabolism and systems biology. Ayurveda has long described health as the harmonious equilibrium of *Doshas*, *Dhatus*, *Agni*, *Mala*, and *Srotas*.^[2] Within this holistic framework, *Ojas* is regarded as the *Sara* (essence) of all seven *Dhatus* and the foundation of *Bala* (strength), *Vyadhikshamatva* (disease resistance), vitality, and overall well-being. Classical texts emphasize that the preservation of *Ojas* is essential for sustaining life, whereas its depletion (*Ojakshaya*) leads to impaired vitality and increased susceptibility to disease.

Although *Ojas* is often correlated with immunity in contemporary Ayurvedic literature, its physiological significance extends beyond immune defence to include tissue nourishment, metabolic balance, resilience, and maintenance of systemic health. Therefore, interpreting *Ojas* solely as immunity may not adequately reflect its broader role in Ayurvedic physiology.^[3]

Recent advances in immune-metabolism and systems biology provide an opportunity to reinterpret the concept of *Ojas* from a contemporary scientific perspective. Rather than establishing direct equivalence, these disciplines offer conceptual frameworks to explore the relationship between *Ojas*, immune regulation, and physiological homeostasis. Accordingly, this review critically examines the classical concept of *Ojas* and explores its possible association with immune homeostasis, immunometabolism, and systems biology, with the aim of fostering an evidence-based understanding of this fundamental Ayurvedic concept.^[4]

CONCEPT OF OJAS IN AYURVEDA

Ojas is one of the most fundamental concepts in Ayurvedic physiology and is regarded as the essence (*Sara*) of all seven *Dhatus*.^[5] It is considered the vital factor responsible for sustaining life, maintaining strength (*Bala*), promoting vitality, and protecting the body against disease. The term *Ojas* is derived from the Sanskrit root "*Uj*", meaning to be strong,

powerful, or radiant, reflecting its role as the source of physical, mental, and physiological Vigor.

According to classical Ayurvedic texts, *Ojas* is formed as the purest essence during the sequential nourishment and transformation of the *Dhatus*. It represents the culmination of efficient digestion (*Agni*), proper tissue metabolism, and balanced *Dhatu* formation. Therefore, the quality and quantity of *Ojas* depend upon the integrity of *Agni* and the normal functioning of the *Dhatus* and *Srotas*.^[6]

Ayurvedic literature describes two forms of *Ojas*: *Para Ojas* and *Apara Ojas*. *Para Ojas* is considered the supreme and indispensable form, located in the heart (*Hridaya*) in a very small quantity, and is essential for the sustenance of life. Any significant loss of *Para Ojas* is incompatible with life. *Apara Ojas*, on the other hand, circulates throughout the body, contributing to strength, complexion, enthusiasm, stability, and resistance to disease.^[7]

The physiological functions of *Ojas* extend beyond physical strength. Classical texts attribute to *Ojas* the maintenance of vitality, mental clarity, emotional stability, proper functioning of the sense organs, and overall physiological harmony. *Ojas* is also regarded as the basis of *Bala* and *Vyadhikshamatva*, enabling the body to withstand diseases and recover from illness. Conversely, depletion of *Ojas* (*Ojakshaya*) manifests as weakness, fatigue, loss of enthusiasm, impaired sensory and mental functions, and increased susceptibility to disease.

Thus, *Ojas* represents a comprehensive physiological principle that reflects the integrity, nourishment, and functional competence of the body. Rather than being confined to a single organ or system, it embodies the harmonious interaction of metabolic, structural, and functional processes that collectively maintain health and longevity. This multidimensional nature of *Ojas* forms the basis for exploring its relationship with contemporary concepts of immune homeostasis and systemic physiological regulation.

OJAS, BALA AND VYADHIKSHAMATVA: AN AYURVEDIC PERSPECTIVE

In Ayurveda, the concepts of *Ojas*, *Bala*, and *Vyadhikshamatva* are closely interrelated and collectively contribute to the maintenance of health and resistance against disease. Although these terms are often used together, they represent distinct physiological entities with complementary roles. *Ojas* is regarded as the fundamental essence of all *Dhatus*, *Bala*

represents the functional expression of physical and mental strength, while *Vyadhikshamatva* denotes the body's capacity to resist the onset and progression of disease.

Classical Ayurvedic texts describe *Ojas* as the basis of *Bala*, indicating that adequate *Ojas* is essential for maintaining normal physiological functions and enhancing the body's resilience. *Bala* is traditionally classified into *Sahaja Bala* (innate strength), *Kalaja Bala* (strength influenced by age and seasonal factors), and *Yuktikrita Bala* (acquired strength through appropriate diet, lifestyle, exercise, and *Rasayana* therapy). The preservation of *Ojas* is therefore fundamental for sustaining all three forms of *Bala*.

The concept of *Vyadhikshamatva*, described by Acharya Charaka, encompasses both the ability to prevent the occurrence of disease (*Vyadhi-utpada Pratibandhakatva*) and the capacity to limit disease severity and promote recovery (*Vyadhi-bala Virodhitva*). Although *Vyadhikshamatva* is often compared with immunity, it extends beyond immune defence and includes the body's overall adaptive and protective mechanisms. Since *Ojas* nourishes the *Dhatu*s and supports *Bala*, it plays a crucial role in maintaining *Vyadhikshamatva* and preserving physiological equilibrium.

The relationship among these concepts can be understood as a sequential physiological process. Proper digestion and metabolism through balanced *Agni* ensure adequate nourishment of the *Dhatu*s, leading to the formation of healthy *Ojas*. Well-maintained *Ojas* manifests as *Bala*, which ultimately enhances *Vyadhikshamatva* and enables the body to withstand internal and external stressors. Conversely, impairment of *Agni*, defective *Dhatu* formation, or depletion of *Ojas* weakens *Bala* and reduces the body's capacity to maintain health.

Thus, *Ojas* should not be viewed merely as a determinant of disease resistance but as a comprehensive physiological principle underlying vitality, functional competence, and systemic resilience. This understanding provides a suitable foundation for exploring its conceptual relationship with the modern concept of immune homeostasis.

Immune Homeostasis: A Modern Perspective

The immune system is a highly coordinated network of cells, tissues, and signalling molecules that protects the body against pathogens while preserving the integrity of healthy tissues.^[8] Beyond its defensive role, the immune system is actively involved in tissue repair,

maintenance of self-tolerance, and regulation of inflammatory responses. These functions are collectively maintained through immune homeostasis, a dynamic state in which immune activation and immune regulation remain precisely balanced to ensure optimal physiological function.

Immune homeostasis is achieved through the coordinated actions of the innate and adaptive immune systems. The innate immune system provides the first line of defence through physical barriers, phagocytic cells, natural killer cells, and soluble mediators, whereas the adaptive immune system generates antigen-specific responses mediated by T and B lymphocytes. Under normal physiological conditions, these two arms of immunity work in concert to eliminate harmful agents while preventing excessive or inappropriate immune activation.

The maintenance of immune homeostasis depends on a complex network of regulatory mechanisms, including cytokine signalling, regulatory T cells, immune checkpoints, and controlled resolution of inflammation. Following the elimination of pathogens or tissue injury, anti-inflammatory pathways are activated to restore tissue function and prevent chronic inflammation. Failure of these regulatory mechanisms may result in persistent inflammation, immune deficiency, or autoimmune disorders, highlighting the importance of maintaining immune balance rather than simply enhancing immune responses.^[9]

Recent advances have further demonstrated that immune homeostasis is closely influenced by interactions among metabolic, endocrine, nervous, and microbial systems. Factors such as nutrition, sleep, psychological stress, physical activity, ageing, and gut microbiota significantly modulate immune function and determine the body's capacity to maintain physiological equilibrium. Consequently, immune homeostasis is now recognized as a systems-level process that reflects the coordinated functioning of multiple biological networks rather than the activity of the immune system alone.

This holistic understanding of immune regulation provides a valuable framework for exploring the physiological significance of *Ojas*. While *Ojas* should not be regarded as a direct equivalent of immunity, its classical attributes of vitality, resilience, and maintenance of health conceptually align with the broader objective of immune homeostasis, namely the preservation of physiological balance and resistance to disease.

Immunometabolism: Linking Metabolism and Immune Function

Immunometabolism is an emerging field that explores the interplay between cellular metabolism and immune function. It has become increasingly evident that immune cells require distinct metabolic programs to support their activation, differentiation, and effector functions. Rather than serving only as a source of energy, metabolic pathways actively regulate immune responses and influence the balance between inflammation and immune tolerance.

Resting immune cells primarily rely on oxidative phosphorylation to meet their energy requirements. However, upon activation, many immune cells undergo metabolic reprogramming, shifting towards glycolysis to rapidly generate energy and biosynthetic intermediates necessary for proliferation and cytokine production. In contrast, regulatory immune cells depend largely on oxidative phosphorylation and fatty acid oxidation to maintain immune tolerance and resolve inflammation. Thus, alterations in cellular metabolism directly influence the quality, magnitude, and duration of immune responses.

The relationship between metabolism and immunity extends beyond individual immune cells. Nutritional status, mitochondrial function, hormonal regulation, gut microbiota, and systemic metabolic health collectively shape immune competence. Disturbances in these processes can disrupt immune homeostasis, contributing to chronic inflammation, autoimmune diseases, metabolic disorders, and increased susceptibility to infections. Consequently, immunometabolism has emerged as a key determinant of physiological resilience and overall health.

From an Ayurvedic perspective, the close association between metabolism and physiological integrity bears conceptual resemblance to the central role of *Agni* in maintaining health. Classical texts describe balanced *Agni* as essential for proper digestion, tissue nourishment, and the formation of healthy *Ojas*. Although *Agni* should not be equated with cellular metabolism, both concepts emphasize the importance of efficient metabolic processes in sustaining normal physiological function. Likewise, impairment of *Agni* leading to defective *Dhatu* nourishment and reduced *Ojas* conceptually parallels the influence of metabolic dysregulation on immune dysfunction described in modern immunometabolism.

These similarities suggest that *Ojas* may be viewed as an outcome of efficient physiological metabolism and tissue integrity rather than merely as a marker of immune competence. Therefore, immunometabolism provides a valuable scientific framework for interpreting the

interconnected relationship among metabolism, immune regulation, and systemic resilience while preserving the conceptual distinctiveness of Ayurvedic physiology.

Systems Biology: A Network-Based Perspective of Ojas

Systems biology is an interdisciplinary approach that seeks to understand the human body as an integrated network of interacting biological systems rather than as isolated organs or individual molecules. It emphasizes that physiological functions arise from the coordinated interaction of genetic, metabolic, immune, endocrine, neural, and microbial networks. Health is therefore considered an emergent property of these interconnected systems, while disease results from disturbances in their dynamic balance.

Unlike the traditional reductionist approach, which studies individual components separately, systems biology focuses on the communication and regulation among multiple physiological pathways. Advances in genomics, proteomics, metabolomics, and computational biology have demonstrated that biological processes are highly interconnected, with changes in one system often influencing the function of others. Consequently, maintaining health depends on preserving the stability and adaptability of these complex biological networks.^[10]

This systems-level perspective closely aligns with the holistic principles of Ayurveda. Classical Ayurvedic physiology describes health as the equilibrium of *Doshas*, *Dhatus*, *Agni*, *Malas*, and *Srotas*, supported by proper functioning of the mind and senses. Rather than viewing these components independently, Ayurveda considers them to be functionally interconnected, where disturbance in one component can influence the entire organism. The concept of *Ojas* reflects this integrated understanding, as its formation depends on balanced *Agni*, proper *Dhatu* nourishment, unobstructed *Srotas*, and overall physiological harmony.

From a systems biology perspective, *Ojas* may be interpreted as a systems-level indicator of physiological integrity and resilience rather than a discrete anatomical structure or a single biochemical entity. It represents the cumulative outcome of efficient metabolic processes, healthy tissue function, balanced regulatory mechanisms, and the body's capacity to adapt to internal and external stressors. In this context, immune homeostasis constitutes one important component of a broader network that collectively maintains health and resilience.

Although the conceptual similarities between *Ojas* and systems biology are compelling, they should not be interpreted as direct scientific equivalence. *Ojas* is a unique Ayurvedic

construct rooted in classical principles, whereas systems biology is a contemporary scientific framework based on experimental and computational approaches. Nevertheless, systems biology offers a valuable model for understanding how the diverse physiological functions attributed to *Ojas* may emerge from the coordinated interaction of multiple biological systems. Such an integrative perspective encourages interdisciplinary research and provides new opportunities to investigate *Ojas* using modern scientific methodologies while preserving its original Ayurvedic context.

Bridging Ojas with Modern Science: An Integrative Perspective

The concept of *Ojas* has often been interpreted in contemporary literature as the Ayurvedic equivalent of immunity. While this comparison has helped introduce Ayurvedic principles to a broader scientific audience, it does not fully represent the multidimensional nature of *Ojas* described in classical texts. *Ojas* is not merely associated with disease resistance but also with vitality, tissue nourishment, mental stability, longevity, and the maintenance of life.^[11] Therefore, a broader integrative approach is required to understand its physiological significance.

Modern biomedical science has gradually moved beyond viewing the immune system as an isolated defence mechanism. Current evidence suggests that immune function is closely integrated with metabolism, neuroendocrine regulation, tissue repair, and the gut microbiome, all of which collectively contribute to maintaining physiological homeostasis. The concepts of immunometabolism and systems biology have further strengthened this understanding by demonstrating that health depends on the coordinated interaction of multiple biological networks rather than the function of a single organ or system.

Similarly, Ayurveda describes health as the harmonious balance of *Doshas*, *Dhatus*, *Agni*, *Malas*, *Srotas*, and the mind. Within this framework, *Ojas* represents the culmination of proper digestion, tissue nourishment, and physiological balance. Its formation depends on healthy *Agni* and sequential *Dhatu* transformation, while its preservation reflects the functional integrity of the entire organism. These classical descriptions suggest that *Ojas* is better understood as an integrative physiological principle rather than as an isolated entity.^[12]

A conceptual comparison reveals several functional parallels between Ayurvedic physiology and modern biological sciences. Balanced *Agni* ensures efficient digestion and tissue metabolism, which may be conceptually related to the role of metabolism in maintaining cellular and immune functions. The proper nourishment of *Dhatus* reflects tissue integrity

and normal physiological function, whereas *Bala* represents the functional capacity of the organism to maintain health. Similarly, immune homeostasis describes the body's ability to maintain balanced immune responses through coordinated regulation among metabolic, immune, endocrine, and neural systems. Although these concepts arise from different theoretical frameworks, they converge on the common objective of preserving physiological stability and adaptive capacity.

Despite these similarities, *Ojas* should not be considered synonymous with immunity or any single biological marker. Unlike modern biomedical concepts, *Ojas* encompasses physical, psychological, and physiological dimensions of health that cannot currently be measured by a single laboratory parameter. Its multidimensional nature suggests that it may represent an emergent property of integrated physiological functioning rather than a discrete anatomical or biochemical entity. This interpretation is consistent with the systems biology perspective, which recognizes that complex physiological states arise from interactions among multiple interconnected networks.

Future research should therefore move beyond simplistic correlations between *Ojas* and immunity and focus on developing interdisciplinary models that combine Ayurvedic principles with advances in immunology, metabolomics, systems biology, and computational biology. Integrating clinical assessment of *Ojas* with objective biomarkers may provide new insights into the scientific basis of health, resilience, and disease resistance while preserving the conceptual integrity of Ayurveda. Such an approach may strengthen evidence-based Ayurvedic research and facilitate meaningful dialogue between traditional medicine and contemporary biomedical science.

Clinical Implications of Ojas in Health and Disease

The concept of *Ojas* has significant clinical relevance in Ayurveda, where it is regarded as a key determinant of health, vitality, and resistance to disease. Classical texts describe that adequate *Ojas* supports normal physiological functions, promotes physical and mental well-being, and enhances the body's capacity to withstand environmental and pathological challenges. Conversely, depletion of *Ojas* (*Ojakshaya*) is associated with weakness, fatigue, impaired tissue nourishment, loss of enthusiasm, increased susceptibility to disease, and delayed recovery.

From a modern perspective, these attributes broadly correspond to the concept of physiological resilience, which reflects the body's ability to maintain homeostasis under conditions of stress, infection, or injury. Emerging evidence suggests that disturbances in immune regulation, metabolism, and chronic inflammation contribute to the development of various disorders, including autoimmune diseases, metabolic syndrome, cardiovascular diseases, allergies, and recurrent infections. Although direct scientific evidence linking *Ojas* to these conditions is currently limited, the holistic functions attributed to *Ojas* provide a useful framework for understanding the integrated maintenance of health.

Ayurveda emphasizes that preservation of *Ojas* depends upon balanced *Agni*, proper nutrition, adequate sleep, mental well-being, regular physical activity, and *Rasayana* therapy. Interestingly, these same factors are recognized in modern medicine as important determinants of immune function and overall health. Therefore, strategies aimed at preserving *Ojas* may contribute to promoting physiological resilience and supporting long-term health. However, these relationships require further validation through well-designed clinical and translational studies.

Future Directions and Research Gaps

Despite increasing scientific interest in *Ojas*, its modern interpretation remains largely conceptual. Most published studies have focused on comparing *Ojas* with immunity, whereas its broader relationship with physiological resilience, metabolism, and systems-level regulation has received limited attention. Furthermore, there is currently no standardized method for assessing *Ojas* or universally accepted biomarkers that accurately reflect its physiological status.

Future research should focus on developing objective assessment tools by integrating classical Ayurvedic parameters with modern approaches such as metabolomics, proteomics, immunological biomarkers, and systems biology. Longitudinal clinical studies evaluating the effects of *Rasayana* therapy, dietary interventions, and lifestyle modifications on *Ojas*-related outcomes would provide stronger scientific evidence. Collaborative research involving Ayurveda, immunology, computational biology, and systems medicine may help establish a more comprehensive understanding of *Ojas* while preserving its classical context.

CONCLUSION

Ojas is a fundamental concept of Ayurvedic physiology that represents vitality, strength, resilience, and the harmonious functioning of the body. While it has often been associated with immunity, its classical description encompasses broader physiological functions related to tissue nourishment, metabolic balance, and maintenance of life. Contemporary concepts such as immune homeostasis, immunometabolism, and systems biology provide valuable perspectives for interpreting the multidimensional role of *Ojas* without reducing it to a single biological entity. Rather than considering *Ojas* as the equivalent of immunity, it may be better understood as an integrative physiological construct that reflects systemic health and adaptive capacity. Further interdisciplinary research combining classical Ayurvedic knowledge with modern biomedical approaches is required to validate these conceptual relationships and strengthen the scientific foundation of Ayurvedic physiology.

REFERENCES

1. Hall, J. E. (2021). *Guyton and Hall textbook of medical physiology* (14th ed.). Elsevier.
2. Agnivesha. (2022). *Charaka Samhita* (Y. T. Acharya, Ed.; Charaka & Dridhabala, Rev.; Reprint ed., Sutra Sthana 30). Chaukhamba Surbharati Prakashan.
3. Agnivesha. *Charaka Samhita* (Sutra Sthana 17).
4. O'Neill, L. A. J., Kishton, R. J., & Pearce, E. J. A guide to immunometabolism for immunologists. *Nature Reviews Immunology*, 2016; 16: 553–565.
5. Sushruta. (2022). *Sushruta Samhita* (Y. T. Acharya, Ed.; Reprint ed., Sutra Sthana, Chapter 15, Shlokas 19–25). Chaukhambha Sanskrit Sansthan.
6. Agnivesha. *Charaka Samhita* (Sutra Sthana, Chapter 28: Dhatu Poshana Siddhanta).
7. Vagbhata. (2022). *Ashtanga Hridaya* (H. Paradkar, Ed.; Reprint ed., Sutra Sthana, Chapter 11). Chaukhambha Orientalia.
8. Abbas, A. K., Lichtman, A. H., & Pillai, S. (2021). *Cellular and molecular immunology* (10th ed.). Elsevier.
9. Di Sotto, A., Vitalone, A., & Di Giacomo, S. Plant-derived nutraceuticals and immune system modulation: An evidence-based overview., 2020; 8(3): 468. <https://doi.org/10.3390/vaccines8030468>
10. Patwardhan, B. (2014). Bridging Ayurveda with evidence-based scientific approaches in medicine. *EPMA Journal*, 5, Article 19. <https://doi.org/10.1186/1878-5085-5-19>
11. Rao, R. V. Ayurveda and the science of aging. *Journal of Ayurveda and Integrative Medicine*, 2018; 9(3): 225–232. <https://doi.org/10.1016/j.jaim.2017.10.002>

12. Sharma, H. Ayurveda: Science of life, genetics, and epigenetics. *AYU (An International Quarterly Journal of Research in Ayurveda)*, 2016; 37(2): 87.
https://doi.org/10.4103/ayu.ayu_220_16