



SPORTS PHYSIOLOGY IN AYURVEDA: A DOSHIC PERSPECTIVE AND ITS UTILITY IN SPORTS MEDICINE

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ABSTRACT

Background: Athletic performance depends on the coordinated functioning of multiple physiological systems. While modern sports medicine focuses on improving performance, preventing injuries, and enhancing recovery, Ayurveda offers a broader perspective by emphasizing the balance of Doshas, Agni, Dhatus, Ojas, and Prakriti. Integrating these concepts may provide a more personalized and holistic approach to athlete care. **Objective:** To explore the relevance of Ayurvedic physiological principles in sports medicine and propose an integrative model linking Ayurveda with contemporary exercise physiology. **Methods:** A review was conducted by interpreting classical Ayurvedic concepts in the context of modern sports physiology. Functional correlations were established between Tridosha, Panchavata, Panchapitta, Panchakapha, Agni, Sapta Dhatus, and Ojas and key determinants of athletic performance, recovery, and adaptation. **Results:** Vata correspond with movement, neuromuscular coordination, speed, agility, and reflexes; Pitta with metabolism, energy production, thermoregulation, focus, and competitive drive; and Kapha with structural integrity, muscular strength, endurance, recovery, and immunity. Agni is the physiological basis of efficient metabolism, nutrient utilization, and muscle recovery, while the Sapta Dhatus contribute to tissue nourishment, oxygen transport, musculoskeletal health, neural function, and regeneration. Ojas is an indicator of resilience, immune competence, recovery capacity, and sustained performance. These correlations support individualized exercise prescription, nutrition, recovery strategies, and sport selection based on an athlete's Prakriti and Doshic predominance. **Conclusion:** Ayurvedic physiology complements modern sports science by offering a personalized framework for optimizing athletic performance, enhancing recovery, reducing injury risk, and promoting long-term health. Integrating traditional wisdom with contemporary exercise physiology may contribute to the development of more comprehensive and athlete-centred sports medicine.

KEYWORDS: Ayurveda; Sports Physiology; Sports Medicine; Tridosha; Exercise Physiology; Agni; Ojas; Prakriti; Athletic Performance; Personalized Medicine.

INTRODUCTION

Sport has always been more than a display of physical strength. From ancient civilizations to modern elite competitions, athletic performance has reflected the remarkable ability of the human body to adapt to increasing physical and psychological demands. Today, sports medicine has evolved into a multidisciplinary field that integrates exercise physiology, biomechanics, nutrition, psychology, rehabilitation, and regenerative medicine to improve performance, prevent injuries, and accelerate recovery. Despite these advances, one challenge continues to persist: athletes exposed to similar training programs often respond very differently. Some recover rapidly and consistently perform at a high level, whereas others experience recurrent injuries, prolonged fatigue, or performance decline despite receiving comparable coaching, nutrition, and medical care.

This variability has shifted the focus of sports science toward personalized medicine. Modern research increasingly recognizes that athletic performance is influenced not only by training intensity but also by genetic background, metabolic efficiency, neuromuscular coordination, psychological resilience, sleep quality, nutritional status, and environmental interactions. Consequently, individualized approaches to training, recovery, and performance optimization have become central to contemporary sports medicine. However, most existing models primarily rely on measurable physiological and biochemical parameters, with relatively little emphasis on the integrated regulation of physical, metabolic, and psychological functions that collectively determine long-term athletic success.

Ayurveda offers a distinctly different yet remarkably complementary perspective. Rather than viewing the body as a collection of independent organ systems, it describes human physiology as an interconnected network of functional principles that continuously interact to maintain health and facilitate adaptation. More than two millennia ago, Ayurvedic scholars emphasized that optimal health is achieved through the harmonious balance of *Doshas, Agni, Dhatus, Malas, and mental well-being*, a concept that closely aligns with the modern understanding of physiological homeostasis. This holistic framework becomes particularly relevant



in sports medicine, where peak performance depends on the synchronized functioning of multiple physiological systems rather than the efficiency of any single organ.^[1]

Among the fundamental concepts of *Ayurveda*, *Tridosha*, *Agni*, *Sapta Dhatus*, *Ojas*, *Bala*, and *Prakriti* provide a comprehensive framework for understanding human performance. These concepts extend beyond disease and pathology, describing how the body maintains physiological balance, responds to physical stress, adapts to environmental challenges, and preserves vitality. Unlike reductionist models that examine isolated mechanisms, *Ayurvedic* physiology explains biological function through dynamic interactions that govern movement, metabolism, tissue nourishment, structural stability, immunity, cognition, and resilience. Such an integrated systems approach has considerable relevance in understanding the complex physiology of athletic performance.^[2]

The doctrine of *Tridosha* represents the functional foundation of this framework. *Vata* governs movement and communication within the body, regulating neuromuscular activity, coordination, sensory integration, and the transportation of biological substances. *Pitta* governs transformation through metabolism, thermoregulation, enzymatic activity, cognition, and cellular energy production. *Kapha* provides structural integrity, lubrication, endurance, tissue stability, and biological resilience. Together, these three physiological regulators maintain functional equilibrium, allowing the body to perform efficiently under varying physical demands. Athletic performance therefore depends not merely on muscular strength or cardiovascular endurance but on the harmonious interaction of these functional regulators.^[3]

Interestingly, many of these classical descriptions closely parallel the physiological processes recognized in contemporary exercise science. *Vata* corresponds with movement, neuromuscular coordination, reaction time, agility, flexibility, and rapid motor responses. *Pitta* corresponds with energy metabolism, ATP production, thermoregulation, enzymatic activity, decision-making, and competitive drive. *Kapha* corresponds with muscular strength, connective tissue integrity, joint stability, endurance, recovery, and immune competence. These correlations should not be interpreted as direct anatomical equivalents but rather as functional similarities that provide a meaningful bridge between classical *Ayurvedic* concepts and modern physiological understanding.^[4]

Ayurveda further refines this functional organization through the subdivisions of *Panchavata*, *Panchapitta*, and *Panchakapha*, each representing specialized physiological activities. *Prana Vata* regulates respiration and higher neurological functions essential for concentration during competition. *Udana Vata* contributes to force generation and explosive movements, while *Vyana Vata* coordinates circulation and locomotion throughout the body. *Samana Vata* facilitates digestion and nutrient assimilation, whereas *Apana Vata* supports pelvic stability, elimination, and recovery following exercise. Similarly, the five subdivisions of *Pitta* regulate metabolism, oxygen transport, cognitive function, vision, and thermoregulation, while the five subdivisions of *Kapha* maintain respiratory support, joint lubrication, neural nourishment, digestive protection, and hydration. Collectively, these functional subdivisions provide an integrated physiological network capable of explaining many aspects of athletic performance from an *Ayurvedic* perspective.^[5]

Another central concept is *Agni*, which extends far beyond digestion. *Ayurveda* describes *Agni* as the driving force behind all biological transformations, including nutrient assimilation, tissue metabolism, energy production, protein synthesis, and regeneration. Efficient *Agni* ensures optimal nourishment of tissues, supports muscle development, enhances recovery, and sustains performance during repeated physical exertion. Conversely, impaired *Agni* may contribute to fatigue, delayed recovery, poor tissue repair, and diminished physical capacity. These descriptions closely resemble contemporary concepts such as metabolic flexibility, mitochondrial efficiency, nutrient utilization, and exercise-induced anabolic adaptation.^[6]

The sequential nourishment of *Sapta Dhatus* provides an equally comprehensive understanding of tissue physiology. *Rasa* supports hydration and nutrient distribution, *Rakta* facilitates oxygen transport, *Mamsa* provides muscular strength, *Meda* serves as an energy reserve, *Asthi* offers skeletal support, *Majja* maintains neural function, and *Shukra* culminates in the formation of *Ojas*, the essence of vitality. This sequential model emphasizes that successful athletic performance depends on the coordinated health of every tissue rather than the musculoskeletal system alone. The concept resonates strongly with modern exercise physiology, which recognizes the importance of integrated cardiovascular, metabolic, skeletal, neuromuscular, and endocrine adaptations in determining athletic capacity.^[7]

Among all *Ayurvedic* concepts, *Ojas* may hold particular significance in sports medicine. *Ojas* represents the essence of all *Dhatus* and reflects the body's capacity for resilience, adaptation, immunity, recovery, and sustained performance. Athletes with preserved *Ojas* demonstrate greater resistance to illness, faster recovery, improved stress tolerance, and more consistent performance during prolonged training and competition. Conversely, depletion of *Ojas* manifests as persistent fatigue, recurrent infections, burnout, impaired recovery, and declining performance—features that closely resemble the clinical manifestations of overtraining syndrome recognized in modern sports medicine. Although *Ojas* has no direct biomedical equivalent, it may be viewed as a multidimensional indicator of physiological reserve integrating immune competence, neuroendocrine stability, metabolic adaptability, and psychological resilience.^[8]

The growing acceptance of integrative medicine provides an opportunity to reinterpret these classical concepts in light of contemporary scientific knowledge. Rather than considering *Ayurveda* and modern exercise physiology as separate or competing disciplines, they may be viewed as complementary systems that describe human performance from different perspectives. Modern physiology explains biological mechanisms at molecular, cellular, and organ-system levels, whereas *Ayurveda* emphasizes



functional integration, constitutional individuality, and adaptive balance. Combining these perspectives may contribute to more comprehensive strategies for athlete assessment, individualized training, nutritional planning, recovery optimization, and injury prevention.^[9]

Although *Ayurveda* has gained increasing attention in sports medicine, existing literature has largely focused on isolated interventions such as herbal supplementation, yoga, massage therapy, or rehabilitation practices. A comprehensive physiological framework that systematically integrates the fundamental principles of *Ayurveda* with contemporary exercise physiology remains limited. Bridging this gap could expand the scientific understanding of personalized athlete care and stimulate interdisciplinary research in integrative sports medicine.^[10]

OBJECTIVE

To explore the relevance of *Ayurvedic* physiological principles in sports medicine and propose an integrative model linking *Ayurveda* with contemporary exercise physiology.

METHODS

A review was conducted by interpreting classical *Ayurvedic* concepts in the context of modern sports physiology. Functional correlations were established between *Tridosha*, *Panchavata*, *Panchapitta*, *Panchakapha*, *Agni*, *Sapta Dhatus*, and *Ojas* and key determinants of athletic performance, recovery, and adaptation.

DISCUSSION

Understanding athletic performance requires looking beyond individual physiological systems and appreciating the body as an integrated functional unit. Modern sports physiology has made remarkable progress in explaining the cardiovascular, neuromuscular, metabolic, endocrine, and biomechanical responses to exercise. Nevertheless, athletic success cannot be attributed to the optimal performance of a single organ or system. It is the result of continuous interaction among multiple physiological processes that enable movement, energy production, tissue repair, adaptation, and recovery. In this context, *Ayurveda* offers a systems-based perspective that complements contemporary sports science by viewing the human body as a dynamic network of interconnected functional principles rather than a collection of isolated organs.^[11]

The concept of *Tridosha* provides the foundation of this integrative understanding. Instead of representing anatomical structures, *Vata*, *Pitta*, and *Kapha* describe the major physiological forces responsible for maintaining normal body function. When interpreted from the perspective of exercise physiology, these principles demonstrate striking functional similarities with several well-established physiological mechanisms. *Vata* corresponds with movement, neuromuscular coordination, reaction time, agility, proprioception, and rapid motor responses. These functions collectively determine an athlete's ability to initiate movement, maintain balance, and execute complex motor skills with precision. Likewise, *Pitta* corresponds with metabolism, ATP production, thermoregulation, enzymatic activity, cognitive processing, and competitive drive, all of which are essential for sustaining exercise intensity and adapting to increased metabolic demands. *Kapha* corresponds with structural integrity, muscular strength, joint stability, endurance, tissue repair, and immune competence, thereby providing the physical foundation required for consistent performance and effective recovery.^[12]

These functional correlations become even more meaningful when the subdivisions of *Tridosha* are considered. The concepts of *Panchavata*, *Panchapitta*, and *Panchakapha* illustrate how *Ayurveda* explains physiological specialization through distinct functional domains. For instance, *Vyana Vata* governs circulation and coordinated movement, functions that closely resemble the integrated cardiovascular and neuromuscular responses observed during exercise. *Pachaka Pitta* regulates metabolic transformation and nutrient utilization, while *Ranjaka Pitta* reflects the physiological importance of oxygen transport through healthy blood. Similarly, *Shleshaka Kapha* maintains joint lubrication and mechanical stability, whereas *Tarpaka Kapha* contributes to the nourishment of the nervous system. Although these comparisons should not be interpreted as direct anatomical equivalents, they demonstrate that *Ayurvedic* physiology describes body functions in a manner that remains relevant when viewed through the lens of modern systems biology.^[13]

Another noteworthy observation emerging from this review is the central importance of *Agni* in athletic performance. Classical *Ayurvedic* texts describe *Agni* as the basis of all biological transformation, extending far beyond the process of digestion alone. This broader interpretation closely resembles the modern understanding of metabolism, where nutrient assimilation, mitochondrial energy production, protein synthesis, tissue remodeling, and cellular adaptation collectively determine exercise capacity and recovery.^[14] Athletes with efficient metabolic regulation are generally able to utilize nutrients more effectively, recover more rapidly following intense exercise, and adapt better to progressive training loads. Conversely, impaired metabolic efficiency is frequently associated with fatigue, delayed recovery, reduced exercise tolerance, and increased susceptibility to overtraining. These observations suggest that the *Ayurvedic* concept of *Agni* remains physiologically relevant even when interpreted using contemporary scientific knowledge.^[15]

The concept of *Sapta Dhatus* further reinforces the holistic nature of *Ayurvedic* physiology. Athletic performance depends not only on well-developed skeletal muscles but also on adequate hydration, efficient oxygen delivery, healthy connective tissues,



strong bones, optimal neural function, hormonal balance, and effective immune responses. Ayurveda explains these interconnected processes through the sequential nourishment of *Rasa, Rakta, Mamsa, Meda, Asthi, Majja, and Shukra*, ultimately culminating in the formation of *Ojas*. Rather than viewing tissues as isolated entities, this sequential model emphasizes the interdependence of every structural and functional component of the body.^[16] Interestingly, this perspective aligns with contemporary sports medicine, which increasingly recognizes that long-term athletic success depends upon the coordinated adaptation of multiple physiological systems rather than isolated improvements in muscle strength or aerobic capacity.^[17]

Among all *Ayurvedic* concepts, *Ojas* arguably has the greatest potential relevance in sports medicine. *Ojas* represents vitality, resilience, adaptive capacity, and the body's ability to withstand physical and psychological stress. Athletes with preserved *Ojas* are likely to demonstrate consistent performance, efficient recovery, stronger immunity, greater emotional stability, and better tolerance to prolonged training.^[18] In contrast, depletion of *Ojas* is characterized by fatigue, recurrent illness, poor recovery, reduced motivation, and declining performance. These manifestations closely resemble the multidimensional nature of overtraining syndrome described in modern sports medicine.^[19] Although *Ojas* cannot currently be measured using a single biochemical marker, it may be interpreted as a multidimensional indicator of physiological resilience that integrates immune competence, neuroendocrine balance, metabolic adaptability, and psychological well-being. This interpretation offers an interesting direction for future research aimed at identifying objective biomarkers that collectively reflect this traditional concept.^[20]

One of the most valuable contributions of *Ayurveda* to contemporary sports medicine is its emphasis on individualization through *Prakriti*. Modern sports science increasingly acknowledges that athletes respond differently to identical training programmes because of genetic, physiological, and environmental variability.^[21] *Ayurveda* recognized this principle centuries ago by describing constitutional diversity through *Prakriti*. This constitutional framework explains differences in body composition, metabolic characteristics, psychological traits, recovery capacity, and disease susceptibility. Consequently, *Prakriti*-based assessment may provide an additional dimension for personalizing exercise prescription, nutritional planning, recovery strategies, and injury prevention. Such an approach aligns closely with the growing emphasis on precision medicine and individualized athlete management.^[22]

Despite these promising correlations, the present review should be interpreted with appropriate scientific caution. Most of the proposed relationships are functional and conceptual rather than experimentally established. *Ayurvedic* physiology and contemporary biomedical science evolved within different philosophical and methodological frameworks, making direct one-to-one comparisons both inappropriate and scientifically limiting. Instead, these concepts should be viewed as complementary models that describe human physiology from different perspectives. Appreciating this distinction is essential for developing meaningful interdisciplinary research without oversimplifying either system of knowledge.^[23]

The future of integrative sports medicine depends on generating robust scientific evidence rather than relying solely on theoretical correlations. Carefully designed clinical studies are required to investigate whether *Prakriti* influences aerobic capacity, anaerobic performance, recovery kinetics, injury susceptibility, or psychological resilience. Similarly, advances in metabolomics, genomics, wearable technology, artificial intelligence, and systems biology offer exciting opportunities to explore the physiological basis of *Agni* and *Ojas* using objective scientific parameters. Such research may not only validate traditional concepts but also contribute to the development of more personalized and comprehensive approaches to athlete care.^[24]

Taken together, the evidence discussed in this review supports the development of an Integrative Sports Physiology Model (ISPM) in which *Tridosha, Agni, Dhatus, Ojas, and Prakriti* are viewed as functional regulators of athletic performance. Rather than replacing established principles of exercise physiology, this model broadens the understanding of human performance by incorporating constitutional individuality, functional balance, and adaptive resilience. Integrating these perspectives has the potential to enrich both Ayurveda and modern sports medicine while opening new avenues for interdisciplinary research and clinical application.^[25]

CONCLUSION

The present review demonstrates that the classical concepts of *Tridosha, Panchavata, Panchapitta, Panchakapha, Agni, Sapta Dhatus, Ojas, and Prakriti* provide meaningful functional perspectives that complement current knowledge in exercise physiology. *Vata* corresponds with movement and neuromuscular coordination, *Pitta* with metabolic transformation and energy production, and *Kapha* with structural stability, endurance, and recovery. *Agni* supports efficient metabolism and tissue adaptation, the *Dhatus* collectively sustain the structural and functional requirements of athletic performance, and *Ojas* reflects the resilience necessary for long-term physical excellence. Together, these principles offer a holistic framework for understanding the complex physiological interactions that underpin sports performance. Although many of these correlations remain conceptual, they provide a biologically plausible basis for integrating *Ayurvedic* physiology with contemporary sports medicine. Importantly, this integrative perspective does not seek to replace modern scientific knowledge. Instead, it expands the understanding of athletic performance by emphasizing individualized care, functional harmony, and adaptive capacity, principles that resonate strongly with the current movement toward precision and personalized medicine. Future research should focus on validating these concepts through interdisciplinary studies that combine *Ayurvedic* assessment methods with modern physiological, biochemical, molecular, and digital technologies. Such an approach may help establish evidence-based applications of Ayurveda in sports medicine while



contributing to the development of personalized strategies for performance enhancement, injury prevention, recovery optimization, and long-term athlete health. Ultimately, integrating the strengths of *Ayurveda* and contemporary exercise physiology has the potential to transform sports medicine from a discipline that primarily enhances performance into one that also promotes resilience, sustainability, and lifelong health. Such a model would not only benefit competitive athletes but could also contribute to improving physical fitness and well-being in the broader population.

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