



Ayurvedic Interpretation Of Circadian Rhythms: Mechanisms, Physiology, And Clinical Relevance

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Abstract: Ayurveda emphasizes health maintenance and disease prevention through alignment with natural temporal rhythms, particularly the circadian rhythm. It describes physiological and behavioural cycles as the dynamic interplay of Vata, Pitta, and Kapha Doshas, each predominating during specific phases of the 24-hour cycle. This ancient chronobiological concept parallels modern circadian science, which recognizes endogenous biological clocks regulated by the suprachiasmatic nucleus. Circadian rhythms govern sleep-wake cycles, metabolism, digestion, immunity, and hormonal regulation and are synchronized by environmental cues such as light, diet, and activity. Disruption of circadian alignment is associated with metabolic, immune, and neuropsychological disorders. Ayurvedic regimens such as *Dinacharya* and *Ritucharya* offer a time-based preventive framework that supports biological homeostasis and addresses contemporary circadian-related health challenges.

Index Terms - Circadian rhythm, *Dinacharya*, *Ritucharya*, *Ahara*, *Nidra*, Suprachiasmatic Nucleus (SCN)

INTRODUCTION

Ayurveda, the classical Indian system of life science and medicine, presents a profound yet holistic understanding of time-dependent physiological variations long before the advent of modern chronobiology. Although the Sanskrit literature does not mention “circadian rhythm” as a distinct construct, the concept is intrinsically embedded in Ayurvedic doctrines such as Kala (time as a biological regulator), *Dinamana-Ratrimana* (day-night cycles), *Dosha gati* (predictable temporal dominance of Vata, Pitta, and Kapha), *Agni bala* (diurnal variability of metabolic and digestive fire), and *Dinacharya-Ritucharya* (daily and seasonal regimens for biological synchronization). Ayurveda emphasizes that health is maintained when internal bodily cycles are in harmony with natural time rhythms and that disease emerges when lifestyle choices oppose these temporal codes, resulting in *Dosha prakopa* and *Agnimandya*.

The contemporary relevance of Ayurveda in lifestyle and preventive health sciences has renewed scientific interest in decoding its temporal physiology using the tools of modern chronobiology. Recent interdisciplinary perspectives suggest that *Dosha* dominance across specific time periods parallels rhythmic variations in autonomic tone, endocrine hormones, gut motility, metabolic processing, neurocognitive activity, and tissue-level repair. Ayurvedic guidelines for ideal meal timing, early sleep, abstinence from nighttime eating, early-morning awakening during *Brahma Muhurta*, and routine-based homeostasis reflect a highly empirical observation of predictable daily biological oscillations.

Therefore, understanding circadian physiology through an Ayurvedic lens is not merely a retrospective correlation but a promising integrative approach for developing a broader chronotherapeutic and chrono-preventive model, particularly salient for non-communicable, lifestyle-linked, and mind-body disorders. This review aims to establish a physiological bridge between classical Ayurvedic time theory and modern

circadian science, reinforcing Ayurveda's potential contribution to the global dialogue on biological timing, personalized lifestyle medicine, and circadian health restoration.

Variation of the Doshas in their normal state, known as *Prakrita Dosha Vaishamy*, represent the natural and physiological fluctuations of *Vata*, *Pitta*, and *Kapha* that occur throughout daily, seasonal, and age-related cycles. Ayurveda does not view the Doshas as static entities; instead, they constantly shift in response to time, environment, diet, and activity. These changes are not pathological but essential for maintaining bodily homeostasis, supporting metabolic balance, and enabling adaptation to changing conditions.

Across the 24-hour cycle, the *Doshas* follow a predictable rhythm. *Kapha* predominates in the *Poorvahnaana Poorvarathri*, contributing to stability, lubrication, and a slower pace suitable for awakening and preparing for rest. *Pitta* becomes dominant during *Madhyahna* and *Madhya rathri*, supporting strong digestive activity at noon and internal metabolic repair during the night. *Vata* governs the early *Aparahna* and *Apararathri*, periods associated with clarity, creativity, movement, and elimination. These diurnal fluctuations parallel the body's circadian rhythm and help regulate digestion, sleep, cognition, and energy levels.

Seasonal variations in *Dosha* also occur naturally. *Vata* accumulates during summer due to dryness and heat, aggravates during the rainy season when instability increases, and pacifies in autumn when conditions stabilize. *Pitta* accumulates during the rainy season, aggravates in autumn as heat intensifies, and pacifies during early winter. *Kapha* accumulates in late winter because of cold and heaviness, aggravates in spring as accumulated moisture liquefies, and pacifies in summer. These shifts help the body adapt to climate changes and maintain balance throughout the year.

Age-related variations further illustrate normal Dosha dynamics. Childhood is *Kapha*-dominant due to rapid growth and tissue building. Adulthood is governed by *Pitta*, reflecting strong metabolism, productivity, and vitality. Old age is characterized by *Vata* predominance, marked by increased dryness, mobility, and gradual degeneration. These patterns are considered natural stages of life and assist in understanding physical and mental changes across the lifespan¹.

The *Doshas* also fluctuate with daily activities. During digestion, *Kapha* predominates at the beginning of a meal, *Pitta* becomes active during the metabolic phase, and *Vata* governs the end of digestion as lightness and movement return. Similarly, sleep begins under *Kapha*'s influence, shifts toward *Pitta* during around midnight, and transitions to *Vata* in the early morning, leading to lighter sleep and dreams.

These normal variations of the Doshas are vital for preserving physiological balance. They regulate appetite, sleep, mood, immunity, and energy cycles. Only when such fluctuations exceed their natural limits or persist abnormally do they become pathological and contribute to disease. Understanding *Prakrita Dosha Vaishamy* helps clarify how the body maintains equilibrium and why lifestyle routines must be synchronized with natural rhythms.

Factors Influencing Circadian Rhythm:

Dinacharya works by synchronizing the body's internal biological clock with external environmental cues such as light, temperature, and food timing. Regular routines—like waking before sunrise, eating the main meal at midday, and sleeping early stabilize circadian rhythms. These practices optimize hormonal cycles, including cortisol and melatonin secretion, support digestive enzyme activity aligned with *Pitta*, and reduce stress-driven *Vata* fluctuations. By aligning daily behaviors with predictable Dosha cycles, *Dinacharya* maintains physiological coherence, enhances metabolic efficiency, improves sleep-wake regulation, and prevents circadian disruption².

Ritucharya regulates long-term circannual (seasonal) rhythms, helping the body adapt to environmental changes in temperature, humidity, daylight duration, and food availability. Seasonal routines modulate neuroendocrine pathways—including melatonin secretion, cortisol patterns, thermoregulatory responses, immune rhythm, and metabolic gene expression—which naturally shift across seasons³.

Ahara plays a fundamental role in regulating the circadian rhythm, eating the main meal at midday aligns with *Pitta* and optimal *Agni* which corresponds scientifically to the time when digestive enzyme secretion, insulin sensitivity, and metabolic rate are highest. Regular eating patterns strengthen the synchrony between the central circadian clock in the suprachiasmatic nucleus (SCN) and peripheral metabolic clocks, while irregular, late-night, or heavy meals disturb *Dosha* balance—especially *Pitta* and *Kapha*—and cause misalignment of glucose metabolism, hormone release, and gut micro biome rhythms. Thus, *Ahara* not only nourishes tissues but also balances metabolic rhythms, preventing circadian disruption⁴.

Nidra plays a central role in regulating the circadian rhythm because sleep directly synchronizes the brain's master clock—the suprachiasmatic nucleus (SCN)—with internal metabolic processes. Adequate and timely sleep helps maintain the normal secretion pattern of key hormones such as melatonin, which rises in darkness to promote sleep, and cortisol, which peaks in the early morning to support wakefulness. Proper *Nidra* also stabilizes physiological cycles such as body temperature, digestion, immune activity, and neurotransmitter balance. When sleep is delayed, irregular, or insufficient, it disrupts the SCN signals and desynchronizes peripheral clocks in organs like the liver, gut, and endocrine glands, leading to impaired metabolism, altered appetite regulation, emotional instability, and reduced immunity⁵.

The factors which cause a shift in circadian rhythm include *Vega dharana* and *udheerana*, disturbed *Agni* and improper *Ahara -Viharas*. *Vega dharana* and *udheerana* disturb the normal *Dosha gati* and biological timing of the body. Suppressing urges such as sleep, hunger, or defecation leads to *Vata* aggravation and *Agni* dysfunction, resulting in delayed sleep, irregular appetite, and disturbed digestion, thereby shifting the circadian rhythm. Conversely, provoking urges at inappropriate times—such as eating without hunger or sleeping during the day—aggravates *Kapha* and *Pitta*, causing metabolic sluggishness and impaired nighttime sleep. Thus, both *Vega Dharana* and *Udheerana* disrupt the natural synchronization between physiological urges and the light–dark cycle, leading to circadian rhythm imbalance⁶.

Adhyashana overloads digestive and metabolic cycles, causing *Pitta* aggravation and impaired digestive rhythms, which leads to post-prandial lethargy and delayed metabolic signalling. *Vishamashana* disrupts the temporal coordination between hunger signals and digestive capacity, predominantly aggravating *Vata*, resulting in irregular appetite, glucose fluctuations, and sleep disturbances. *Anashana* weakens *Agni* and increases *Vata*, producing hypoglycaemia, fatigue, altered cortisol rhythm, and delayed or fragmented sleep. Collectively, these faulty eating patterns desynchronize peripheral metabolic clocks from the central biological clock, leading to circadian misalignment and increased risk of metabolic and sleep disorders⁷.

Impacts of circadian rhythm shifts:

Circadian rhythm shifts exert profound effects on human physiology by disrupting the temporal coordination between central and peripheral biological clocks. Misalignment of the suprachiasmatic nucleus with environmental cues such as the light–dark cycle results in altered rhythmic secretion of key hormones, including melatonin and cortisol, leading to impaired sleep architecture, reduced sleep efficiency, and neurocognitive dysfunction⁸. At the metabolic level, circadian disruption alters clock-gene expression in peripheral tissues such as the liver, pancreas, adipose tissue, and skeletal muscle, resulting in impaired glucose tolerance, reduced insulin sensitivity, dyslipidaemia, and abnormal energy homeostasis. These changes increase susceptibility to obesity, metabolic syndrome, and type 2 diabetes mellitus⁹. Additionally, circadian shifts impair immune rhythmicity, promote low-grade systemic inflammation, and reduce cellular repair and antioxidant defense mechanisms, thereby increasing vulnerability to infections, inflammatory disorders, and accelerated aging. Chronic circadian misalignment further affects cardiovascular regulation by disturbing autonomic balance, endothelial function, and blood pressure rhythms, contributing to heightened cardiovascular risk. Collectively, circadian rhythm shifts compromise systemic homeostasis and play a critical role in the pathogenesis of metabolic, neuroendocrine, immune, and lifestyle-related disorders

CONCLUSION:

Circadian rhythm represents a fundamental temporal organization of human physiology, governed by the coordinated interaction between the central (temporal) biological clock and multiple peripheral clocks across organ systems. Disruption of this finely regulated system results in neuroendocrine, metabolic, immune, and cardiovascular dysregulation, contributing to the growing burden of lifestyle-related disorders. The present article highlights that both modern chronobiology and Ayurvedic temporal physiology recognize time as a critical determinant of health, emphasizing the importance of rhythmic alignment in

daily activities such as sleep, diet, and behavior. Ayurvedic concepts of *Kala*, *Dosha gati*, disturbed *Agni*, and *Dinacharya* provide a holistic framework that parallels contemporary understanding of central–peripheral clock synchrony. Integrating these traditional insights with modern circadian science offers a comprehensive, rhythm-oriented approach for prevention and management of circadian rhythm disorders, reinforcing the relevance of time-aligned lifestyle interventions in promoting systemic homeostasis and long-term health

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