

Relevance of Ayurvedic Dinacharya in Prevention of Metabolic Syndrome and Circadian Rhythm Disorders in the Digital Age

Dr. Vikrant Sharma¹, Dr. Sunil Sharma², Dr. Diksha Sharma³, Dr. Abhinav Rathore⁴

¹*Professor, Department of Swasthavritta and Yoga, Saraswati Ayurved Hospital and Medical College, Gharuan Punjab, India.*

²*Assistant Professor, Department of Dravyaguna Vigyana, Saraswati Ayurved Hospital and Medical College, Gharuan Punjab, India.*

³*Assistant Professor, Department of Swasthavritta and Yoga, Saraswati Ayurved Hospital and Medical College, Gharuan Punjab, India.*

⁴*Professor, Department of Panchkarma, Saraswati Ayurved Hospital and Medical College, Gharuan Punjab, India*

Abstract—The rapid digitalization of modern lifestyle has significantly altered human behavioural patterns, leading to sedentary habits, irregular sleep cycles, unhealthy dietary practices, psychological stress, and excessive screen exposure. These changes have contributed to the increasing prevalence of metabolic syndrome and circadian rhythm disorders worldwide. Metabolic syndrome comprises a cluster of conditions including obesity, insulin resistance, hypertension, dyslipidemia, and cardiovascular risk. Ayurveda emphasizes the importance of Dinacharya (daily regimen) for maintaining equilibrium between body, mind, and environment. Dinacharya is based on synchronization with natural circadian rhythms and includes practices such as waking at Brahma Muhurta, oral hygiene, exercise, oil massage, bathing, timely meals, meditation, and proper sleep. Contemporary scientific evidence supports that circadian alignment improves metabolic health, hormonal regulation, and psychological wellbeing. This review explores the relevance of Ayurvedic Dinacharya in preventing metabolic syndrome and circadian rhythm disturbances in the digital era. The article also correlates classical Ayurvedic principles with modern chronobiology and highlights the role of lifestyle regulation in disease prevention.

Index Terms—Ayurveda, Dinacharya, Metabolic Syndrome, Circadian Rhythm, Digital Lifestyle, Chronobiology, Preventive Medicine, Lifestyle Disorders

I. INTRODUCTION

The twenty-first century has witnessed unprecedented technological advancement resulting in profound transformation of human lifestyle and behaviour. Digitalization through smartphones, laptops, internet-based occupations, social media platforms, online gaming, artificial intelligence, and virtual communication systems has become an inseparable part of daily life. While these innovations have improved efficiency, connectivity, education, and healthcare accessibility, they have simultaneously introduced a range of lifestyle-related health challenges. Excessive dependence on digital technology has substantially altered natural behavioural rhythms and reduced synchronization with environmental cycles.¹

Modern populations increasingly experience prolonged sitting, physical inactivity, unhealthy eating patterns, sleep deprivation, mental stress, reduced outdoor activities, and continuous exposure to artificial light from electronic devices. These habits have become major contributors to the growing prevalence of non-communicable diseases and metabolic disorders worldwide. Among these, metabolic syndrome and circadian rhythm disorders are particularly significant due to their widespread occurrence and long-term complications.²

Metabolic syndrome refers to a constellation of metabolic abnormalities including abdominal obesity, insulin resistance, hyperglycemia, hypertension, and dyslipidemia. It represents a major risk factor for type 2 diabetes mellitus, cardiovascular diseases, stroke, and chronic inflammatory conditions. According to global health statistics, sedentary lifestyle and poor sleep hygiene associated with digital overexposure are key determinants in the increasing incidence of metabolic syndrome among both adults and adolescents.³

Circadian rhythm disorders arise from disruption of the endogenous biological clock that regulates sleep-wake cycles, hormonal secretion, digestion, thermoregulation, cardiovascular activity, and cognitive functions. Excessive nighttime exposure to blue light emitted from digital devices suppresses melatonin production, delays sleep onset, and impairs sleep quality. Irregular sleeping schedules, night-shift work, binge-watching, social media addiction, and continuous online engagement further aggravate circadian misalignment. Scientific evidence indicates that chronic circadian disruption adversely affects glucose metabolism, appetite regulation, endocrine balance, immune response, and mental health.⁴

Long before the development of modern chronobiology, Ayurveda recognized the importance of biological rhythms and their influence on health and disease. Ayurveda describes health as a state of equilibrium among Doshas, Agni, Dhatus, and mental wellbeing. Maintenance of this equilibrium depends greatly on proper lifestyle regulation in accordance with natural cycles of time. The concept of Dinacharya—daily regimen—is elaborately explained in classical Ayurvedic texts such as Charaka Samhita, Sushruta Samhita, and Ashtanga Hridaya.⁵

Dinacharya includes a sequence of healthy daily practices beginning from waking at Brahma Muhurta and extending through oral hygiene, exercise, oil massage, bathing, meditation, timely meals, occupational discipline, and proper sleep. These regimens are intended to align bodily functions with environmental and circadian rhythms. Ayurveda emphasizes that deviation from natural routines leads to Doshic imbalance, impaired digestion (Agnimandya), toxin accumulation (Ama), and subsequent disease manifestation.⁶

The principles of Dinacharya are highly relevant in the present digital age because many modern health disorders originate from lifestyle irregularities and chronobiological disturbances. Practices such as early awakening, physical activity, mindful eating, stress management, and adequate sleep can directly counteract the harmful effects of sedentary digital living. Furthermore, Ayurvedic approaches provide a holistic framework addressing physical, mental, behavioral, and environmental dimensions of health.⁷ Recent advances in chronomedicine and circadian biology have demonstrated remarkable similarities with Ayurvedic concepts of time-based physiology. Research confirms that synchronization of food intake, exercise, sleep, and hormonal rhythms with circadian cycles significantly improves metabolic health and reduces disease risk. This scientific validation has renewed global interest in traditional lifestyle-based preventive healthcare systems.⁸

II. AIM

To evaluate the role of Ayurvedic Dinacharya in prevention and management of metabolic syndrome and circadian rhythm disorders in the digital age.

III. OBJECTIVES

1. To understand the concept of Dinacharya in Ayurveda.
2. To analyze the relationship between circadian rhythm disruption and metabolic syndrome.
3. To correlate Ayurvedic daily regimen with modern chronobiology.
4. To evaluate the preventive role of Dinacharya in digital lifestyle disorders.

IV. MATERIALS AND METHODS

This review article is based on:

- Published articles from indexed journals related to circadian rhythm, chronobiology, metabolic syndrome, and lifestyle medicine.
- Modern scientific literature related to sleep disorders, obesity, insulin resistance, stress, and digital health.

V. CONCEPT OF DINACHARYA IN AYURVEDA

Dinacharya refers to the ideal daily regimen described in Ayurveda for maintaining physical, mental, and spiritual wellbeing. It is based on the cyclical dominance of Doshas throughout the day.⁹

Major Components of Dinacharya¹⁰

1. Brahma Muhurta Uttishtha (early morning awakening)
2. Dantadhavana (oral hygiene)
3. JihvaNirlekhana (tongue scraping)
4. Gandusha and Kavala
5. Nasya
6. Abhyanga (oil massage)
7. Vyayama (exercise)
8. Snana (bath)
9. Timely and wholesome meals
10. Meditation and spiritual practices
11. Proper sleep (Nidra)

Metabolic Syndrome: Modern Perspective¹¹

Metabolic syndrome is a cluster of interconnected metabolic abnormalities that increase the risk of cardiovascular disease and diabetes.

Components of Metabolic Syndrome

- Central obesity
- Insulin resistance
- Hypertension
- Dyslipidemia
- Hyperglycemia

Risk Factors in the Digital Age

- Prolonged screen exposure
- Sedentary lifestyle
- Fast food consumption
- Sleep deprivation
- Psychological stress
- Physical inactivity

Circadian Rhythm Disorders

Circadian rhythm is the endogenous 24-hour biological clock regulating physiological processes.

Common Circadian Rhythm Disturbances

- Delayed sleep phase disorder

- Insomnia
- Shift work disorder
- Sleep deprivation
- Social jet lag

Excessive nighttime exposure to blue light from digital devices suppresses melatonin secretion and disrupts sleep architecture.

Correlation between Dinacharya and Circadian Biology¹²

Ayurvedic Principle	Modern Correlation	Health Benefit
Early rising	Synchronization with cortisol rhythm	Better metabolic regulation
Timely meals	Improved insulin sensitivity	Prevention of obesity
Morning exercise	Enhanced energy expenditure	Cardiovascular protection
Meditation	Reduction in cortisol levels	Stress management
Proper sleep	Melatonin regulation	Hormonal balance
Abhyanga	Parasympathetic activation	Improved circulation and relaxation

VI. RELEVANCE OF DINACHARYA IN PREVENTION OF METABOLIC SYNDROME^{13,14}

1. Brahma Muhurta Awakening

Ayurveda recommends waking before sunrise.

Benefits

- Enhances mental alertness
- Improves digestion and metabolism
- Synchronizes circadian rhythm
- Reduces Kapha accumulation

Modern studies suggest early awakening improves hormonal regulation and insulin sensitivity.

2. Vyayama (Exercise)

Regular physical activity is essential in prevention of obesity and diabetes.

Ayurvedic Perspective

Exercise improves:

- Agni (digestive fire)
- Meda metabolism

- Circulation
- Physical endurance

Modern Correlation

Exercise:

- Improves glucose uptake
- Reduces insulin resistance
- Enhances cardiovascular fitness
- Controls body weight

3. Timely Meals and Dietary Discipline

Ayurveda strongly discourages irregular eating habits.

Principles

- Eat according to digestive capacity
- Avoid overeating
- Consume freshly prepared food
- Take meals at regular intervals

Irregular meal timing in the digital lifestyle contributes to obesity and metabolic dysregulation.

4. Nidra (Sleep Regulation)

Improper sleep is a major factor in metabolic syndrome.

Effects of Sleep Disturbance

- Increased cortisol
- Increased appetite
- Weight gain
- Reduced insulin sensitivity

Ayurveda regards proper sleep as one of the Trayopastambha (three pillars of life).

5. Abhyanga (Oil Massage)

Daily oil massage reduces stress and Vata imbalance.

Physiological Benefits

- Improves blood circulation
- Reduces sympathetic overactivity
- Enhances sleep quality
- Relieves muscular fatigue caused by prolonged digital device use

6. Meditation and Mental Discipline

Digital addiction and information overload increase stress and anxiety.

Benefits of Meditation

- Enhances parasympathetic tone
- Reduces stress hormones
- Improves sleep

- Prevents emotional eating

VII. DIGITAL LIFESTYLE AND AYURVEDIC PERSPECTIVE¹⁵

Digital Habit	Possible Ayurvedic Imbalance	Resulting Disorder
Late-night screen exposure	Vata-Pitta aggravation	Insomnia
Sedentary work	Kapha increase	Obesity
Fast food consumption	Agnimandya	Metabolic syndrome
Stress and multitasking	Raja-Tama dominance	Anxiety and burnout
Irregular meals	Vishama Agni	Digestive disorders

Chronobiology and Ayurveda

Chronobiology studies biological rhythms and their effects on health. Ayurveda had already emphasized time-dependent physiological functioning thousands of years ago. 16

Dosha Dominance According to Time

Time Period	Dominant Dosha
6 AM – 10 AM	Kapha
10 AM – 2 PM	Pitta
2 PM – 6 PM	Vata
6 PM – 10 PM	Kapha
10 PM – 2 AM	Pitta
2 AM – 6 AM	Vata

This rhythmic pattern closely resembles modern circadian physiology.

VIII. PREVENTIVE STRATEGIES BASED ON DINACHARYA IN THE DIGITAL AGE^{17,18}

Recommended Lifestyle Modifications

- Wake before sunrise
- Avoid screen exposure before bedtime
- Practice daily exercise and yoga
- Maintain regular meal timings
- Prefer mindful eating
- Follow sleep hygiene
- Practice meditation and pranayama

- Reduce sedentary behavior
- Perform Abhyanga regularly

Table: Impact of Digital Lifestyle on Metabolic and Circadian Health

Digital Lifestyle Factor	Physiological Effect	Ayurvedic Interpretation	Possible Clinical Outcome
Excessive screen time	Reduced physical activity	Kapha aggravation	Obesity, fatigue
Late-night mobile use	Melatonin suppression	Vata-Pitta imbalance	Insomnia, anxiety
Irregular meal timing	Disturbed glucose metabolism	Vishama Agni	Metabolic syndrome
Fast food consumption	Increased inflammation and dyslipidemia	Ama formation	Diabetes, dyslipidemia
Sedentary occupation	Reduced calorie expenditure	Meda Dushti	Weight gain
Chronic digital stress	Elevated cortisol levels	Raja dominance	Hypertension, burnout
Sleep deprivation	Hormonal dysregulation	Nidra Vaigunya	Insulin resistance
Social media addiction	Mental overstimulation	ManovahaSrotodushti	Depression, irritability

Table: Dinacharya Practices and Their Chronobiological Correlation

Dinacharya Practice	Recommended Time	Circadian Correlation	Physiological Benefit
Brahma Muhurta awakening	Before sunrise	Cortisol awakening response	Improved alertness
Water intake in morning	Early morning	Gastrointestinal activation	Detoxification
Vyayama (exercise)	Morning	Increased metabolic efficiency	Weight control

)			
Abhyanga	Before bath	Parasympathetic activation	Stress reduction
Main meal at midday	Noon	Peak digestive enzyme activity	Better digestion
Meditation	Morning/evening	Cortisol regulation	Mental calmness
Light dinner	Before sunset or early night	Improved insulin sensitivity	Better sleep
Nidra (sleep)	Night	Melatonin synchronization	Hormonal balance

Table: Ayurvedic Interpretation of Metabolic Syndrome Components

Modern Component	Ayurvedic Correlation	Dominant Dosha Involvement	Pathological Mechanism
Central obesity	Sthaulya	Kapha	Meda accumulation
Hyperglycemia	Prameha	Kapha-Pitta	Agnimandya
Dyslipidemia	Medodushiti	Kapha	Lipid metabolism disturbance
Hypertension	Rakta-gata Vata	Vata-Pitta	Vascular dysfunction
Insulin resistance	Dhatvagni Dushti	Kapha-Vata	Impaired tissue metabolism

Table: Preventive Role of Dinacharya in Digital Age Disorders

Disorder	Digital Risk Factor	Relevant Dinacharya Practice	Expected Outcome
Obesity	Sedentary behavior	Daily exercise	Improved metabolism
Insomnia	Night screen	Early sleep routine	Better sleep quality

	exposure		
Anxiety	Information overload	Meditation and Pranayama	Mental relaxation
Hypertension	Chronic stress	Abhyanga and Yoga	Reduced sympathetic activity
Diabetes	Irregular eating	Timely meals	Better glycemic control
Eye strain	Continuous gadget use	Netra care and sleep	Reduced ocular fatigue
Burnout syndrome	Work overload	Proper rest and routine	Improved wellbeing

Table: Comparison between Modern Circadian Medicine and Ayurvedic Dinacharya

Aspect	Modern Chronobiology	Ayurvedic Concept
Biological clock	Suprachiasmatic nucleus	Kala and Dosha rhythm
Hormonal rhythm	Circadian endocrine regulation	Dosha cyclic dominance
Sleep-wake cycle	Melatonin regulation	Nidra
Meal timing	Chrononutrition	Kala Bhojana
Activity rhythm	Daytime metabolic activation	Vyayama during Kapha period
Mental wellbeing	Stress neurobiology	Sattva balance
Preventive healthcare	Lifestyle medicine	Swasthavritta

Table: Suggested Dinacharya Schedule for Digital Era Population

Time	Recommended Activity	Health Benefit
4:30–5:30 AM	Wake up (Brahma Muhurta)	Circadian synchronization
5:30–6:00 AM	Oral hygiene and hydration	Digestive activation
6:00–7:00 AM	Yoga, exercise, Pranayama	Metabolic enhancement
7:00–8:00 AM	Bath and breakfast	Physical freshness
10:00 AM–2:00 PM	Main work period and lunch	Peak productivity and digestion
5:00–6:00 PM	Light walk/relaxation	Stress reduction

7:00–8:00 PM	Light dinner	Better metabolism
9:00–10:00 PM	Meditation and sleep	Hormonal recovery

IX. DISCUSSION

The modern digital era has created a lifestyle environment characterized by physical inactivity, excessive mental stimulation, irregular routines, disturbed sleep patterns, and altered food habits. These factors collectively contribute to the development of metabolic syndrome and circadian rhythm disorders, which are now considered major global public health challenges. Ayurveda recognized the importance of disciplined daily living thousands of years ago and proposed Dinacharya as a preventive framework to maintain harmony between the body, mind, and external environment.¹⁹

Metabolic syndrome is fundamentally associated with impaired metabolism, obesity, insulin resistance, inflammation, and neuroendocrine dysregulation. From an Ayurvedic perspective, these pathological conditions can be correlated with Agnimandya (diminished digestive and metabolic fire), accumulation of Ama (metabolic toxins), Kapha aggravation, Medo Dhatu vitiation, and disturbance of Vata-mediated biological regulation. Irregular sleep, late-night awakening, excessive screen exposure, emotional stress, and untimely food consumption disturb the natural balance of Doshas and impair metabolic homeostasis.²⁰

One of the most important contributions of Dinacharya is restoration of circadian synchronization. Modern chronobiology confirms that almost every physiological function including digestion, insulin secretion, hormone release, cardiovascular activity, immune modulation, and neuronal repair follows circadian rhythmicity. Disturbance of these rhythms results in metabolic dysfunction and inflammatory changes. Ayurveda similarly emphasizes that bodily functions operate according to temporal cycles governed by Dosha predominance during different periods of the day. This demonstrates a remarkable parallel between Ayurvedic time-based physiology and modern circadian science.²¹

The recommendation of waking during Brahma Muhurta has significant physiological relevance.

Early morning awakening synchronizes the body with natural light-dark cycles and promotes proper cortisol rhythm, mental clarity, bowel evacuation, and respiratory function. In contrast, habitual late-night sleeping and delayed awakening commonly observed in digital lifestyles contribute to lethargy, Kapha accumulation, impaired metabolism, obesity, and psychological disturbances. Scientific evidence indicates that delayed sleep phase and social jet lag are strongly associated with diabetes, hypertension, and cardiovascular disease.²²

Ayurvedic emphasis on regular physical activity through Vyayama is particularly relevant in combating sedentary digital behavior. Prolonged sitting associated with office work, online education, gaming, and smartphone dependence reduces energy expenditure and predisposes individuals to obesity and insulin resistance. Regular exercise improves glucose utilization, lipid metabolism, mitochondrial function, and cardiovascular health. Ayurveda states that appropriate exercise enhances digestive power, lightness of body, physical endurance, and Dosha equilibrium. Thus, Vyayama acts as both preventive and therapeutic intervention for metabolic disorders.²³

Another critical aspect of Dinacharya is regulation of dietary timing and eating behaviour. Modern research in chrononutrition demonstrates that meal timing significantly influences glucose metabolism, insulin sensitivity, and weight regulation. Late-night eating and irregular meal schedules impair circadian metabolic signalling and increase risk of obesity and metabolic syndrome. Ayurveda strongly advocates timely food intake according to digestive capacity and natural hunger signals. Midday meals are considered optimal because digestive fire (Agni) is strongest during Pitta predominance. This aligns with modern evidence showing improved metabolic efficiency during daytime eating.²⁴

Sleep regulation (Nidra) represents another major pillar of Ayurvedic preventive medicine. Sleep deprivation caused by excessive screen exposure, binge-watching, social media addiction, and occupational stress is increasingly prevalent in modern society. Blue light exposure from electronic devices suppresses melatonin secretion and delays sleep onset. Chronic sleep disturbance adversely affects appetite regulation, glucose tolerance, stress hormone levels, immune function, and emotional

stability. Ayurveda considers improper sleep as a major causative factor for fatigue, obesity, mental disturbances, and premature aging. Adoption of proper sleep hygiene according to Dinacharya can therefore significantly reduce metabolic and neuropsychological disorders.²⁵

The practice of Abhyanga (daily oil massage) may also have therapeutic relevance in digital-age stress disorders. Continuous mental workload and prolonged gadget use increase sympathetic nervous system activity and muscular tension. Abhyanga promotes parasympathetic dominance, improves circulation, reduces stress, enhances sleep quality, and stabilizes Vata Dosha. Emerging evidence suggests that massage therapies reduce cortisol levels and improve autonomic balance, supporting Ayurvedic observations.²⁶

Mental health disturbances are another major consequence of digital overexposure. Constant notifications, multitasking, social comparison, information overload, and reduced interpersonal interaction contribute to anxiety, irritability, depression, and burnout. Ayurveda identifies uncontrolled sensory indulgence and intellectual errors (Prajnaparadha) as important causes of disease. Meditation, Pranayama, spiritual discipline, and mindful living prescribed under Dinacharya improve emotional resilience, concentration, and psychological wellbeing. These practices reduce sympathetic overactivity and help regulate neuroendocrine responses associated with stress-related metabolic disorders.²⁷

The concept of digital addiction can also be interpreted through Ayurvedic understanding of disturbed sensory control (AsatmyaIndriyarthasamyoga). Excessive stimulation of visual and auditory senses through digital devices disrupts mental equilibrium and circadian regulation. Dinacharya promotes controlled sensory engagement and disciplined daily routines, thereby helping maintain cognitive and emotional balance.²⁸

Furthermore, Dinacharya has important preventive implications for public health. Lifestyle disorders impose enormous economic and healthcare burdens globally. Preventive strategies based on Ayurvedic daily regimens are economical, non-invasive, culturally adaptable, and sustainable. Incorporating Dinacharya principles into schools, workplaces,

community health programs, and digital wellness campaigns may help reduce the prevalence of obesity, diabetes, cardiovascular disease, sleep disorders, and stress-related illnesses.²⁹

The integration of Ayurvedic lifestyle medicine with modern chronobiology offers a promising interdisciplinary approach for future healthcare. While contemporary medicine effectively manages complications of metabolic syndrome, Ayurveda provides long-term preventive strategies targeting root lifestyle causes. Combining these systems may improve patient compliance, promote holistic health, and enhance quality of life.³⁰

However, despite increasing scientific interest, more evidence-based clinical trials are required to validate specific Dinacharya interventions in metabolic syndrome and circadian disorders. Standardization of protocols, objective biomarkers, and long-term population studies are necessary to establish broader clinical acceptance and policy implementation.³¹

X. CONCLUSION

The digital age has fundamentally altered human lifestyle patterns, resulting in increased prevalence of metabolic syndrome, obesity, diabetes, sleep disturbances, stress disorders, and circadian rhythm abnormalities. Excessive screen exposure, sedentary behaviour, irregular food habits, sleep deprivation, and chronic psychological stress have disrupted the natural synchronization between human physiology and environmental rhythms. These lifestyle disturbances adversely affect metabolic regulation, hormonal balance, cardiovascular health, mental wellbeing, and overall quality of life. Ayurveda offers a comprehensive preventive framework through the concept of Dinacharya, which emphasizes disciplined daily living in harmony with natural biological cycles. Dinacharya includes practices such as early awakening, proper hygiene, regular exercise, timely meals, meditation, oil massage, and adequate sleep. These regimens collectively help maintain Dosha balance, improve digestive and metabolic functions, enhance immunity, regulate mental health, and promote circadian synchronization. Modern chronobiology and lifestyle medicine increasingly support Ayurvedic principles by demonstrating the importance of circadian alignment in maintaining

metabolic homeostasis and preventing chronic diseases. Scientific studies confirm that proper sleep hygiene, regular physical activity, stress reduction, and time-regulated food intake significantly improve insulin sensitivity, hormonal regulation, cardiovascular function, and psychological stability. Thus, many traditional Ayurvedic recommendations correspond closely with contemporary biomedical understanding of circadian physiology. Dinacharya is highly relevant in the present era because it addresses the root behavioural and environmental causes responsible for lifestyle disorders. By promoting mindful living, sensory discipline, and biological rhythm regulation, Ayurveda provides an effective strategy to counteract the harmful consequences of digital overdependence and sedentary modern living. The holistic nature of Dinacharya not only supports physical health but also enhances emotional resilience, cognitive function, and social wellbeing. Implementation of Dinacharya-based lifestyle interventions at individual and community levels may significantly contribute to prevention of metabolic syndrome and circadian rhythm disorders. Public awareness programs, workplace wellness initiatives, educational reforms, and integration of Ayurvedic preventive healthcare into modern medical practice may help reduce the growing burden of non-communicable diseases globally.

REFERENCES

- [1] Panda S. Circadian physiology of metabolism. *Science*. 2016;354(6315):1008-15.
- [2] Bass J, Takahashi JS. Circadian integration of metabolism and energetics. *Science*. 2010;330(6009):1349-54.
- [3] Scheer FAJL, Hilton MF, Mantzoros CS, Shea SA. Adverse metabolic effects of circadian misalignment. *Proc Natl Acad Sci USA*. 2009;106(11):4453-8.
- [4] Knutson KL. Sleep duration and cardiometabolic risk. *Curr Cardiol Rep*. 2012;14(5):507-12.
- [5] Reutrakul S, Van Cauter E. Circadian disruption and metabolic disease risk. *Endocr Rev*. 2018;39(2):79-132.
- [6] Sharma H, Chandola HM. Ayurvedic concepts related to lifestyle disorders. *Evid Based Complement Alternat Med*. 2011;2011:1-7.

- [7] Patwardhan B, Vaidya ADB, Chorghade M. Ayurveda and natural products drug discovery. *Curr Sci*. 2004;86(6):789-99.
- [8] Potter GD, Cade JE, Grant PJ, Hardie LJ. Nutrition and the circadian system. *Br J Nutr*. 2016;116(3):434-42.
- [9] Taheri S, Lin L, Austin D, Young T, Mignot E. Short sleep duration and obesity. *PLoS Med*. 2004;1(3):210-7.
- [10] Spiegel K, Tasali E, Penev P, Van Cauter E. Sleep curtailment and metabolic dysfunction. *Lancet*. 2009; 354:1435-9.
- [11] Misra A, Khurana L. Obesity and metabolic syndrome in developing countries. *J Clin Endocrinol Metab*. 2008;93(11):S9-30.
- [12] Dwivedi RR, Ranade S. Textbook of Swasthavritta. Varanasi: Chaukhambha Sanskrit Series; 2015.
- [13] Alberti KGMM, Eckel RH, Grundy SM, Zimmet PZ, Cleeman JJ, Donato KA, et al. Harmonizing the metabolic syndrome. *Circulation*. 2009;120(16):1640-5.
- [14] James SM, Honn KA, Gaddameedhi S, Van Dongen HPA. Shift work: disrupted circadian rhythms and sleep implications. *Nat Sci Sleep*. 2017; 9:111-32.
- [15] Garaulet M, Gómez-Abellán P. Timing of food intake and obesity. *Br J Nutr*. 2014;111(4):561-72.
- [16] Roenneberg T, Allebrandt KV, Meroz M, Vetter C. Social jetlag and obesity. *Curr Biol*. 2012;22(10):939-43.
- [17] Morris CJ, Yang JN, Scheer FA. The impact of circadian misalignment on cardiovascular and metabolic function. *Nat Rev Cardiol*. 2012;9(9):535-47.
- [18] Froy O. Metabolism and circadian rhythms—implications for obesity. *Endocr Rev*. 2010;31(1):1-24.
- [19] Arble DM, Bass J, Laposky AD, Vitaterna MH, Turek FW. Circadian timing of food intake contributes to weight gain. *Obesity*. 2009;17(11):2100-2.
- [20] St-Onge MP, Ard J, Baskin ML, Chiuve SE, Johnson HM, Kris-Etherton P, et al. Sleep duration and quality: impact on lifestyle behaviors and cardiometabolic health. *Circulation*. 2016;134(18):e367-86.
- [21] Gupta R, Pandi-Perumal SR. Circadian rhythm sleep disorders in adolescents. *Sleep Med Clin*. 2018;13(1):31-40.
- [22] Kessler RC, Berglund P, Demler O, Jin R, Merikangas KR, Walters EE. Lifetime prevalence of mental disorders in digital era populations. *Arch Gen Psychiatry*. 2005;62(6):593-602.
- [23] Czeisler CA. Perspective: casting light on sleep deficiency. *Nature*. 2013;497(7450):S13.
- [24] Tahara Y, Shibata S. Chronobiology and nutrition. *Neuroscience*. 2013; 253:78-88.
- [25] Potter GDM, Skene DJ, Arendt J, Cade JE, Grant PJ, Hardie LJ. Circadian rhythm and sleep disruption: causes and metabolic consequences. *Proc Nutr Soc*. 2016;75(4):391-400.
- [26] Wright KP Jr, McHill AW, Birks BR, Griffin BR, Rusterholz T, Chinoy ED. Entrainment of the human circadian clock to natural light-dark cycle. *Curr Biol*. 2013;23(16):1554-8.
- [27] Vetter C, Devore EE, Ramin CA, Speizer FE, Willett WC, Schernhammer ES. Mismatch of sleep and work timing and risk of type 2 diabetes. *Diabetes Care*. 2015;38(9):1707-13.
- [28] Knutson KL, Van Cauter E. Associations between sleep loss and increased risk of obesity and diabetes. *Ann N Y Acad Sci*. 2008; 1129:287-304.
- [29] Fonken LK, Nelson RJ. The effects of light at night on circadian clocks and metabolism. *Endocr Rev*. 2014;35(4):648-70.
- [30] Logan RW, McClung CA. Rhythms of life: circadian disruption and brain disorders. *Nat Rev Neurosci*. 2019;20(1):49-65.
- [31] Patterson RE, Sears DD. Metabolic effects of intermittent fasting. *Annu Rev Nutr*. 2017; 37:371-93.