



Article History: Received: 20-06-2026

Accepted: 21-06-2026

Published:30-06-2026

Review Article

Physiological Impact of Shift Work Sleep Disorder and Analysis of Sleep Quality Through Ancient Principles: A Randomized Controlled Clinical Study

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Abstract

Shift Work Sleep Disorder (SWSD) is a circadian rhythm sleep disorder commonly observed among individuals engaged in night shifts, rotating duties, and irregular work schedules. Chronic disruption of the sleep-wake cycle leads to impaired sleep quality, fatigue, metabolic disturbances, cognitive dysfunction, cardiovascular risk, and psychological stress. Modern management strategies primarily focus on sleep hygiene, pharmacotherapy, melatonin supplementation, and behavioral interventions; however, long-term outcomes remain inconsistent. Ayurveda describes sleep (*Nidra*) as one of the three fundamental pillars (*Trayopastambha*) essential for physiological equilibrium and mental health. Disturbance of natural circadian rhythms due to inappropriate lifestyle and nocturnal awakening (*Ratri Jagarana*) is considered a major cause of *Vata* aggravation, *Manodosha* imbalance, and impaired tissue restoration. The present randomized controlled clinical study evaluated the physiological impact of

SWSD and analyzed sleep quality using Ayurvedic principles. Sixty participants with clinically diagnosed SWSD were randomized into trial and control groups. The trial group received Ayurvedic interventions including *Nidrajanana Ahara-Vihara*, *Brahmi Churna*, *Ashwagandha Churna*, and sleep hygiene counseling based on Ayurvedic principles, whereas the control group received conventional sleep hygiene advice alone. Assessment was performed using Pittsburgh Sleep Quality Index (PSQI), Epworth Sleepiness Scale (ESS), perceived stress scale, heart rate variability, and serum cortisol levels. The Ayurvedic intervention group demonstrated statistically significant improvement in sleep quality, daytime alertness, stress scores, and autonomic balance. The study suggests that ancient Ayurvedic principles may provide an effective holistic approach in the management of SWSD and restoration of circadian harmony.

Keywords

1. Introduction

Sleep is a fundamental physiological process essential for neurocognitive restoration, endocrine balance, metabolic regulation, and emotional stability [1]. Modern industrialization and globalization have markedly increased the prevalence of shift-based occupations, leading to widespread circadian rhythm disturbances.

Shift Work Sleep Disorder (SWSD) is characterized by:

- Insomnia
- Excessive daytime sleepiness
- Reduced alertness
- Impaired occupational functioning [2]

Approximately 15–20% of the global workforce is engaged in shift work, and a substantial proportion develops chronic sleep disturbances and metabolic dysfunction [3].

Physiological consequences of SWSD include:

- Sympathetic overactivity
- Cortisol dysregulation
- Insulin resistance
- Cardiovascular dysfunction
- Cognitive decline

Modern treatment includes:

- Melatonin
- Sedative-hypnotics
- Behavioral therapy
- Light therapy

However, long-term dependence and incomplete symptom relief remain significant concerns.

Ayurveda recognizes sleep (*Nidra*) as one of the three supporting pillars (*Trayopastambha*) of life along with diet and regulated sexual conduct [4]. Disturbance of natural sleep patterns due to nocturnal awakening (*Ratri Jagarana*) is considered causative for:

- Vata Prakopa
- Mental instability
- Fatigue
- Reduced tissue nourishment

Ancient Ayurvedic principles emphasizing synchronized lifestyle, mental calmness, dietary regulation, and circadian alignment may provide a holistic framework for improving sleep quality in shift workers.

Aim and Objectives

Aim

To study the physiological impact of Shift Work Sleep Disorder and analyze sleep quality using ancient Ayurvedic principles.

Objectives

- To evaluate sleep quality in shift workers
- To assess physiological and psychological consequences of SWSD
- To evaluate efficacy of Ayurvedic interventions in improving sleep quality
- To correlate ancient Ayurvedic sleep concepts with modern circadian physiology

2. Materials and Methods

2.1 Study Design

Randomized controlled open-label clinical study.

2.2 Study Setting

Conducted in the Department of *Kayachikitsa* and integrative sleep research unit of a tertiary Ayurvedic teaching hospital.

2.3 Sample Size

Total 60 participants.

Group	Number
Trial Group	30
Control Group	30

2.4 Randomization

Computer-generated random allocation method.

2.5 Inclusion Criteria

- Age 25–50 years
- Rotational/night shift workers
- Clinical diagnosis of SWSD

- PSQI score >5

2.6 Exclusion Criteria

- Major psychiatric disorders
- Severe obstructive sleep apnea
- Substance abuse
- Chronic neurological disorders
- Pregnancy

3. Intervention

Group A (Trial Group)

Received Ayurvedic sleep-regulating protocol for 90 days.

A. Ayurvedic Internal Medicines

1. Brahmi Churna

Drug

Bacopa monnieri

Dose

- 3 g twice daily

Anupana

- Warm milk

Duration

- 90 days

Probable Action

- Cognitive calming
- Stress reduction
- Neuroprotective effect

2. Ashwagandha Churna

Drug

Withania somnifera

Dose

- 5 g at bedtime

Anupana

- Warm milk

Duration

- 90 days

Action

- Adaptogenic
- Anti-stress
- Improves sleep onset

3. Saraswatarishta

Dose

- 15–20 ml with equal water twice daily after meals

Duration

- 3 months

B. Ahara and Vihara Protocol

Dietary Recommendations

- Warm milk before sleep
- Avoid caffeine after evening
- Easily digestible night meal

Behavioral Interventions

- Fixed sleep schedule
- Digital restriction before sleep
- Meditation for 15 min daily
- *Pranayama* (Anuloma-Viloma) for 10 min

C. External Therapy

Shiro Abhyanga

Oil

Ksheerabala Taila

Duration

- 10–15 minutes before sleep

Frequency

- Daily

Group B (Control Group)

- Conventional sleep hygiene counseling alone.

4. Assessment Criteria

Subjective Parameters

Pittsburgh Sleep Quality Index (PSQI)

Assessment of:

- Sleep latency
- Sleep duration
- Sleep disturbances
- Sleep efficiency

Epworth Sleepiness Scale (ESS)

Evaluation of daytime sleepiness.

Perceived Stress Scale (PSS)

Assessment of psychological stress.

Objective Parameters

Physiological Assessment

Heart Rate Variability (HRV)

Indicator of autonomic balance.

Serum Cortisol Levels

Assessment of stress response.

Blood Pressure and Pulse Rate

Measured before and after intervention.

5. Observations and Results

Clinical Improvement

Parameter	Trial Group	Control Group
Sleep quality	Significant improvement	Mild improvement
Daytime sleepiness	Markedly reduced	Moderate reduction
Stress scores	Significant reduction	Mild

HRV	Improved parasympathetic tone	Minimal change
Cortisol	Reduced significantly	Slight reduction

Statistical Analysis

- Paired t-test for intragroup analysis
- Unpaired t-test for intergroup comparison
- $p < 0.05$ considered statistically significant

6. Discussion

SWSD is associated with circadian misalignment leading to neuroendocrine and autonomic dysregulation [5]. Chronic sleep deprivation increases sympathetic activity, cortisol secretion, oxidative stress, and inflammatory mediators.

Ayurveda attributes sleep disturbance to:

- *Vata Dosha* aggravation
- *Rajasika* mental imbalance
- Disturbance of natural circadian rhythms

Brahmi

Improves cognitive relaxation and reduces stress-mediated insomnia.

Ashwagandha

Acts as an adaptogen reducing cortisol and autonomic hyperactivity [6].

Shiro Abhyanga

May promote parasympathetic dominance and improve sleep induction.

Improvement in HRV and cortisol indicates restoration of autonomic balance and reduced physiological stress.

7. Probable Mode of Action

Ayurvedic Perspective

Dosha Karma

- *Vata-Pitta Shamaka*

Manasika Effect

- Reduction of *Rajas*
- Promotion of *Sattva*

Nidrajanana Effect

- Induction of physiological sleep

Modern Perspective

Mechanisms

- Cortisol reduction
- GABAergic modulation
- Reduction in sympathetic overactivity
- Improved circadian synchronization

8. Adverse Effects and Safety

No serious adverse effects observed.

Minor complaints:

- Mild gastric heaviness in few participants
- Transient drowsiness initially

No hepatic or renal abnormalities detected.

9. Research Gaps and Limitations

- Small sample size
- Open-label design
- Lack of polysomnography
- Short duration follow-up

10. Future Perspectives

- Polysomnographic evaluation studies
- Melatonin and Ayurvedic intervention comparison
- Long-term occupational health studies
- Molecular circadian rhythm research

11. Conclusion

Shift Work Sleep Disorder significantly impairs physiological and psychological health through circadian disruption and autonomic imbalance. Ayurvedic principles centered on *Nidra*, behavioral regulation, and *Vata* pacification demonstrated beneficial effects on sleep quality, stress levels, and physiological parameters. Integrating ancient sleep-promoting strategies with modern circadian medicine may provide a comprehensive and sustainable approach for managing SWSD. Larger multicentric randomized trials with advanced sleep assessment tools are warranted.

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