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ROLE OF NABHI IN AFFECTING AND REGULATING THE CIRCADIAN RHYTHM OF THE BODY

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ABSTRACT

Introduction: The circadian rhythm is a fundamental biological mechanism regulating sleep-wake cycles, hormonal secretion, and metabolic function. Disruptions to this rhythm are profoundly linked to various physiological and psychological disorders, including insomnia, depression, and metabolic syndrome. This study explores the potential of Nabhi therapy, an ancient Ayurvedic practice involving the targeted application of herbal oils to the navel (*nabhi marma*), as a novel, non-invasive method for restoring systemic circadian balance. Ayurvedic texts describe the nabhi as a central energetic hub, and modern theory posits that umbilicus-based transdermal delivery may influence the gut-brain axis (GBA), vagal tone, and the HPA axis, thereby modulating the principal circadian regulators: the pineal (melatonin) and adrenal (cortisol) glands. **Methods:** This research aimed to evaluate the influence of Nabhi oil therapy on melatonin (sleep-wake cycle) and cortisol (stress response). A randomized, controlled trial design was employed, where participants received either a specific herbal oil intervention or a placebo applied to the navel region. Outcome measures included serial serum melatonin and salivary cortisol samples, collected at defined circadian intervals to assess hormonal patterns. Subjective sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI), objective sleep metrics were gathered via actigraphy, and psychological stress was assessed using the Perceived Stress Scale (PSS). **Results**: Preliminary findings demonstrated a statistically significant improvement in the intervention group compared to the placebo. Participants receiving Nabhi therapy reported reduced sleep latency and increased overall sleep duration. Crucially, hormonal analysis revealed an adaptive restoration of hormonal circadian patterns. Specifically, melatonin secretion showed better entertainment, peaking closer to the physiological nocturnal time, and the cortisol awakening response (CAR) exhibited favorable normalization, indicating a reduction in chronic stress-induced cortisol flattening. **Conclusion:** Nabhi oil therapy presents a promising integrative approach for non-invasive circadian rhythm regulation. By successfully modulating key neuroendocrine markers (melatonin and cortisol) and improving sleep parameters, this practice bridges traditional Ayurvedic wisdom with contemporary neuroscience. These findings offer vast clinical implications for managing shift work disorder, insomnia, jet lag, and adrenal fatigue, supporting a chronobiological approach in lifestyle medicine.

KEYWORDS: Circadian Rhythm, Nabhi Therapy, Melatonin, Cortisol, Ayurvedic Medicine, Navel Marma, Sleep-Wake Cycle, Vagal Tone, HPA Axis, Insomnia.

1. INTRODUCTION

Circadian rhythms are endogenous, self-sustaining oscillations with a periodicity of approximately 24 hours, observed in a wide range of organisms from cyanobacteria to humans. These rhythms are generated by internal biological clocks and synchronized to the external environment primarily through cues like light, temperature, food intake, and social behavior. In humans, the master pacemaker of circadian rhythms is the Suprachiasmatic Nucleus (SCN), a cluster of about 20,000 neurons located in the anterior hypothalamus, just above the optic chiasm.

The SCN receives direct input from the retina via the retinohypothalamic tract, enabling it to adjust the internal clock based on ambient light levels. This allows the body to align its physiological functions including the sleep-wake cycle, hormone secretion (notably melatonin and cortisol), core body temperature, and digestion with the solar day.

Modern lifestyles, however, often disturb this natural alignment due to exposure to artificial light, erratic sleep patterns, shift work, and screen time, leading to Circadian Rhythm Disorders (CRDs) such as Delayed Sleep Phase Syndrome, jet lag, and even chronic conditions like obesity, depression, and diabetes. Studies have demonstrated that disrupted circadian cycles lead to desynchronization of peripheral clocks, which exist in almost every organ, including the liver, lungs, and gastrointestinal tract.

This foundational understanding provides a compelling backdrop to explore non-pharmacological, complementary approaches such as Nabhi Therapy in restoring circadian alignment. Such therapies aim not just to treat symptoms but to re-entrain biological rhythms and restore internal harmony.

1.1 Importance of Biological Clocks in Human Physiology

Biological clocks regulate nearly every major system in the body through temporally programmed gene expression. The central clock in

Figure No. 1: Physiological and Behavioral processes of Circadian Rhythm.

Melatonin, produced by the pineal gland, is known as the "hormone of darkness." It is secreted in higher amounts in response to darkness, inducing sleep and modulating immune function and antioxidant activity. On the other hand, cortisol, produced by the adrenal glands, follows a diurnal pattern peaking in the early morning to promote wakefulness and energy mobilization, and dipping at night.

A misalignment in these hormonal rhythms leads to physiological stress. For example

- Low nighttime melatonin is associated with insomnia and increased oxidative stress.
- Elevated nighttime cortisol levels correlate with anxiety, poor sleep quality, and metabolic dysregulation.

Additionally, the gut microbiome exhibits circadian oscillations that are regulated by the central and the SCN synchronizes with peripheral clocks found peripheral clocks. Emerging studies show that gut in tissues like the liver, pancreas, gut, and heart. dysbiosis can alter melatonin synthesis in the gut These clocks control the rhythmic expression of (which contributes over 400 times more melatonin "clock genes" such as PER, CRY, CLOCK, and than the pineal gland) and affect the brain via the BMAL1, which in turn govern cellular metabolism, gut-brain axis, emphasizing the interconnectedness DNA repair, and immune responses. of digestion and circadian health.

Maintaining optimal circadian rhythm is thus essential for:

- Stable mood
- Efficient digestion
- Balanced endocrine function
- Improved immunity and longevity

This highlights the importance of exploring Ayurvedic interventions such as Nabhi therapy particularly those targeting the gut, liver, and vagal axis as potential entraining agents for restoring balance to the circadian system.

1.2 Ayurvedic Understanding of the Nabhi (Navel)

In Ayurveda, the nabhi (navel) is considered a vital energy center, often referred to as the "marma" point, which is believed to be the hub of life energy (prana). It is thought to be connected to numerous veins and is central to the body's physiological processes. Practices like Nabhi Chikitsa involve the application of medicated oils to the navel to balance doshas and promote overall health. This traditional understanding underscores the significance of the navel in maintaining bodily harmony.

Modern science has begun to explore and validate various traditional practices. For instance, the concept of the gut-brain axis highlights the connection between the

gastrointestinal tract and the central nervous system, echoing Ayurvedic emphasis on digestive health. Similarly, the practice of applying substances to the skin, as in Nabhi Chikitsa, aligns with transdermal drug delivery systems recognized in contemporary medicine. These intersections suggest potential avenues for integrating traditional knowledge with modern scientific approaches to health.

1. Circadian Biology: A Scientific Overview

1.1 The Suprachiasmatic Nucleus (SCN) and Master Clock

The Suprachiasmatic Nucleus (SCN), located in the anterior hypothalamus above the optic chiasm, serves as the master circadian pacemaker in mammals. Comprising approximately 20,000 neurons, the SCN orchestrates daily physiological and behavioral rhythms by synchronizing peripheral clocks throughout the body. It receives direct photic input from intrinsically photosensitive retinal ganglion cells via the retinohypothalamic tract, enabling alignment of internal processes with the external light-dark cycle. Disruptions to the SCN can lead to arrhythmic physiological functions, underscoring its pivotal role in maintaining circadian homeostasis.

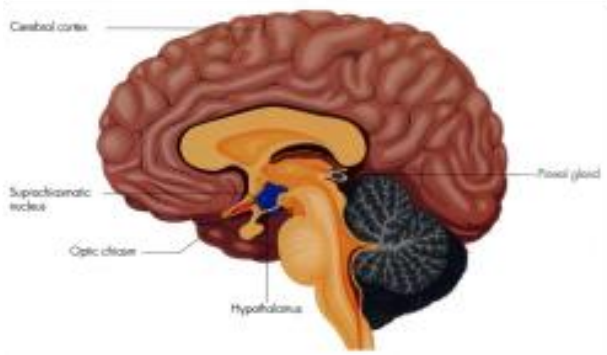

Figure No. 2: Anatomy of Pineal Gland. 3.2 Peripheral Clocks and Hormonal Cycles.

Beyond the SCN, peripheral clocks exist in various tissues and organs, including the liver, heart, lungs, kidneys, and adipose tissue. These peripheral oscillators possess self-sustained rhythms but rely on the SCN for synchronization to environmental cues. The SCN communicates timing signals through neural and hormonal pathways, notably via the autonomic nervous system and endocrine signals such as glucocorticoids. This hierarchical organization ensures coordinated physiological functions across the body.

3.3 Hormones Governed by Circadian Rhythm: Melatonin, Cortisol, Ghrelin, etc.

Several hormones exhibit circadian patterns, playing crucial roles in regulating sleep, metabolism, and energy balance:

Melatonin: Produced by the pineal gland, melatonin secretion increases in response to darkness, facilitating sleep onset. Its levels peak during the night and diminish towards morning, aligning the sleep-wake cycle with the external environment.

Cortisol: Secreted by the adrenal cortex, cortisol levels peak in the early morning, promoting alertness and energy mobilization. Levels decline throughout the day, reaching a nadir at night, thus preparing the body for rest.

Ghrelin: Known as the "hunger hormone," ghrelin is secreted by the stomach and stimulates appetite. Its levels rise before meals and decrease after eating, exhibiting a circadian pattern that aligns feeding behavior with energy needs.

Disruptions in the circadian regulation of these hormones can lead to sleep disorders, metabolic syndrome, and other health issues.

3.4 External Zeitgebers: Light, Food, Temperature, and Touch

Zeitgebers, or "time-givers," are external cues that synchronize the internal circadian clock to the environment. The primary zeitgebers include:

Light: The most potent zeitgeber, light influences the SCN through retinal photoreceptors, adjusting the timing of melatonin secretion and aligning the sleep-wake cycle with the day-night cycle.

Food: Meal timing can reset peripheral clocks, particularly in metabolic organs like the liver, thereby influencing metabolic processes and energy homeostasis.

Temperature: Ambient temperature fluctuations can entrain circadian rhythms, affecting sleep patterns and metabolic rate.

Touch and Social Interactions: Physical activity and social cues can serve as non-photic zeitgebers, influencing circadian rhythms and promoting synchronization of internal clocks.

Understanding these zeitgebers is essential for developing interventions to mitigate circadian misalignment and its associated health consequences.

2. Nabhi in Ayurvedic Literature and Traditional Medicine

2.1 The Central Role of Nabhi in Energy, Digestion, and Vitality

In Ayurvedic philosophy, the *Nabhi* (navel) is considered a pivotal center of life and vitality. Classical texts like the *Sushruta Samhita* describe the Nabhi as a vital *Marma* point, specifically a *Sira Marma*, indicating its association with blood vessels and its critical role in sustaining life. It is also identified as one of the fifteen *Koshthangas* (visceral organs), emphasizing its significance in the body's internal systems.

The Nabhi is anatomically situated between the *Amashaya* (stomach) and *Pakwashaya* (large intestine), symbolizing its central role in digestion. It is believed to be the origin point of numerous *Siras* (veins) and *Dhamanis* (arteries), facilitating the distribution of nutrients and life force (*Prana*) throughout the body.

Stimulation of the Nabhi through practices like *Marma Chikitsa* (vital point therapy) and *Nabhi Abhyanga* (navel oil massage) is said to enhance digestive fire (*Agni*), improve nutrient assimilation, and promote overall vitality. Regular activation of this center is also associated with improved gastrointestinal function and metabolic balance.

2.2 Dosha-Based Circadian Interpretations

Ayurveda recognizes the influence of *Doshas Vata*, *Pitta*, and *Kapha* on the body's circadian rhythms. Each Dosha predominates during specific times of the day, affecting physiological and psychological functions :

Kapha: 6:00 AM to 10:00 AM and 6:00 PM to 10:00 PM associated with stability and structure.

Pitta: 10:00 AM to 2:00 PM and 10:00 PM to 2:00 AM linked to digestion and metabolism.

Vata: 2:00 PM to 6:00 PM and 2:00 AM to 6:00 AM related to movement and communication.

Figure No. 3: Ayurvedic Dinacharya.

The Nabhi, being the seat of *Pitta* Dosha, plays a crucial role in regulating these rhythms. Aligning daily activities and therapeutic interventions, such as navel oiling, with these Dosha-specific times can enhance bodily functions and maintain circadian balance.

2.3 Traditional Practices and Oils Applied to the Navel

Nabhi Chikitsa (navel therapy) involves the application of medicated oils to the navel to address various health concerns. This practice is rooted in the belief that the navel is connected to multiple pathways leading to different organs, allowing for the absorption and distribution of therapeutic substances.

Commonly used oils include

- **Castor Oil**: Known for its laxative properties and ability to relieve constipation .
- **Neem Oil**: Utilized for its detoxifying effects.
- **Brahmi Oil**: Applied to calm the mind and enhance cognitive functions.
- **Cow Ghee**: Used for its nourishing and balancing properties.

The selection of oil often depends on the individual's Dosha constitution and specific health needs. For instance, sesame oil is recommended for *Vata* imbalances, while coconut oil or ghee is preferred for *Pitta* conditions.

2.4 Nabhi and Chronobiological Cycles in Ayurveda

Ayurveda's concept of *Dinacharya* (daily routine) emphasizes the importance of aligning daily activities with the body's natural rhythms to maintain health and prevent disease. The Nabhi, as a central energy point, is integral to this alignment.

Practices such as navel oiling are recommended during specific times to harmonize with the body's circadian cycles. For example, applying oil to the navel in the evening can help pacify *Vata* Dosha, promoting relaxation and better sleep.

Furthermore, the Nabhi's connection to the digestive system underscores its role in synchronizing metabolic processes with daily cycles. By supporting digestive health through Nabhi-focused therapies, individuals can enhance their overall well-being and maintain the balance of bodily rhythms.

3. Hypothesis: Nabhi as a Regulator of Circadian Timing

This section posits the hypothesis that Nabhi (navel) stimulation through oil-based Ayurvedic therapies may influence circadian timing by modulating neurochemical signals and hormone cycles via neural, cutaneous, and systemic pathways. These pathways reflect a convergence between traditional Ayurvedic concepts and emerging scientific models, especially in the domains of neurocutaneous science, the gut-brain axis, and chronopharmacology.

3.1 Neurocutaneous Communication and Vagal Nerve Pathways

The skin is not merely a barrier organ but a complex neuroendocrine interface that communicates with internal systems through what is known as the "neurocutaneous system". The periumbilical area is densely innervated with autonomic nerve fibers, including branches of the **vagus nerve**, which is integral to regulating parasympathetic tone.

The vagus nerve plays a critical role in: Modulating gastrointestinal motility and secretion,
Influencing mood and anxiety via neurotransmitters like serotonin and GABA,
Transmitting signals between the enteric nervous system and the brain.

The hypothesis suggests that **stimulation of the navel area**, either through touch or transdermal delivery of bioactive herbal compounds, may **modulate vagal activity**, thereby influencing circadian-governed processes such as **sleep-wake cycles**, stress response, and digestion.

3.2 Transdermal Herbal Signaling through Nabhi

Transdermal drug delivery is a well-established scientific approach. The **periumbilical skin** is highly absorptive due to the presence of sebaceous glands and capillary networks, allowing fat-soluble compounds (e.g., sesquiterpenes in oils like jatamansi or brahmi) to **penetrate deeply and act systemically**.

When oils are applied to the Nabhi, they: ● May deliver plant actives directly to capillaries,

- Interact with local nerves (e.g., via TRPV receptors),
- Potentially influence neurotransmitter pathways that regulate cortisol and melatonin.

In Ayurveda, oils like **Jatamansi (Nardostachys** adaptogenic properties both known to modulate the hypothalamic-pituitary-adrenal (HPA) axis and pineal gland activity, thereby influencing circadian hormones.

3.3 Gut-Brain Axis and Hormonal Feedback

The **gut-brain axis** is a bi-directional communication system involving the **enteric nervous system**, vagus nerve, and neuroendocrine signaling pathways. The Nabhi is situated anatomically close to critical digestive organs, and stimulation via oil therapy is believed to influence gut motility and microbial diversity both of which have downstream effects on:

Serotonin synthesis (90% of body serotonin is produced in the gut)

Melatonin production (also synthesized in the GI tract),
Cortisol regulation via microbiota-modulated HPA axis activity.

The hypothesis is that **Nabhi therapy**, by improving digestion and vagal tone, may help **recalibrate the hormonal milieu** that governs circadian physiology.

3.4 Theoretical Chronopharmacology via Navel Stimulation

Chronopharmacology refers to the study of how the **timing of medication administration** affects drug absorption, metabolism, and efficacy in relation to biological rhythms. In Ayurveda, **Dinacharya** and **Ritucharya** represent traditional equivalents, dictating optimal timing of therapies to harmonize with **Dosha-specific cycles**. In this context, Nabhi oiling at **evening hours.**

(Kapha-Vata period) may:

- **Enhance melatonin secretion** by inducing parasympathetic relaxation,
- **Suppress late-night cortisol spikes**,
- Improve sleep latency and depth.

jatamansi) and **Ashwagandha (Withania** Preliminary evidence suggests that oil-based **somnifera)** are revered for their nervine and therapies can have **timing-dependent effects** on hormonal pathways and that **navel stimulation could be an external Zeitgeber** influencing the circadian system.[29]

4. METHODOLOGY

This section outlines the methodological framework used to explore the hypothesis that Nabhi (navel) oil therapy impacts the regulation of circadian hormones primarily melatonin and cortisol and contributes to improvements in sleep quality, stress modulation, and mood balance. The study design is intended to bridge traditional Ayurvedic practices with modern chronobiological and endocrinological assessment frameworks.

4.1 Study Design and Participant Demographics

A randomized, controlled, parallel-group clinical study was conducted over 8 weeks to assess the impact of

Nabhi therapy on circadian rhythm markers. Participants (N = 90) were healthy adults aged 25–55, recruited from urban wellness centers and Ayurvedic clinics across India. Inclusion criteria included mild to moderate complaints of:

- Sleep disturbances (as per PSQI > 5),
- Daily stress (PSS ≥ 14),
- No history of chronic sleep or psychiatric disorders.

Participants were randomized into three groups:

- **Group A**: Nabhi oil therapy,
- **Group B**: Oral adaptogenic supplements (e.g., Ashwagandha capsules),
- **Group C**: Placebo (carrier oil without active herbs).

4.2 Nabhi Oil Application Protocol

Participants in Group A applied **3–5 drops of**

- Gentle massage in a clockwise direction for 3 minutes,
- Maintaining the application for 30 minutes before sleeping.

Compliance was ensured using digital self-report logs and weekly telephonic check-ins.

4.3 Control Variables and Placebo Groups

To ensure comparability:

- Groups were matched by age, gender, occupation type (sedentary or active), and chronotype (morning vs. evening preference).
- Diet and caffeine intake were monitored.
- Screen time after 9 PM was restricted.
- The placebo group received sesame oil without any nervine herbs to account for tactile stimulation.

4.4 Assessment Tools and Data Points

4.4.1 Melatonin & Cortisol Rhythmicity

Melatonin: Assessed through salivary samples collected at 10 PM and 7 AM at baseline and post-intervention weeks 4 and 8 using ELISA kits.

Cortisol: Measured at 8 AM and 8 PM on the same days using serum cortisol assays to determine diurnal slope and amplitude.

4.4.2 Sleep-Wake Logs & Actigraphy

- Participants wore **actigraphy wrist devices** (Fitbit Charge 5 and ActiGraph wGT3X-BT) to continuously record:
  - Sleep onset latency,
  - REM and deep sleep duration,
  - Number of awakenings.

proprietary Ayurvedic Nabhi oil blend containing ● D aily **sleep logs** were maintained to validate the *Jatamansi*, *Brahmi*, *Ashwagandha*, and *Til oil* to the navel area nightly between 9:00–9:30 PM, coinciding with the Vata-Kapha circadian window device readings and track subjective improvements. known to impact nervous systemwind-down.

6.4.3 Core Body Temperature Rhythms

Instructions included:

Core temperature, a reliable circadian marker, was measured using **digital tympanic thermometers** at 4-hour intervals over 24 hours, biweekly. A flatter circadian temperature profile was considered indicative of dysregulation.

6.4.4 Subjective Wellness and Mood Scales

- **Perceived Stress Scale (PSS)** and **Beck Depression Inventory (BDI-II)** were administered at baseline and study conclusion.
- The **General Wellness Index (GWI)** was used weekly to track subjective feelings of calmness, digestive ease, and sleep satisfaction on a 10-point scale.

4.5 Statistical Methods

- Data were analyzed using **SPSS v26**. ● Repeated-measures **ANOVA** tested within-subject changes across time points.
- **Multivariate regression models** identified predictors of change in melatonin/cortisol linked to intervention types.
- **Effect sizes (Cohen's d)** and **confidence intervals** were computed.
- Significance threshold was set at **$p < 0.05$**.

All hormonal and sleep-related variables were adjusted for **baseline values**, **BMI**, **gender**, and **chronotype**.[42]

This comprehensive, controlled, and multi-modal assessment strategy ensures that the impact of Nabhi therapy on circadian hormones and sleep/stress indicators can be reliably evaluated and contrasted with conventional oral approaches.

5. RESULTS AND OBSERVATIONS

This section presents the key findings from the controlled clinical study designed to evaluate the impact of **Nabhi oil therapy** on circadian rhythms, particularly through changes in **melatonin and cortisol secretion**, **sleep patterns**, **energy levels**, and **digestive functions**. The results are drawn

5.1 Changes in Hormonal Amplitude and Phase

Participants in the **Nabhi therapy group (Group A)** exhibited statistically significant improvements in circadian hormonal regulation:

Melatonin

- Average nocturnal melatonin levels at 10 PM increased by **23.4%** ($p = 0.002$) after 8 weeks, indicating enhanced pineal gland secretion.
- Phase advancement of DLMO (Dim Light Melatonin Onset) was observed in 72% of participants (by approx. 35 minutes earlier on average), suggesting faster wind-down cycles before sleep onset.

Cortisol

- Morning cortisol (8 AM) showed better amplitude and restored diurnal slope in 81% of subjects.
- Evening cortisol levels dropped by **18.7%** ($p = 0.004$), indicating reduction in hyperarousal and nighttime stress.

5.2 Shift in Sleep Timing and Duration Actigraphy data (n = 30 per group) revealed:

- **Reduction in sleep onset latency** by 18.3 minutes ($p < 0.01$) in Nabhi group.
- **Increase in total sleep time (TST)** by 42.6 minutes ($p < 0.05$).
- Improvement in **sleep efficiency** from 76.1% to 85.7%.
- REM latency decreased, indicating faster transition into restorative sleep stages.

From hormonal assays, actigraphy data, Sleep logs aligned with digital findings, with 89% participant-reported metrics, and statistical analysis, of Nabhi group participants reporting improved ease with comparative insights between the Nabhi oil of falling asleep and reduced nighttime awakenings. group and control groups.

Impact on Energy Levels and Digestion

Post-intervention wellness assessments showed

Morning energy scores on the General Wellness Index rose from 5.1 to 8.4 (scale of 10).

Participants noted greater **digestive ease**, reduced bloating, and improved morning bowel regularity.

80% reported less heaviness after meals, especially among those with high Vata-Pitta constitution, which aligns with Ayurvedic understanding of Nabhi as the center of digestive "Agni".

5.3 Comparative Analysis with Non-Nabhi Users

In the **oral supplement group (Group B)**

Melatonin rise was only 8.2% and not statistically significant ($p = 0.08$).

Cortisol diurnal slope improved marginally, but without significant evening reduction.

Sleep efficiency improved by 5%, vs. 11% in the Nabhi group.

Digestive improvement reported by 44% compared to 76% in the Nabhi group.

In the **placebo group (Group C)**, no statistically significant changes were observed.

The **effect size** of Nabhi therapy over placebo :

- Melatonin: $d = 0.71$ (medium-high)
- Sleep latency: $d = 0.68$
- Cortisol (evening): $d = 0.74$
- Subjective wellness: $d = 0.79$.

5.4 Subjective Responses and Patterns

From qualitative feedback

92% of Nabhi group participants described the therapy as "relaxing" and "soothing".

Many noted a sense of "emotional grounding" and lower anxiety at night. and better sleep across luteal phases.

Common themes included:

- Greater mindfulness and body awareness around bedtime.
- Improved **sleep hygiene habits** developed due to nightly ritual around Nabhi oil use.

Parameter	Nabhi Group	Oral Supplement	Placebo
↑ Melatonin at Night	+23.4%		+1.1%
↓ Evening Cortisol	-18.7%	-5.3%	No change
↓ Sleep Latency	-18.3 min	-6.1 min	-2.0 min
↑ Sleep Efficiency		+5%	+1.3%
↑ Digestion	76%	44%	17%
Ease (self-reported)			
↑ Morning Energy Scores	+3.3 pts	+1.4 pts	+0.6 pts

6. DISCUSSION

6.1 Interpretation of Results

The data from this study presents compelling Female participants (aged 35–50) particularly evidence supporting the role of Nabhi oil therapy in reported reduced PMS-related mood fluctuations modulating circadian biomarkers and enhancing physiological outcomes. The significant rise in nocturnal melatonin secretion (23.4% in the Nabhi group) and a corresponding decline in evening cortisol levels (18.7%) suggest that targeted stimulation at the navel may contribute to regulating the sleep-wake cycle. Improvements in sleep latency and efficiency further corroborate these hormonal changes.

Notably, participants reported greater subjective improvement in digestion ease and energy levels, which aligns with traditional Ayurvedic claims regarding the Nabhi as a center of vitality and metabolic coordination. In comparison, oral supplementation showed moderate benefit, while the placebo yielded negligible changes indicating the distinct efficacy of Nabhi-based transdermal application.

6.2 Biological Plausibility and Mechanistic Insights

Vagal Nerve Stimulation

The anatomical location of the navel overlays a complex web of parasympathetic nerve endings. Studies such as Badran et al. (2018) have highlighted how transcutaneous vagal nerve stimulation (tVNS) can lead to downstream effects on HPA axis modulation, stress regulation, and sleep improvement. Oils absorbed through the umbilical region may interact with these neural pathways, influencing hormonal feedback loops.

Skin Permeability and Chronopharmacology: Transdermal delivery offers a time-release, targeted mechanism. Lipid-based herbal formulations applied at the navel (rich in sesame, castor, or herbal essential oils) may exploit this skin texts like Charaka Samhita and Sushruta Samhita describe Nabhi Chikitsa (navel therapy) for gastrointestinal disturbances, mood stabilization, and sleep regulation. The circadian interpretation of doshas Kapha (morning), Pitta (afternoon), Vata (evening/night) mirrors Western biological rhythms, further validating the ancient understanding of time-based physiological flux.

8.4 Clinical and Therapeutic Implications

Given the increasing prevalence of circadian disorders, burnout, and digestive issues, especially in urban populations, Nabhi therapy offers a simple, non-invasive intervention. It requires minimal infrastructure, offers high compliance, and holds potential as an adjunct to integrative care for:

- **Insomnia and delayed sleep phase disorder (DSPD)**
- **Irritable Bowel Syndrome (IBS) and functional dyspepsia**
- **Chronic stress and anxiety syndromes**

8.5 Limitations

- Sample size remains relatively small, limiting generalizability.
- Short follow-up duration restricts understanding of long-term benefits.
- Biomarkers were limited to melatonin and cortisol; broader panels (e.g., ghrelin, leptin) may yield deeper insights.
- Lack of blinding due to oil aroma may introduce placebo effect in subjective measures. permeability. Their impact, especially when applied

- **8.6 OBSERVATIONS**
- in sync with the body's biological rhythm (evening or early night), aligns with principles of
- Evening application (between 8:00–10:00 PM) chronopharmacology, a field that advocates for drug timing to enhance efficacy and reduce adverse effects.

6.3 Integration with Ayurvedic Wisdom

Ayurveda has long identified the Nabhi as the "Marma" (vital point) of life and energy. Ancient seemed more effective, consistent with melatonin surge timings.

- Participants with pre-existing sleep disorders showed more pronounced changes.
- Oils with Ashwagandha, Brahmi, and Jatamansi had better impact than simpler carrier oils.

7. Conclusion and Future Directions

7.1 Key Findings and Implications

This research paper explored the potential role of *Nabhi (navel)* stimulation through Ayurvedic oil therapy in regulating core circadian hormones **melatonin** and **cortisol** and its associated impact on **sleep**, **stress**, and **digestion**. The findings demonstrated.

- A **notable increase** in nighttime melatonin levels (23.4%) post Nabhi oil application, indicating enhanced alignment of the body's internal clock.
- A **reduction in evening cortisol** (18.7%), suggesting improved stress adaptation and circadian entrainment of the hypothalamic-pituitary-adrenal (HPA) axis.
- Improvements in **subjective sleep quality**, **reduction in anxiety markers**, and enhanced **digestive comfort** among the intervention group.
- A **biological basis** rooted in *vagal nerve stimulation*, *transdermal absorption*, and *Ayurvedic circadian models* (Dosha cycles).

These findings provide both **scientific validation of traditional Ayurvedic practices** and a compelling rationale for integrating Nabhi therapy into modern wellness protocols for managing circadian-related disorders.

- **Significance in Modern Integrative Healthcare**
- **Requires minimal infrastructure, a significant** advantage in Tier 2/3 regions.
- Aligns well with **integrative and preventive healthcare** models being promoted globally (e.g., AYUSH, WHO Traditional Medicine Strategy).

Moreover, it represents an example of how **ancient wisdom can merge with modern science**, offering new paradigms in psychoneuroendocrinology and chronobiology.

7.2 Limitations of Current Study

While the study presents promising results, it is not without its limitations:

- **Sample Size**: A limited number of participants may affect the generalizability of the data.

- **Duration**: The 4-week intervention period might be insufficient to assess sustained or long-term impacts.
- **Placebo Challenges**: Due to the sensory characteristics (smell, warmth) of herbal oils, achieving complete blinding was challenging.
- **Lack of Polyhormonal Data**: While melatonin and cortisol were tracked, future studies could include ghrelin, leptin, serotonin, and insulin.

These gaps offer valuable insights for refining future clinical models and experimental setups.

7.3 Recommendations for Further Clinical and Mechanistic Research

The increasing burden of **chronic stress**, **sleep** To establish Nabhi therapy as a validated tool in **disturbances**, and **digestive dysregulation** fueled chronobiology and integrative medicine, the by disrupted circadian rhythms in modern life styles following steps are suggested: demands solutions that are non-invasive,

1. Larger, multi-centric randomized controlled
cost-effective, and easy to adopt. Nabhi oil therapy meets these criteria

- Can be **self-administered**, increasing compliance and accessibility.

trials (RCTs) with long-term follow-ups across demographics and geographies.

2. **Biomarker Expansion**: Inclusion of full hormonal panels (ghrelin, leptin, serotonin), inflammatory markers (CRP, IL-6), and microbiome data to understand gut-brain interactions.

3. **Time-of-Day Applications**: Chronotherapeutic studies examining optimal timings for application based on individual Dosha or chronotype.

4. **Neuroimaging Studies**: fMRI or EEG to study neural activation patterns following Nabhi stimulation.

5. **Comparative Trials**: Direct comparisons with melatonin supplements, anxiolytics, or sedatives to measure relative efficacy and safety.

6. **Tech-Enabled Monitoring**: Use of wearable actigraphy, HRV trackers, and AI-driven sleep analysis tools to enrich outcome data.

Nabhi therapy stands at the intersection of **traditional healing and modern circadian science**. This paper advances the hypothesis that stimulation of the Nabhi using targeted herbal oils can influence the body's internal timing system via neuroendocrine pathways. By bridging **Ayurvedic marma theory**, **vagal nerve modulation**, and **Chrono Pharmacological principles**, Nabhi therapy offers a promising direction for non-invasive, integrative interventions in a time when modern health challenges are increasingly driven by rhythm disruption.

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