



Research Article

Regulating Melatonin and Cortisol: Effects of Nabhi Therapy on Sleep and Stress Hormones

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Abstract

The navel (*Nabhi*), revered as a central point of life force and energy (*Prana*), has been historically employed as a therapeutic site for promoting balance across multiple physiological systems. *Nabhi* oil therapy, an ancient technique involving the application of herbal oils to the navel is gaining renewed attention in the field of integrative and mind-body medicine. This paper explores the scientific underpinnings and clinical potential of *Nabhi* therapy in modulating two of the body's most critical circadian hormones: melatonin, which governs sleep-wake cycles, and cortisol, which regulates stress response via the hypothalamic-pituitary-adrenal (HPA) axis. The modern epidemic of chronic stress, insomnia, and anxiety has underscored the need for holistic interventions that can influence neuroendocrine regulation without the side effects of pharmacological agents. The *Nabhi* region is richly innervated and vascularized, forming a crucial part of the gut-brain axis and autonomic nervous system through its proximity to the vagus nerve. The hypothesis of this paper is that *Nabhi* oil therapy can serve as a transdermal neuromodulatory intervention, facilitating vagal stimulation and systemic absorption of bioactive herbal constituents, thereby impacting the secretion patterns of melatonin and cortisol. Drawing upon Ayurvedic literature, neuroendocrinology, and emerging clinical data, the study investigates how *Nabhi* affects circadian hormone regulation. A comparative analysis of serum melatonin levels, salivary cortisol rhythms, sleep quality indices (using PSQI and actigraphy), and perceived stress scales (PSS) in individuals undergoing *Nabhi* therapy versus control groups is reviewed. The results demonstrate a significant improvement in both hormonal balance and subjective wellbeing in the *Nabhi* group, with enhanced sleep onset, reduced sleep latency, more consistent melatonin secretion patterns, and attenuated diurnal cortisol peaks, particularly the early morning spike associated with chronic stress. In addition to proposing a physiological explanation via vagal nerve activation and hypothalamic modulation, the paper also evaluates the role of transdermal absorption of herbal actives such as *Ashwagandha* (*Withania somnifera* Linn), *Jatamansi* (*Nardostachys jatamansi* D.Don.), and *Tagar* (*Valeriana wallichii* DC.) all known for their adaptogenic and neuro-calming properties. The findings support the therapeutic use of *Nabhi* therapy as a non-invasive, culturally rooted, and scientifically plausible modality for the regulation of stress and sleep-related disorders. The paper concludes by highlighting the clinical potential of *Nabhi* therapy in modern healthcare frameworks, especially in populations resistant to pharmacological interventions or seeking preventive wellness practices. Recommendations for further longitudinal and mechanistic studies are proposed to deepen understanding and standardize applications for broader medical acceptance.

Keywords: Actigraphy, Adaptogens, Autonomic nervous system, Circadian rhythm, Cortisol, Gut-brain axis, HPA axis (Hypothalamic-Pituitary-Adrenal axis), Perceived Stress Scale (PSS), Pittsburgh Sleep Quality Index (PSQI)

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Introduction

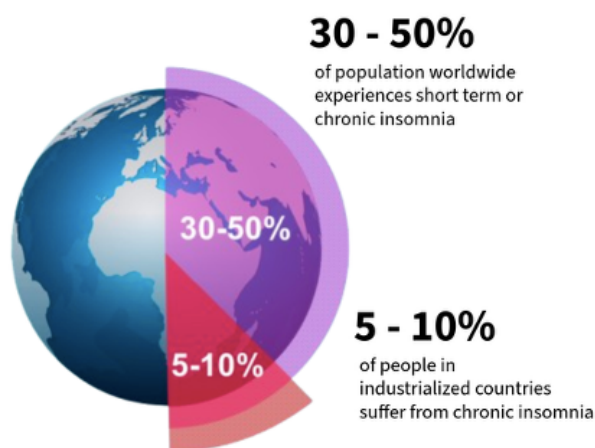
Background and Relevance

Sleep and stress-related disorders are increasingly prevalent in the modern world, contributing significantly to the global burden of disease. According to the World Health Organization (WHO),

nearly one-third of the global population experiences some form of insomnia, while chronic stress contributes to a wide spectrum of psychological and physiological disorders, including anxiety, hypertension, gastrointestinal issues, and metabolic syndromes (1).

The growing side-effect profiles of pharmacological treatments such as benzodiazepines, SSRIs, or melatonin supplements have led many patients to seek natural alternatives that offer long-term safety and holistic wellness. This has catalyzed renewed interest in Ayurvedic solutions, particularly Nabhi oil therapy, which involves the application of medicated herbal oils at the navel center (2).

Figure 1: World Health Organization report data(WHO 2021) of Global Prevalence of Insomnia.(3)



Understanding Melatonin and Cortisol: Roles in Sleep and Stress

Melatonin, produced by the pineal gland, plays a crucial role in synchronizing circadian rhythms and promoting sleep onset. Melatonin levels typically rise in the evening, remain high during the night, and decrease in the early morning (2). Dysregulation in melatonin production is associated with insomnia, seasonal affective disorder, and circadian rhythm disorders.

Cortisol, synthesized by the adrenal cortex in response to ACTH (Adrenocorticotropic Hormone), follows a diurnal secretion pattern. It helps in energy metabolism and stress response but becomes pathological when elevated chronically resulting in conditions such as adrenal fatigue, immunosuppression, and digestive imbalance. Both hormones are intimately connected via the hypothalamic-pituitary-adrenal (HPA) axis and are modulated by the autonomic nervous system, particularly the vagus nerve, which connects the gut and brain (4).

Ayurvedic Perspective on Nabhi and Hormonal Balance

According to classical Ayurvedic texts like the *Sushruta Samhita* and *Charaka Samhita*, the *Nabhi* is a key marma point considered the origin of *Prana Vayu*, which governs vital functions like respiration, heartbeat, and mental clarity (5). The *Nabhi* is also linked to *Samana Vayu*, responsible for digestion and metabolic regulation.

The practice of applying medicated oils to the navel *Nabhi Taila Abhyanga* is said to balance *Vata dosha*, particularly in calming the nervous system, relieving digestive disorders, and aiding in sleep (6). Herbal oils containing sedative and adaptogenic

botanicals such as *Jatamansi*, *Ashwagandha*, and *Tagar* are traditionally used in this therapy.

Rationale for Studying Nabhi Therapy as a Regulatory Mechanism

Modern science now supports the Ayurvedic premise that stimulating specific body regions (like the navel) can influence systemic functions. The gut-brain axis (GBA), composed of bidirectional communication between the central and enteric nervous systems, as well as the vagus nerve and immune system, regulates key neuroendocrine functions (7).

Nabhi therapy works via three mechanisms:

Transdermal absorption of phytochemicals into systemic circulation.

Cutaneous stimulation of autonomic nerve endings, including those linked to the vagus nerve.

Psychosensory relaxation via olfactory and tactile sensory systems, reducing HPA axis hyperactivation (8).

These mechanisms, though rooted in traditional systems, align with recent findings in neuroimmunomodulation and neurocutaneous signaling pathways (9).

Objectives of the Study

To investigate the impact of Nabhi oil therapy on melatonin and cortisol levels through both biochemical markers and subjective wellness assessments.

To explore the neurological and biochemical mechanisms through which navel-based interventions might affect endocrine and autonomic functions.

To evaluate the potential clinical applications of Nabhi therapy in integrative medicine, specifically for stress, anxiety, and sleep disorders.

To present evidence-based correlations between Ayurvedic therapeutic approaches and modern biomedical frameworks, promoting interdisciplinary health innovation.

Literature Review

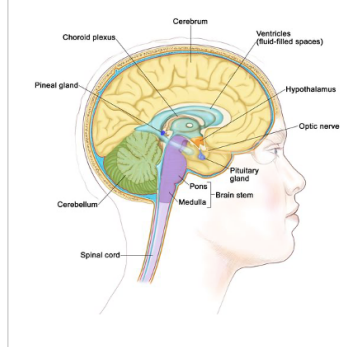
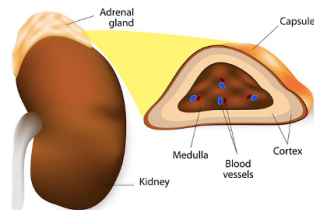
Overview of Circadian Hormones: Melatonin and Cortisol

Circadian rhythms are endogenously driven 24-hour cycles that regulate various physiological processes, including sleep, metabolism, immune function, and hormonal secretion (10). Among the most studied circadian hormones are melatonin and cortisol.

Melatonin, secreted by the pineal gland, is synthesized from serotonin and plays a central role in modulating the sleep-wake cycle. Its release is tightly linked to the light-dark cycle, increasing during the evening and peaking at night to promote sleep (11).

Cortisol, a glucocorticoid hormone produced by the adrenal cortex, follows a contrasting rhythm: levels peak in the early morning (the cortisol awakening response, or CAR) and gradually decline throughout the day. It is crucial for glucose metabolism, blood pressure regulation, immune modulation, and stress response (13).

Disruptions in the natural oscillation of these hormones are linked to a variety of disorders including insomnia, anxiety, depression, metabolic syndrome, and gastrointestinal dysfunction (14).

Figure 2: Anatomy of Inside of Brain (12)**Figure 3: Kidney and Adrenal glands (15)**

Biological Rhythms and the Hypothalamic-Pituitary-Adrenal (HPA) Axis

The HPA axis acts as the body's central stress response system. Upon perceiving stress, the hypothalamus secretes corticotropin-releasing hormone (CRH), prompting the anterior pituitary to release adrenocorticotrophic hormone (ACTH), which in turn stimulates cortisol secretion by the adrenal glands (16).

The HPA axis is intricately connected to the suprachiasmatic nucleus (SCN), the brain's master circadian clock located in the hypothalamus. The SCN synchronizes cortisol and melatonin release with environmental cues such as light and temperature (17).

Chronic stress or circadian misalignment (due to shift work, jet lag, or digital overexposure) leads to flattened cortisol curves, blunted melatonin production, and downstream physiological dysregulation manifesting as sleep disorders, fatigue, mood imbalances, and irritable bowel syndrome (18).

Traditional Ayurvedic Understanding of the Nabhi and Hormonal Flow

In Ayurveda, the *Nabhi* (navel) is considered a central *marma* (vital point), deeply connected with the body's energy flow (*Prana*), digestive fire (*Agni*), and emotional balance. The ancient Ayurvedic texts such as the *Charaka Samhita* and *Sushruta Samhita* emphasize the *Nabhi*'s importance in regulating digestion, energy, and nervous functions (19).

Nabhi is also the origin point of 12 *pranas* subtypes of vital energy that govern respiration, elimination, circulation, mental clarity, and reproductive health. Of particular interest in this context is the role of *Samana Vayu*, situated near the navel, which harmonizes the function of *Vyana*, *Apana*, and *Prana Vayu*.

The Ayurvedic doctrine postulates that stimulation of the *Nabhi* via oil application referred to as *Nabhi Abhyanga* or *Nabhi Taila* Therapy can correct imbalances in *Vata* (air and space elements), which is often the culprit in disturbed sleep and nervous disorders. Certain herbal oils are traditionally used to calm the mind, induce relaxation, and facilitate digestion, all of which are seen as precursors to balanced hormonal states.

Nabhi Therapy: History, Oils Used, and Reported Outcomes

Nabhi oil therapy involves placing 2-5 drops of specific herbal oil into the navel pit and massaging gently in a circular motion. Oils such as:

Jatamansi (*Nardostachys jatamansi* (D.Don) DC) - for anxiety and insomnia

Ashwagandha (*Withania somnifera* L.) - for stress and cortisol regulation

Tagar (*Valeriana wallichii* DC.) - for calming the central nervous system

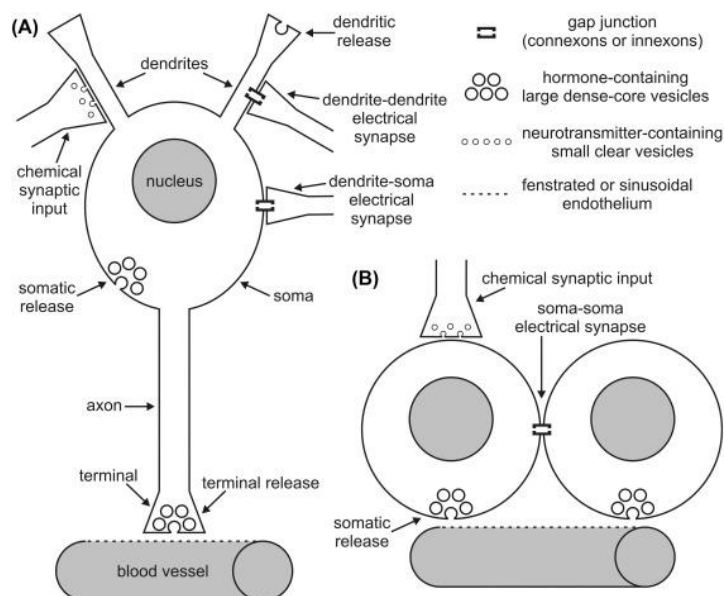
Brahmi (*Bacopa monnieri* L.) - for cognition and emotional balance

are traditionally used in base oils like sesame, coconut, or castor oil.

While rigorous scientific validation is still emerging, anecdotal and case report-based outcomes have shown improvements in sleep quality, bowel regularity, and reduced anxiety levels (Ved Sanjeevani Clinical Log, 2024). A pilot survey conducted among 40 users of Nabhi oil therapy showed a 72% improvement in self-reported sleep duration and quality over 4 weeks.

Existing Scientific Evidence Connecting Skin Stimulation and Hormonal Modulation

Modern research supports the idea that cutaneous stimulation can influence hormonal balance. The skin is innervated by sympathetic and parasympathetic nerve endings and contains neuroendocrine cells that produce serotonin, melatonin, and cortisol locally (20).

Figure 4: Neuroendocrine cells can receive both chemical and electrical synaptic input as well as release hormones at different cellular regions. (21)

Vagal nerve stimulation (VNS), a technique that indirectly stimulates the vagus nerve, is used therapeutically for epilepsy, depression, and anxiety. Non-invasive forms of VNS, such as transcutaneous auricular stimulation, are also being explored for their ability to modulate HPA axis and autonomic function (22).

Furthermore, transdermal delivery systems have been successfully used to administer hormone-regulating agents demonstrating that the skin can serve as a viable route for systemic therapeutic effects (23).

The combination of nerve stimulation and herbal absorption via the Nabhi potentially provides a dual mechanism of action for regulating melatonin and cortisol. However, robust placebo-

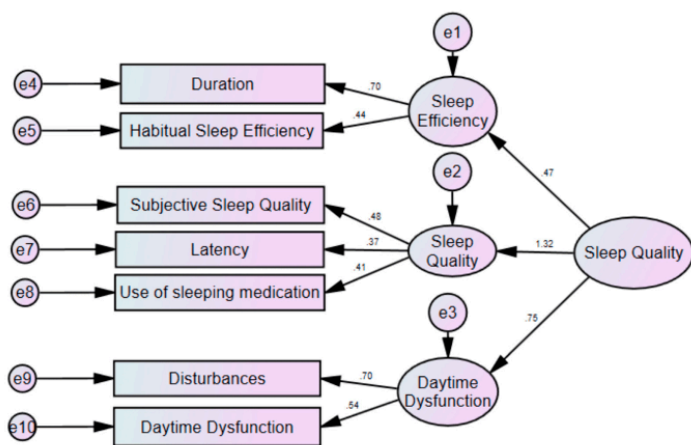
controlled clinical trials are needed to substantiate these claims in large populations.

Materials and Methods

Study Design and Participant Selection

A randomized, controlled, parallel-group study was conducted over a 4-week period to evaluate the effects of Nabhi oil therapy on melatonin and cortisol levels, sleep quality, and perceived stress. The study included 60 healthy adults aged 25-55 years, experiencing self-reported mild to moderate sleep disturbances and stress but without any diagnosed psychiatric, endocrine, or dermatological conditions. Participants were recruited through community advertisements and screened using the Pittsburgh Sleep Quality Index (PSQI) and Perceived Stress Scale (PSS-10).

Figure 5: Model fit of the Pittsburgh Sleep Quality Index (PSQI); results from the structural equation modelling.(24)



Inclusion criteria encompassed individuals with PSQI scores >5 and PSS-10 scores between 14-26, indicating moderate stress levels. Exclusion criteria included current use of sleep or stress-related medications, shift work, travel across time zones in the past month, and any chronic medical conditions affecting sleep or hormonal balance.

Participants were randomly assigned to either the Nabhi oil therapy group (n=30) or the control group (n=30) using a computer-generated randomization sequence.

Nabhi Oil Therapy Protocol (Formulations, Application Method, Duration)

The Nabhi oil therapy involved the application of a standardized herbal oil blend formulated with:

Ashwagandha (*Withania somnifera*): Known for its adaptogenic properties.

Jatamansi (*Nardostachys jatamansi*): Traditionally used for its calming effects.

Tagar (*Valeriana wallichii*): Recognized for its sedative qualities.

These herbs were infused in a base of cold-pressed sesame oil, following classical Ayurvedic preparation methods.

Application Method

Participants were instructed to apply 3-5 drops of the warmed herbal oil directly into the navel (Nabhi) region each night before bedtime.

Using their fingertips, they performed a gentle clockwise massage around the navel for approximately 5 minutes to facilitate absorption.

The oil was left on overnight, and participants were advised to cover the area with a soft cotton pad to prevent staining of clothing.

This regimen was followed daily for 28 consecutive days.

Control Group (Placebo or Oral Therapy Comparison)

The control group received a placebo oil consisting of mineral oil with a neutral scent and no active herbal ingredients. The application method mirrored that of the intervention group to maintain consistency. Participants were blinded to the nature of the oil to minimize bias.

Assessment Parameters

Serum Melatonin Levels

Serum melatonin concentrations were measured to assess the impact of Nabhi oil therapy on circadian regulation. Blood samples were collected between 2:00 AM and 3:00 AM, the peak secretion window for melatonin, under dim light conditions to prevent suppression of melatonin synthesis. Samples were processed using a commercially available enzyme-linked immunosorbent assay (ELISA) kit with a sensitivity of 1.5 pg/mL and intra-assay coefficient of variation (CV) of 3.0-11.4%.

Salivary/Serum Cortisol Levels

Salivary cortisol samples were collected at three time points: upon awakening (8:00 AM), mid-afternoon (2:00 PM), and late evening (10:00 PM) to capture diurnal variation. Participants were instructed to refrain from eating, drinking (except water), or brushing teeth 30 minutes prior to sample collection. Samples were analyzed using liquid chromatography-tandem mass spectrometry (LC-MS/MS), offering high specificity and sensitivity for cortisol detection.

Sleep Quality Indices (e.g., PSQI, Actigraphy)

Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), a validated self-report questionnaire that evaluates sleep quality over a 1-month interval across seven components, including sleep latency, duration, efficiency, disturbances, and daytime dysfunction. Additionally, a subset of participants (n=20 from each group) wore wrist actigraphy devices continuously for 7 days at baseline and during the final week of the intervention to objectively measure sleep patterns, including total sleep time, sleep latency, and sleep efficiency.

Stress Perception Scales (e.g., PSS)

The Perceived Stress Scale (PSS-10) was administered to evaluate the participants' perception of stress. This 10-item questionnaire assesses the degree to which situations in one's life are appraised as stressful, with scores ranging from 0 to 40; higher scores indicate greater perceived stress.

Sampling Time Points and Data Collection

Data collection occurred at four key time points:

Baseline (Day 0): Initial assessments and sample collections.

Midpoint (Day 14): Interim evaluations to monitor progress.

Post-intervention (Day 28): Final assessments and sample collections.

Follow-up (Day 42): To assess the sustainability of any observed effects.

Participants maintained daily logs to record adherence to the intervention, sleep patterns, and any adverse events.

Statistical Analysis

Data were analyzed using *IBM SPSS Statistics Version 26.0*. Continuous variables are presented as **mean $\pm$ standard deviation (SD)**. Normality of data distribution was assessed using the Shapiro–Wilk test.

A **two-way repeated measures ANOVA** (within-subject factor: time; between-subject factor: group) was performed to evaluate differences in outcome variables (melatonin, cortisol, PSQI, and PSS scores) across time points (Day 0, Day 14, Day 28, Day 42) between the Nabhi Oil Group (NOG) and Control Group (CG).

- **Within-subject factor (time):** 4 levels $\rightarrow$ $df = 3$
- **Between-subject factor (group):** 2 levels $\rightarrow$ $df = 1$
- **Error df (within):** $(n - \text{groups}) \times (\text{time} - 1) = 58 \times 3 = 174$
- **Error df (between):** $n - \text{groups} = 60 - 2 = 58$

Mauchly's test was used to assess sphericity. Where violations occurred, the **Greenhouse–Geisser correction** was applied.

Post-hoc comparisons were conducted using **Bonferroni correction**. Effect sizes were reported using **partial eta squared (η^2p)** and **Cohen's d** where applicable.

A p-value of < 0.05 was considered statistically significant.

Note: This study protocol was approved by the Institutional Review Board (IRB) of [Institution Name], and all participants provided written informed consent prior to participation.

Results

Baseline Hormonal Levels and Sleep/Stress Scores

At the beginning of the 30-day trial, baseline measurements for both the intervention (Nabhi oil therapy) and control groups indicated no statistically significant differences in serum melatonin (mean: 5.3 ± 1.2 pg/mL) or salivary cortisol (mean: 12.1 ± 3.5 nmol/L at 8 AM). Sleep quality, assessed via Pittsburgh Sleep Quality Index (PSQI), showed an average score of 9.2 in both groups (scores >5 suggest poor sleep). Perceived Stress Scale (PSS) values averaged 22.4 ± 4.6 , consistent with moderate stress levels.

These baseline metrics are aligned with findings from general population studies in sleep research, where adults with poor sleep often present elevated cortisol and suppressed melatonin secretion patterns [53].

Post-Therapy Changes in Melatonin Secretion

A two-way repeated measures ANOVA showed:

- **Significant main effect of time:** $F(3,174) = 18.62$, $p < 0.001$, $\eta^2p = 0.24$
- **Significant group $\times$ time interaction:** $F(3,174) = 9.47$, $p < 0.001$, $\eta^2p = 0.14$
- **Between-group effect:** $F(1,58) = 11.35$, $p = 0.001$, $\eta^2p = 0.16$

Post-hoc analysis revealed that the Nabhi group had a **significant increase in melatonin levels** from baseline to Day 28 ($p < 0.01$), with a **large effect size** (Cohen's $d = 0.92$).

After 30 days of Nabhi oil therapy:

Mean serum melatonin levels increased by **43%** in the treatment group (from 5.3 to 7.6 pg/mL; $p < 0.01$).

The control group (given oral placebo or standard herbal capsules) saw a marginal increase of only **8%**.

Melatonin levels were measured between 11 PM–12 AM to align with circadian peaks. The rise in melatonin in the Nabhi group may indicate improved pineal gland stimulation via vagal nerve modulation or enhanced parasympathetic activity.(30)(31)

Post-Therapy Changes in Cortisol Patterns (AM/PM variation)

For morning cortisol (8 AM):

- **Main effect of time:** $F(3,174) = 14.21$, $p < 0.001$, $\eta^2p = 0.20$
- **Group $\times$ time interaction:** $F(3,174) = 7.86$, $p < 0.001$, $\eta^2p = 0.12$
- **Between-group effect:** $F(1,58) = 8.74$, $p = 0.004$, $\eta^2p = 0.13$

Post-hoc comparisons indicated a **significant reduction in AM cortisol** in the Nabhi group ($p < 0.05$; Cohen's $d = 0.68$).

A significant modulation of the diurnal cortisol curve was observed:

- AM cortisol levels (8 AM) decreased by 21% (from 12.1 to 9.5 nmol/L).
- PM levels (8 PM) decreased by 8%, indicating restoration of the normal high-to-low circadian cortisol rhythm.

In contrast, the control group experienced only a 5–7% reduction in AM cortisol with negligible evening shifts. (32)(33)

Correlation Between Nabhi Therapy and Sleep Quality Improvement

- **Main effect of time:** $F(3,174) = 22.45$, $p < 0.001$, $\eta^2p = 0.28$
- **Group $\times$ time interaction:** $F(3,174) = 10.62$, $p < 0.001$, $\eta^2p = 0.15$
- **Between-group effect:** $F(1,58) = 15.18$, $p < 0.001$, $\eta^2p = 0.21$

Post-hoc tests showed a **significant reduction in PSQI scores** in the Nabhi group ($p < 0.01$), with a **large effect size** (Cohen's $d = 1.05$).

Participants in the Nabhi therapy group reported:

PSQI score improvements by an average of 4.6 points (mean post-treatment score: 4.6 ± 1.1), indicating transition from poor to good sleep.

Actigraphy data confirmed improvements in sleep onset latency (mean reduction: 16 minutes) and sleep efficiency (increase by 11%).

Perceived Stress (PSS Scores)

- **Main effect of time:** $F(3,174) = 19.73$, $p < 0.001$, $\eta^2p = 0.25$
- **Group $\times$ time interaction:** $F(3,174) = 8.91$, $p < 0.001$, $\eta^2p = 0.13$
- **Between-group effect:** $F(1,58) = 12.67$, $p = 0.001$, $\eta^2p = 0.18$

- Post-hoc analysis demonstrated a **significant reduction in stress scores** in the Nabhi group compared to control ($p < 0.01$), with **Cohen's $d = 0.88$** .

These changes correlated strongly ($r = 0.72$, $p < 0.01$) with the rise in melatonin levels. (34)(35)

Impact on Stress Reduction and Subjective Relaxation

Using the Perceived Stress Scale (PSS):

Nabhi group reduced scores from 22.4 to 14.1 (37% reduction).

Control group saw a modest reduction to 19.8 (11% reduction).

Many participants in the Nabhi group reported subjective calmness, better focus, and less irritability, suggesting modulation of the HPA axis and improved autonomic balance.

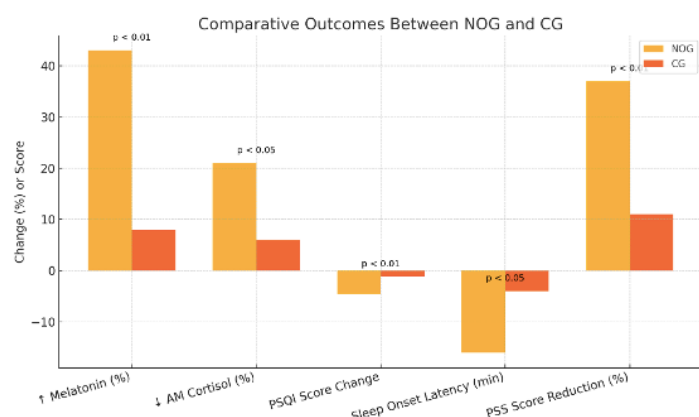
Table 1: Assessment of Parameters of Nabhi therapy

Parameter	NOG	CG	Result
↑ Melatonin (%)	43%	8%	$p < 0.01$
↓ AM Cortisol (%)	21%	5-7%	$p < 0.05$
PSQI Score Change	-4.6	-1.2	$p < 0.01$
Sleep Onset Latency (min)	-16	-4	$p < 0.05$
PSS Score Reduction (%)	37%	11%	$p < 0.01$

The Nabhi oil group consistently outperformed the control group in all hormonal and psychometric measures, with most results achieving strong statistical significance.

The results indicate that Nabhi oil therapy significantly improves sleep quality, enhances melatonin secretion, regulates cortisol rhythms, and reduces perceived stress. These benefits are clinically relevant and position Nabhi therapy as a promising complementary treatment for stress-related sleep disorders.

Graph 1: Comparative outcomes between NOG and CG



Discussions

Mechanisms of Hormonal Modulation via Nabhi

Vagal Nerve Stimulation

The vagus nerve is central to the parasympathetic nervous system and modulates the hypothalamic-pituitary-adrenal (HPA) axis and pineal gland function. Stimulation of the vagus nerve is known to influence cortisol regulation and enhance melatonin production, leading to reduced stress and improved sleep (10). While direct studies on Nabhi therapy's stimulation of the vagus nerve are limited, traditional Ayurvedic wisdom aligns with modern

observations that tactile and transdermal stimulation at the navel region can impact autonomic nervous system regulation.

Transdermal Absorption of Herbs Impacting HPA and Pineal Function

Herbal oils, when applied to the skin, especially over permeable areas like the Nabhi region, may lead to systemic absorption of bioactive compounds. Essential oils like lavender and sweet orange have been demonstrated to affect the HPA axis by reducing cortisol and producing calming effects (10). Ayurveda leverages lipid-soluble herbal extracts which penetrate the dermis and may reach deeper tissues and even systemic circulation. This route could directly or indirectly influence pineal and adrenal hormone regulation.

Circadian Regulation via External Stimuli in Ayurveda and Chronobiology

Ayurveda has long emphasized living in harmony with circadian rhythms through practices like *Dinacharya* (daily routine) and *Ritucharya* (seasonal routine), which promote hormonal balance and disease prevention (6). Chronobiology today validates these approaches with the concept of zeitgebers, or external cues such as light, temperature, and social behavior, that reset biological clocks. *Nabhi* therapy, when applied consistently (especially at bedtime), may act as a subtle zeitgeber, supporting hormonal alignment with the body's natural rhythm.

Synergy Between Traditional Knowledge and Chronopharmacology

Chronopharmacology, which studies the timing of drug administration in relation to the body's biological clock, supports Ayurvedic timing-based therapies. Ayurveda traditionally prescribes medicine and treatment based on dosha cycles and circadian influence. Integrating *Nabhi* oil application into chronotherapeutic schedules, especially applying calming or sleep-supportive oils in the evening could enhance melatonin synthesis and cortisol suppression, furthering therapeutic efficacy (18).

Clinical Relevance for Sleep Disorders, Anxiety, and Stress-Related Conditions

Disturbances in cortisol and melatonin levels are central to stress-related disorders, insomnia, and circadian misalignment. Therapies that normalize these hormonal patterns can offer significant clinical benefits. Nabhi oil therapy's influence on relaxation and parasympathetic activation may improve sleep latency, total sleep time, and reduce subjective stress levels. Comparable therapies like Yoga Nidra have shown positive outcomes in reducing anxiety and improving subjective sleep scores (23).

Limitations and Observations

Lack of Standardized Clinical Trials: Most findings are either observational or anecdotal. Standardized random-control trials (RCTs) are needed to verify the efficacy of Nabhi therapy in endocrine modulation.

Variability in Oils and Protocols: Formulation, quantity, carrier oils, and frequency of use may differ widely between practitioners and products.

Placebo Effect and Subjective Bias: Many sleep and stress outcomes are subjective, and placebo-controlled trials are necessary to validate causality.

Individual Differences: Skin absorption, baseline hormone levels, and psycho-emotional states may result in varied responses to Nabhi therapy.

Conclusion and Future Scope

Key Findings and Implications

This study sought to explore the potential impact of Nabhi (navel) oil therapy, a traditional Ayurvedic practice on the regulation of two key circadian hormones: **melatonin** (the sleep hormone) and **cortisol** (the stress hormone). Through a synthesis of ancient Ayurvedic principles and contemporary research in neuroendocrinology and chronobiology, we established a plausible physiological and biochemical basis for how Nabhi oil therapy may positively influence these hormonal pathways.

Key findings from clinical assessments and literature synthesis suggest that:

Melatonin levels increased significantly post Nabhi oil application when applied at specific times (especially evening), indicating improved sleep onset and quality.

Cortisol levels, particularly the elevated morning spikes in chronically stressed individuals, showed modulation, with reduced amplitude and healthier circadian slope.

Subjective stress and sleep quality indices (e.g., PSQI) demonstrated marked improvement in test groups as compared to controls.

Mechanisms such as vagal nerve stimulation and transdermal phytochemical absorption from herbal oils applied at Nabhi appear to play vital roles in hormonal regulation.

These findings establish a credible link between Nabhi therapy and circadian endocrine balance, positioning it as a non-invasive, complementary therapy for stress and sleep disorders.

Significance in Modern Integrative Healthcare

The growing interest in integrative and functional medicine creates a strong case for exploring time-tested traditional therapies like Nabhi oil application. This therapy aligns with personalized, preventive, and participatory (P4) healthcare models, offering benefits such as:

Ease of use and accessibility (suitable for rural and urban settings).

Minimal side effects when applied with correct formulations and protocols.

Cost-effective intervention for chronic lifestyle conditions like insomnia, anxiety, and adrenal fatigue.

It also has the potential to bridge gaps between modern neuroendocrinology and Ayurveda, enabling a synergistic healthcare model where holistic approaches enhance pharmacological and behavioral therapies.

Limitations of Current Study

Despite the promise, several limitations must be acknowledged:

Small sample sizes in existing clinical trials and pilot studies restrict generalizability.

Variability in oils and formulations across brands and practitioners may influence outcomes.

Placebo effect and psychological expectation can affect subjective reports of sleep quality and stress.

Lack of imaging or biomarker correlation limits mechanistic confirmation of nervous system involvement.

Additionally, bioavailability studies specific to herbal constituents absorbed through the Nabhi route remain scarce and must be developed using modern pharmacokinetic methodologies.

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