Journal of Swasthavritta and Yoga

ISSN Print: 3078-7157
ISSN Online: 3078-7165
JSY 2025; 2(2): 26-30
www.swasthjournal.com
Received: 10-08-2025
Accepted: 12-09-2025

Arun Reddy
Department of Ayurveda and Integrative Medicine, Delhi College of Health Sciences, Delhi, India

Anjali Sharma
Department of Ayurveda and Integrative Medicine, Delhi College of Health Sciences, Delhi, India

Corresponding Author:
Arun Reddy
Department of Ayurveda and Integrative Medicine, Delhi College of Health Sciences, Delhi, India

The Role of Diet and Lifestyle in Managing Stress-Induced Disorders: A Comparative Clinical Study Based on Ayurvedic Principles

Arun Reddy and Anjali Sharma

DOI: https://www.doi.org/10.33545/30787157.2025.v2.i2.A.21

Abstract
Background: Chronic psychosocial stress disrupts neuroendocrine and metabolic homeostasis, giving rise to anxiety, insomnia, and inflammatory disorders. Ayurveda attributes these disturbances to vāta-pitta vitiation, ojas depletion, and disordered agni.
Objective: To compare the effectiveness of an Ayurvedic diet-and-lifestyle intervention versus conventional lifestyle advice in reducing stress, anxiety, sleep disturbances, and inflammation among adults with stress-induced disorders.
Methods: A randomized, controlled, parallel-group trial was conducted over eight weeks with 120 participants (Ayurveda = 60; Control = 60). The intervention group received a doṣa-specific diet plan, daily āsana-prāṇāyāma-dhyāna, and *Withania somnifera* (300 mg twice daily). The control group received standard counselling on healthy living. Outcomes—Perceived Stress Scale (PSS-10), Generalized Anxiety Disorder (GAD-7), Insomnia Severity Index (ISI), heart-rate variability (HRV), and high-sensitivity C-reactive protein (hs-CRP)—were measured at baseline and week 8.
Results: At week 8, the Ayurvedic group showed a greater mean reduction in PSS-10 (−8.3 ± 5.1) compared with control (−3.1 ± 3.6; $p < 0.001$). Anxiety and insomnia decreased significantly (ΔGAD-7 = −5.0 ± 3.9 vs −1.9 ± 3.4; ΔISI = −7.6 ± 5.2 vs −2.7 ± 4.5; $p < 0.001$). HRV (RMSSD) increased (+11.8 ± 10.7 ms vs +2.4 ± 8.2 ms; $p < 0.001$), and hs-CRP decreased (−0.68 ± 0.84 mg/L vs −0.18 ± 0.63 mg/L; $p = 0.002$). No serious adverse events occurred.
Conclusion: The Ayurvedic regimen significantly outperformed standard advice in lowering perceived stress and anxiety, improving sleep and autonomic balance, and reducing inflammation. This demonstrates Ayurveda's relevance for modern stress-management strategies.

Keywords: Ayurveda, *Withania somnifera*, Stress, *Prāṇāyāma*, HRV, Inflammation, Lifestyle Intervention

1. Introduction

Stress is a physiological and psychological response to various external or internal stimuli that threaten an individual's well-being. It is considered one of the most pervasive health challenges in the modern world, affecting individuals across all demographics and socioeconomic backgrounds. Chronic stress, particularly when prolonged and unmanaged, can contribute to a wide range of health issues, including mental health disorders such as anxiety and depression, as well as physical ailments like cardiovascular diseases, metabolic dysfunctions, and sleep disturbances. The impact of stress on mental and physical health is profound and far-reaching, making it a critical area for research and intervention. Stress-induced disorders are now recognized as major contributors to the global burden of disease, leading to substantial healthcare costs and decreased quality of life.

In modern biomedical research, stress is often associated with the activation of the hypothalamic-pituitary-adrenal (HPA) axis and the release of cortisol, a hormone that plays a central role in the body's stress response. While cortisol is necessary for managing short-term stressors, chronic activation of the HPA axis leads to dysregulation of immune function, increased inflammation, and an elevated risk for both mental and physical health conditions. Additionally, stress-related disorders such as anxiety, depression, insomnia, and inflammatory diseases are linked to imbalances in the autonomic nervous system (ANS), resulting in sympathetic dominance and reduced parasympathetic activity. This imbalance further exacerbates stress, creating a vicious cycle that perpetuates the individual's condition.

Ayurveda, an ancient system of medicine originating in India, offers a holistic approach to managing stress and stress-induced disorders by addressing not only the physical symptoms but also the psychological and spiritual aspects of health. Ayurveda is rooted in the concept of balance, emphasizing the importance of maintaining harmony between the body, mind, and spirit. In Ayurvedic philosophy, health is defined as a state of equilibrium between the three fundamental energies or doshas—Vata, Pitta, and Kapha—which govern all physiological and psychological processes. When these doshas are out of balance due to factors such as stress, improper diet, or unhealthy lifestyle habits, it is believed that disease and disorder arise. Ayurveda proposes that stress-induced disorders are primarily caused by the aggravation of the Vata and Pitta doshas, depletion of Ojas (the vital essence), and accumulation of Ama (metabolic waste). Addressing these imbalances through diet, lifestyle modifications, and herbal remedies is central to Ayurvedic treatment.

In Ayurveda, the management of stress involves a multi-faceted approach that includes diet (Āhāra), lifestyle (Vihāra), and mental practices (Ātma Cikitsā). The Ayurvedic diet is personalized based on an individual's dosha constitution and emphasizes foods that promote balance and nourishment. Specific food recommendations, such as warm, easy-to-digest meals, circadian eating patterns, and the avoidance of stimulants like caffeine and refined sugar, are commonly prescribed to reduce stress and support overall well-being. Lifestyle modifications, including practices like yoga, meditation, and breathing exercises (prāṇāyāma), are incorporated to restore harmony within the body and mind, enhancing the individual's ability to manage stress. Furthermore, Ayurvedic herbs such as *Withania somnifera* (ashwagandha), a well-known adaptogen, are often used to support the body's resilience to stress by modulating the HPA axis and reducing inflammation.

Research into the efficacy of Ayurvedic interventions for stress management has been growing over the past few decades, with numerous studies showing promising results. For instance, studies have demonstrated that *Withania somnifera* exhibits anxiolytic, adaptogenic, and anti-inflammatory effects, making it a potent herb for managing stress and related disorders. Similarly, the practice of yoga and prāṇāyāma has been shown to reduce cortisol levels, improve sleep quality, enhance HRV, and alleviate symptoms of anxiety and depression. Furthermore, the Ayurvedic emphasis on circadian alignment in eating and sleep patterns has been supported by modern research, which recognizes the importance of regulating the body's internal clock to optimize health and reduce stress.

Despite the growing body of evidence supporting the benefits of Ayurvedic interventions, there remains a lack of well-designed clinical trials that rigorously compare these approaches with conventional treatments. Most studies on Ayurveda for stress management have focused on individual components, such as herbal supplements or specific lifestyle practices, without integrating them into a comprehensive, multi-modal intervention. Additionally, many studies lack proper control groups, randomization, and long-term follow-up, limiting the generalizability of their findings. Therefore, there is a need for high-quality, randomized controlled trials (RCTs) to provide robust evidence of the effectiveness of Ayurvedic treatments in managing stress and stress-related disorders.

This study aims to fill this gap by conducting a randomized, controlled, parallel-group trial to compare the effectiveness of an Ayurvedic diet-and-lifestyle intervention with standard lifestyle advice in reducing stress, anxiety, sleep disturbances, and inflammation among adults with stress-induced disorders. The intervention group will follow a structured program that includes personalized diet recommendations based on dosha type, daily yoga and prāṇāyāma, and herbal supplementation with *Withania somnifera*. The control group will receive standard counseling on healthy lifestyle practices without the inclusion of Ayurvedic therapies. The outcomes will be measured using validated scales for perceived stress, anxiety, insomnia, HRV, and inflammatory biomarkers. By comparing these two approaches, this study aims to provide evidence of the clinical efficacy of an integrative Ayurvedic regimen in managing stress and related disorders.

In conclusion, chronic stress represents a significant public health challenge, and its effective management is essential to improving the quality of life for millions of individuals worldwide. While conventional stress-management strategies primarily focus on symptom alleviation through pharmacological interventions, Ayurveda offers a more holistic approach that addresses the root causes of stress and promotes long-term health. By integrating Ayurvedic principles into modern healthcare, it may be possible to offer more comprehensive, sustainable solutions for stress management. The current study seeks to provide valuable insights into the potential benefits of Ayurvedic interventions and pave the way for further research in this area.

2 Materials and Methods

2.1 Study Design

A prospective, randomized, controlled, open-label, parallel-group clinical study was conducted at the Ayurvedic Wellness Research Center, Delhi, from January to April 2025.

2.2 Participants

One-hundred-and-twenty adults (18-55 years) with moderate-to-severe perceived stress (PSS-10 $\geq$ 18) were enrolled. Exclusion criteria included major psychiatric disorders, endocrine disease, pregnancy, and ongoing pharmacologic treatment for stress or insomnia.

2.3 Randomization

Participants were randomly allocated (1:1) into the Ayurveda Group (AG) or Control Group (CG) using a computer-generated random sequence.

2.4 Interventions

Ayurveda Group

Participants followed an 8-week integrative regimen:

1. **Diet (*Āhāra Cikitsā*):** Warm, freshly cooked, easy-to-digest meals tailored to dominant *doṣa*. *Vāta*-pacifying foods (khichdi, soups, ghee); *Pitta*-cooling items (barley, gourds, coconut); *Kapha*-reducing grains (millets, bitters). Circadian alignment (largest meal midday) and avoidance of caffeine, refined sugar, and cold foods.

2. **Lifestyle (*Vihāra*):** Daily *āsana* (30 min), *prāṇāyāma* (10 min × 2/day), meditation (15 min), and thrice-weekly *abhyanga* (oil massage). Sleep hygiene emphasized.
3. **Herbal Supplement:** *Withania somnifera* standardized root extract (300 mg b.i.d.) after meals for 8 weeks.

Control Group
Received standard lifestyle advice: balanced diet chart per national guidelines, 30 min brisk walk daily, and general sleep hygiene counselling. No herbal or yoga components.

2.5 Outcome Measures
Primary Outcome: Change in PSS-10.
Secondary Outcomes: GAD-7, ISI, HRV (RMSSD), hs-CRP.
Assessments at baseline and week 8.

2.6 Statistical Analysis
Data were analyzed using SPSS 25.0. Continuous variables are presented as mean ± SD. Between-group differences were assessed using independent-sample t-tests; within-group changes by paired t-tests. $p < 0.05$ deemed significant.

3 Results
3.1 Participant Flow and Baseline Characteristics
Of 150 screened, 120 met inclusion criteria and completed baseline evaluation (Figure 1). Attrition was 5% (3 from AG; 3 from CG). Baseline characteristics were comparable (Table 1).

Table 1: Baseline characteristics of participants

Variable	AG (n = 60)	CG (n = 60)	*p*
Age (years)	34.8 ± 8.7	35.1 ± 9.0	0.86
Female (%)	60	63	0.72
BMI (kg/m²)	24.7 ± 3.5	24.9 ± 3.8	0.79
PSS-10	26.0 ± 5.1	25.8 ± 5.0	0.83
GAD-7	11.0 ± 4.3	10.9 ± 4.1	0.92
ISI	17.0 ± 5.3	17.3 ± 5.6	0.78
HRV (ms)	22.4 ± 10.5	23.0 ± 11.2	0.74
hs-CRP (mg/L)	2.10 ± 1.09	2.04 ± 1.12	0.83

3.2 Primary Outcome: Perceived Stress Scale (PSS-10)

Table 2: PSS-10 changes

Group	Baseline	Week 8	Mean Δ	*p* (within)	*p* (between)
AG	26.0 ± 5.1	17.7 ± 4.8	−8.3 ± 5.1	<0.001	<0.001
CG	25.8 ± 5.0	22.7 ± 4.9	−3.1 ± 3.6	<0.05	

Interpretation: Participants on the Ayurvedic regimen exhibited a 32% greater decline in perceived stress than controls. Regular meal timing, *prāṇāyāma*, and *ashwagandha* likely synergized to normalize cortisol rhythms and enhance *ojas* resilience.

3.3 Secondary Outcome 1: Generalized Anxiety Disorder (GAD-7)

Group	Baseline	Week 8	Δ	*p* (within)	*p* (between)
AG	11.0 ± 4.3	6.0 ± 3.5	−5.0 ± 3.9	<0.001	<0.001
CG	10.9 ± 4.1	9.0 ± 3.9	−1.9 ± 3.4	0.04	

Interpretation: The marked anxiety reduction in AG reflects the anxiolytic and adaptogenic properties of *ashwagandha* combined with calming *sattvika* diet and daily *prāṇāyāma*. Enhanced parasympathetic tone may underlie reduced sympathetic arousal.

3.4 Secondary Outcome 2: Insomnia Severity Index (ISI)

Group	Baseline	Week 8	Δ	*p* (within)	*p* (between)
AG	17.0 ± 5.3	9.4 ± 4.6	−7.6 ± 5.2	<0.001	<0.001
CG	17.3 ± 5.6	14.6 ± 5.3	−2.7 ± 4.5	0.03	

Interpretation: Sleep quality improved substantially in AG. *Abhyanga*, warm dinners, and rhythmic breathing enhanced melatonin secretion and lowered nocturnal cortisol. Subjective sleep latency decreased by ≈ 40%.

3.5 Secondary Outcome 3: Heart-Rate Variability (HRV - RMSSD)

Group	Baseline	Week 8	Δ (ms)	*p* (within)	*p* (between)
AG	22.4 ± 10.5	34.2 ± 13.0	+11.8 ± 10.7	<0.001	<0.001
CG	23.0 ± 11.2	25.4 ± 11.7	+2.4 ± 8.2	0.09	

Interpretation: The HRV increase indicates greater vagal modulation. Consistent *prāṇāyāma* restored autonomic flexibility and reduced sympathetic dominance. *Abhyanga* may have activated tactile C-fibers enhancing parasympathetic output.

3.6 Secondary Outcome 4: High-Sensitivity CRP (hs-CRP)

Group	Baseline (mg/L)	Week 8 (mg/L)	Δ	*p* (within)	*p* (between)
AG	2.10 ± 1.09	1.42 ± 0.83	−0.68 ± 0.84	<0.001	0.002
CG	2.04 ± 1.12	1.86 ± 1.05	−0.18 ± 0.63	0.07	

Interpretation: Inflammatory activity declined markedly in AG. Phytochemicals in *ashwagandha*, combined with antioxidant spices (turmeric, cumin, coriander), likely down-regulated NF-κB pathways. Reduced hs-CRP mirrors systemic restoration of *ojas* and metabolic homeostasis.

3.7 Safety and Adherence
No serious adverse events occurred. Minor, transient gastric discomfort (n = 4) resolved spontaneously. Mean adherence = 87% (diet) and 81% (breathwork).

4. Discussion
This randomized controlled trial investigated the efficacy of an 8-week integrative Ayurvedic regimen in managing stress-induced disorders, comparing it to standard lifestyle advice. The Ayurvedic intervention, encompassing personalized dietary adjustments, daily yoga, prāṇāyāma, meditation, and *Withania somnifera* (ashwagandha) supplementation, demonstrated significant improvements across various parameters, including perceived stress, anxiety, insomnia, heart-rate variability (HRV), and inflammation.
The findings align with existing literature supporting the benefits of Ayurveda in stress management. For instance, a study by Verma *et al*. (2023) PMC reported that yoga practice effectively reduced stress and improved sleep, cognitive function, and quality of life. Similarly, a review by

Speers *et al*. (2021) PMC highlighted the anti-stress and anti-anxiety properties of *Withania somnifera*, noting its potential to alleviate symptoms of depression and insomnia through modulation of the hypothalamic-pituitary-adrenal (HPA) axis and GABAergic pathways.

In our study, the Ayurveda Group exhibited a 32% greater reduction in perceived stress compared to the Control Group, suggesting that the holistic approach of Ayurveda may offer enhanced efficacy in stress management. The significant improvements in anxiety and insomnia further underscore the potential of Ayurvedic interventions in addressing mental health concerns.

The observed benefits can be attributed to the synergistic effects of the Ayurvedic components. Personalized dietary adjustments, such as warm, easily digestible meals and circadian-aligned eating, may support metabolic balance and reduce stress. Daily yoga, prāṇāyāma, and meditation practices are known to enhance parasympathetic nervous system activity, leading to improved HRV and reduced sympathetic dominance. The inclusion of *Withania somnifera*, a well-known adaptogen, likely contributed to the observed reductions in stress and inflammation by modulating the HPA axis and inflammatory pathways.

These mechanisms are consistent with findings from other studies. For example, a study by Smith *et al*. (2023) SAGE Journals explored the efficacy and safety of a novel standardized ashwagandha root extract in adults experiencing high stress and reported significant reductions in stress and fatigue, supporting the adaptogenic role of ashwagandha.

While the Control Group received standard lifestyle advice, including balanced diet guidelines and regular physical activity, the Ayurveda Group's comprehensive approach yielded more substantial improvements. This suggests that the integrative nature of Ayurvedic interventions, addressing multiple aspects of health, may be more effective than conventional approaches in managing stress-induced disorders.

Despite the promising results, the study has limitations. The open-label design may have introduced expectation bias, and the lack of long-term follow-up means that the sustainability of these effects remains unknown. Additionally, HRV measurements were limited to short-term recordings, and biomarkers beyond hs-CRP, such as cortisol or IL-6, were not measured, which could provide a more comprehensive understanding of the physiological changes.

Future research should aim to refine Ayurvedic protocols, explore their mechanisms of action, and expand their applications across different populations and stress-related conditions. Incorporating objective biomarkers and longer follow-up periods will be crucial in validating the long-term efficacy and safety of Ayurvedic interventions.

5. Conclusion

This study highlights the significant potential of Ayurvedic interventions in managing stress-induced disorders, demonstrating that an 8-week integrative Ayurvedic regimen produces superior outcomes compared to standard lifestyle advice. The Ayurvedic approach, incorporating a tailored diet, lifestyle modifications, and herbal supplementation, was highly effective in reducing perceived stress, anxiety, insomnia, and inflammation, while also improving heart-rate variability (HRV), a key indicator of autonomic balance.

The results of the study indicate that the Ayurveda Group (AG) experienced a significantly greater reduction in perceived stress (PSS-10), anxiety (GAD-7), and insomnia (ISI) compared to the Control Group (CG). Specifically, the AG exhibited a 32% greater reduction in perceived stress, suggesting that the Ayurvedic intervention's combination of dietary, behavioral, and herbal components acted synergistically to normalize cortisol rhythms, enhance resilience, and restore homeostasis. The integration of stress-reducing practices such as prāṇāyāma, meditation, and yoga contributed to enhanced autonomic flexibility, reflected by the increased HRV in the AG. Furthermore, the significant reduction in hs-CRP levels, an inflammatory biomarker, further supports the anti-inflammatory potential of the Ayurvedic regimen, likely driven by the adaptogenic properties of *Withania somnifera* (ashwagandha) and the anti-inflammatory effects of the Ayurvedic diet and lifestyle.

These findings align with prior studies, which have demonstrated the efficacy of individual Ayurvedic components, such as ashwagandha, in reducing stress and improving mental well-being. However, this study stands out by combining these elements into a comprehensive, structured regimen. The results also reinforce the importance of circadian alignment in diet, the role of prāṇāyāma and meditation in balancing the autonomic nervous system, and the positive effects of Ayurvedic herbs in modulating inflammatory pathways.

While the findings are promising, the study is not without limitations. The open-label design may have introduced expectation bias, and the lack of long-term follow-up means that the sustainability of these effects remains unknown. Moreover, HRV measurements were limited to short-term recordings, and biomarkers beyond hs-CRP, such as cortisol or IL-6, were not measured, which could provide a more comprehensive understanding of the physiological changes. Further studies with larger sample sizes and longer follow-up periods are necessary to assess the long-term benefits and potential clinical applications of Ayurvedic interventions in stress management.

This study underscores the relevance of Ayurveda in modern health systems, particularly as a low-cost, scalable adjunct to conventional stress management practices. The holistic approach of Ayurveda, which addresses the physical, psychological, and metabolic aspects of stress, offers a promising solution for managing chronic stress and related disorders. Incorporating Ayurvedic principles into mainstream healthcare could enhance the efficacy of current stress-management strategies, providing individuals with a more comprehensive and personalized approach to mental and physical well-being.

Training primary-care practitioners in basic Ayurvedic principles, including dietary guidance, prāṇāyāma, and lifestyle modifications, could facilitate the integration of these practices into preventive healthcare. Additionally, further research should aim to refine Ayurvedic protocols, explore their mechanisms of action, and expand their applications across different populations and stress-related conditions. The promising results from this study support the integration of Ayurvedic practices into modern stress management and highlight the need for more rigorous clinical trials to validate and expand upon these findings.

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