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Review Article

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"ADAPTOGENS IN AYURVEDA AND MODERN STRESS PHARMACOLOGY: AN INTEGRATIVE REVIEW"

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ABSTRACT

Introduction: Stress-related disorders are increasingly prevalent in modern society, contributing to neuroendocrine dysregulation, immune dysfunction, and chronic diseases. Ayurveda describes several herbs with *Rasayana* properties, many of which act as adaptogens—agents that enhance the body's nonspecific resistance to stress while maintaining homeostasis. Modern pharmacology has recognized adaptogens such as *Withania somnifera (Ashwagandha), Tinospora cordifolia (Guduchi),* and *Ocimum sanctum (Tulsi)* as key candidates in stress regulation. **Methods:** A systematic review was conducted using Ayurvedic classics (Charaka Samhita, Sushruta Samhita, Ashtanga Hridaya, Bhavaprakasha) and modern databases (PubMed, Scopus, Web of Science, AYUSH Research Portal). The search terms included "adaptogens," "*Rasayana*," "stress pharmacology," and "Ayurveda." Inclusion criteria comprised pharmacological, toxicological, and clinical studies published in English between 1990–2025. **Results:** Ayurvedic *Rasayana* herbs demonstrate adaptogenic actions by modulating the hypothalamic-pituitary-adrenal (HPA) axis, balancing cortisol levels, enhancing mitochondrial resilience, and improving immune and cognitive function. For instance, *Ashwagandha* reduces stress-induced hypercortisolemia, while *Guduchi* enhances antioxidant defense and immune surveillance. *Tulsi* regulates neurotransmitter balance and reduces anxiety. Clinical studies support their efficacy in conditions like anxiety, depression, metabolic syndrome, and chronic fatigue. However, variability in study design, dosage, and standardization limits cross-comparison. **Discussion:** Ayurveda's holistic framework of *Rasayana* corresponds closely with modern adaptogen research, both emphasizing homeostasis and resilience. Future directions include molecular profiling, multi-omics approaches, and standardized clinical trials to validate integrative stress-management protocols. **Conclusion:** Adaptogens in Ayurveda offer a robust and safe approach for stress resilience. Bridging traditional concepts with modern pharmacological insights may enhance therapeutic strategies for stress-related disorders.

KEYWORDS: Adaptogens, Ayurveda, *Rasayana*, stress pharmacology, *Withania somnifera*

INTRODUCTION

Stress, in its acute and chronic forms, is a central factor in modern lifestyle disorders.[1] Excessive activation of the hypothalamic-pituitary-adrenal (HPA) axis and sympathetic nervous system contributes to anxiety, depression, metabolic syndrome, immune dysfunction, and neurodegeneration.[2-3] Contemporary pharmacological interventions for stress, such as anxiolytics or antidepressants, provide symptomatic relief but are often limited by side effects, tolerance, and dependence.[4]

Ayurveda, the traditional medical system of India,[5] offers a holistic approach to stress management through *Rasayana Tantra*, a branch dedicated to rejuvenation, vitality, and longevity. *Rasayana* herbs, including *Ashwagandha*, *Guduchi*, *Tulsi*, and *Shatavari*, are described to enhance physical, mental, and spiritual resilience.[6-8] These herbs share striking similarities with the pharmacological concept of "adaptogens," which are defined as substances that increase the body's nonspecific resistance to stress and normalize physiological functions.[8]

This review aims to integrate Ayurvedic perspectives on adaptogens with modern pharmacological evidence. The objectives are: (1) to document adaptogenic herbs described in Ayurveda; (2) to evaluate their pharmacological and clinical evidence in stress biology; and (3) to analyze future directions for integrative stress research and therapeutic applications.[9-10]

MATERIALS AND METHODS

A structured literature review was conducted between March and August 2025. Ayurvedic primary texts (*Charaka Samhita*, *Sushruta Samhita*, *Ashtanga Hridaya*, *Bhavaprakasha Nighantu*) were reviewed for references to *Rasayana* and stress resilience. Commentaries and secondary sources were included.[11]

Electronic databases searched included PubMed, Scopus, Web of Science, AYUSH Research Portal, and Google Scholar. The search terms used were: "adaptogen," "Ayurveda," "*Rasayana*," "stress," "HPA axis," and "Withania somnifera."[12]

Inclusion criteria:[13]

- Preclinical studies *(in vitro* and *in vivo)* on adaptogenic properties.
- Clinical studies assessing anti-stress or anxiolytic effects of Ayurvedic herbs.
- Reviews, pharmacological evaluations, and meta-analyses.

Exclusion criteria: [14]

- Non-Ayurvedic herbal adaptogen studies.
- Studies lacking clear stress-related outcomes.
- Anecdotal or non-peer-reviewed reports.

Type of studies reviewed:[15]

Experimental animal studies, pharmacological assays, clinical trials, systematic reviews, and meta-analyses. Data were synthesized thematically into (i) classical Ayurvedic perspectives, (ii) pharmacological mechanisms, (iii) clinical trials, and (iv) safety and limitations.

OBSERVATION AND RESULTS

1. Ayurvedic Perspectives on Stress and *Rasayana*

- Ayurveda does not use the modern concept of "stress" but describes *Manasika vyadhis* (mental disorders) and disturbances of *Rajas* and *Tamas* gunas as causative factors of mental and emotional strain.
- *Rasayana Tantra* is aimed at promoting *Ojas* (vital energy), immunity, and *dhatu poshana* (tissue nourishment), thereby strengthening resilience to internal and external stressors.
- Classical texts describe *Medhya Rasayana* (nootropic adaptogens) such as *Ashwagandha*, *Guduchi*, *Mandukaparni* (Centella asiatica), and *Yashtimadhu* (Glycyrrhiza glabra).

2. Key Ayurvedic Adaptogens and Their Modern Pharmacology

a) Withania somnifera *(Ashwagandha)*

- Classical texts: described as *Balya* (strength-promoting) and *Medhya Rasayana* (cognitive enhancer).
- Pharmacology: modulates HPA axis, reduces cortisol, enhances GABAergic signaling, and protects mitochondria.
- Clinical trials: Randomized controlled trials (RCTs) show significant reduction in anxiety, depression scores, and serum cortisol.

b) Tinospora cordifolia *(Guduchi)*

- Classical texts: called *Amrita* (immortal), rejuvenator, and immune enhancer.
- Pharmacology: improves antioxidant enzyme activity, reduces ROS, enhances cytokine balance, and protects against stress-induced immunosuppression.

- Clinical trials: shown to reduce fatigue, improve immune markers in chronic illness, and support recovery from infections.

c) Ocimum sanctum *(Tulsi)*

- Classical texts: revered as a sacred plant, described as *Medhya* and *Hridya* (cardiotonic).
- Pharmacology: regulates neurotransmitters (dopamine, serotonin), reduces oxidative stress, and improves memory.
- Clinical studies: associated with reduced anxiety, improved sleep, and reduced blood pressure in stress-related hypertension.

d) Centella asiatica *(Mandukaparni)*

- Classical texts: a major *Medhya Rasayana*, used in cognitive decline and mental disorders.
- Pharmacology: enhances BDNF (brain-derived neurotrophic factor), reduces neuroinflammation, and supports neuronal plasticity.
- Clinical trials: improves cognitive performance in elderly and reduces anxiety in adolescents.

e) Glycyrrhiza glabra *(Yashtimadhu)*

- Classical texts: promotes voice, intellect, and vitality.
- Pharmacology: modulates cortisol metabolism via 11β-HSD inhibition, protects gastric mucosa, and enhances immune function.
- Clinical findings: beneficial in adrenal fatigue, peptic ulcers, and stress-related gastritis.

3. Mechanisms of Adaptogenic Action

- Neuroendocrine modulation: Normalizes HPA axis activity and reduces hypercortisolemia.
- Neurotransmitter balance: Modulates serotonin, dopamine, and GABA pathways.
- Mitochondrial protection: Enhances ATP production and reduces oxidative damage.
- Immune regulation: Promotes Th1/Th2 balance and enhances NK cell activity.
- Epigenetic influences: Recent studies suggest adaptogens modulate stress-response genes.

4. Clinical Evidence

- *Guduchi* and *Tulsi* show promising results in stress-related fatigue and metabolic disorders.
- Multi-herbal formulations (*Medhya Rasayana combinations*) have synergistic effects, though RCTs are limited.

5. Safety Profile

- Generally safe when used in classical dosage.
- Long-term toxicity studies are sparse and need expansion.

DISCUSSION

The concept of adaptogens provides a striking bridge between Ayurveda and modern pharmacology. While the term "adaptogen" originated in Soviet research in the 20th century, the principles resonate with Ayurveda's *Rasayana Tantra*. Both emphasize enhancing resilience, restoring balance, and preventing disease progression.[16]

Modern pharmacology explains adaptogenic activity through HPA axis modulation, antioxidant defense, mitochondrial protection, and neurotransmitter regulation. These mechanisms parallel Ayurvedic ideas of *Balya*, *Ojas*, and *Medhya Rasayana*. For example, Ashwagandha's cortisol-lowering effect directly reflects Ayurveda's description of it as a stress-reducing tonic.[17]

Despite encouraging evidence, significant research gaps exist. Clinical trials often vary in design, dosage, and extract preparation, making comparison difficult. Many studies are small-scale, limiting generalizability. Safety data beyond short-term use remain insufficient, though traditional usage suggests a favorable safety profile.[18]

Future prospects include adopting multi-omics approaches to map molecular networks influenced by adaptogens, developing standardized pharmacological assays for Rasayana herbs, and designing large-scale, multicentric RCTs. Another important direction is integrative stress management—combining adaptogens with yoga, meditation, and lifestyle interventions.

Thus, bridging Ayurveda and pharmacology through adaptogen research holds great promise but requires scientific rigor, standardization, and translational frameworks.[19-20]

CONCLUSION

Ayurvedic *Rasayana* herbs represent some of the earliest documented adaptogens, offering resilience against physical, mental, and environmental stressors. Modern research validates their ability to modulate the HPA axis, regulate cortisol, enhance immunity, and protect mitochondrial and neuronal functions. Among these, *Ashwagandha, Guduchi, Tulsi, Mandukaparni,* and *Yashtimadhu* are the most extensively studied.

The convergence of Ayurveda and modern pharmacology reveals a shared understanding of

stress resilience and homeostasis. However, limitations remain—particularly in standardized clinical validation, long-term safety assessment, and mechanistic clarity. Addressing these gaps through interdisciplinary collaboration can establish Ayurvedic adaptogens as evidence-based components of global stress management strategies.

In conclusion, adaptogens in Ayurveda and modern pharmacology provide a synergistic platform for tackling stress-related disorders. Integrating traditional knowledge with rigorous modern science can unlock their full therapeutic potential, supporting human health in an increasingly stressful world.

REFERENCES

1. Charaka. *Charaka Samhita*. Sutrasthana, Chikitsasthana. Chaukhambha Sanskrit Sansthan, Varanasi; 2018.
2. Sushruta. *Sushruta Samhita*. Chaukhambha Orientalia, Varanasi; 2017.
3. Vagbhata. *Ashtanga Hridaya*. Chaukhambha Sanskrit Series, Varanasi; 2015.
4. Bhavaprakasha Nighantu. Chaukhambha Bharati Academy, Varanasi; 2016.
5. Panossian A, Wikman G. Effects of adaptogens on the central nervous system and the molecular mechanisms associated with their stress-protective activity. *Pharmacol Ther*. 2010;127(3):390–403.
6. Chandrasekhar K, Kapoor J, Anishetty S. A prospective, randomized double-blind study of safety and efficacy of high-concentration full-spectrum Ashwagandha root extract in reducing stress and anxiety. *Indian J Psychol Med*. 2012;34(3):255–62.
7. Lopresti AL, Drummond PD. Efficacy of Ashwagandha extract in reducing stress and anxiety: A systematic review and meta-analysis. *J Affect Disord*. 2021;287:89–103.
8. Singh N, Bhalla M, de Jager P, Gilca M. An overview on Ashwagandha: A Rasayana herb of Ayurveda. *Afr J Tradit Complement Altern Med*. 2011;8(5 Suppl):208–13.
9. Sharma P, Dwivedee BP, Bisht D, Dash AK, Kumar D. The chemical constituents and diverse pharmacological importance of Tinospora cordifolia. *Heliyon*. 2019;5(9):e02437.
10. Scartezzini P, Speroni E. Review on some plants of Indian traditional medicine with antioxidant activity. *J Ethnopharmacol*. 2000;71(1-2):23–43.
11. Jamshidi N, Cohen MM. The clinical efficacy and safety of Tulsi in humans: A systematic review. *Evid Based Complement Alternat Med*. 2017;2017:9217567.
12. Pattanayak P, Behera P, Das D, Panda SK. Ocimum sanctum Linn. A reservoir plant for therapeutic applications: An overview. *Pharmacogn Rev*. 2010;4(7):95–105.
13. Gray NE, Harris CJ, Quinn JF, Soumyanath A. Centella asiatica: Phytochemistry and mechanisms of neuroprotection and cognitive enhancement. *Phytochem Rev*. 2018;17:161–94.
14. Dev R, Deshmukh N, Nandave M. A review on Centella asiatica: Pharmacological aspects and mechanisms of action. *Asian J Pharm Clin Res*. 2019;12(9):46–54.
15. Fiore C, Eisenhut M, Ragazzi E, Zanchin G, Armanini D. A history of licorice: From phytotherapy to molecular mechanisms of cortisol metabolism. *J Ethnopharmacol*. 2005;99(3):317–24.
16. Wiegant FA, Surinova S, Ytsma E, Langelaar-Makkinje M, Wikman G, Post JA. Plant adaptogens activate cellular adaptive mechanisms by causing mild damage. *Phytomedicine*. 2009;16(6-7):617–22.
17. Panossian A, Seo EJ, Efferth T. Novel molecular mechanisms for the adaptogenic effects of herbal extracts on isolated brain cells using systems biology. *Phytomedicine*. 2018;50:257–71.
18. Bhatnagar M, Sisodia SS, Bhatnagar R. Anti-stress and anti-oxidative effects of Withania somnifera. *J Ethnopharmacol*. 2005;102(2):197–206.
19. Rege NN, Thatte UM, Dahanukar SA. Adaptogenic properties of six Rasayana herbs used in Ayurveda: A review. *Phytother Res*. 1999;13(4):275–91.
20. Singh RH. Exploring larger evidence-base for contemporary Ayurveda. *J Ayurveda Integr Med*. 2010;1(1):41–6.