Adaptogenic and Stress-Relieving Herbs in Mental Health

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ABSTRACT

Mental health disorders such as stress, anxiety, and depression have become a major global concern, significantly affecting quality of life and productivity. Conventional pharmacological treatments, although effective, are often associated with adverse effects and long-term dependency. In recent years, adaptogenic and stress-relieving herbs have gained growing attention as safer, holistic alternatives in the management of mental health disorders. Adaptogens are natural substances that enhance the body's resilience to physical, emotional, and environmental stressors by modulating the hypothalamic–pituitary–adrenal (HPA) axis and maintaining homeostasis. Herbs such as Withania somnifera (Ashwagandha), Bacopa monnieri (Brahmi), Ocimum sanctum (Tulsi), Panax ginseng (Ginseng), and Rhodiola rosea have demonstrated promising results in reducing stress, improving cognition, regulating neurotransmitter activity, and protecting against oxidative damage. Several clinical studies support their role in alleviating symptoms of anxiety, depression, and stress-related disorders, with minimal side effects. However, standardization, dosage optimization, and large-scale clinical validation remain challenges for their wider acceptance in modern medicine. This review aims to highlight the pharmacological mechanisms, therapeutic benefits, and clinical evidence of adaptogenic herbs in promoting mental well-being, thereby offering a natural and sustainable approach to mental health care.

Keywords: Adaptogens, Stress-relieving herbs, mental health, Anxiety, Depression, Herbal medicine

INTRODUCTION

Background and Global Burden of Mental Health Disorders

Mental health is increasingly recognized as a critical component of overall health and well-being. Disorders such as stress, anxiety, depression, and insomnia have emerged as major public health challenges worldwide. According to the World Health Organization (WHO), one in every eight individuals suffers from a mental disorder, with stress-related conditions being among the most prevalent. Chronic psychological stress negatively influences quality of life, work productivity, interpersonal relationships, and physical health. It is also strongly associated with lifestyle diseases such as hypertension, diabetes, and cardiovascular disorders.In modern society, rapid urbanization, intense occupational pressure, competitive lifestyles, and exposure to digital media have contributed significantly to the rising prevalence of stress and anxiety. The COVID-19 pandemic further highlighted the vulnerability of mental health, with millions of individuals reporting increased psychological stress, burnout, and emotional instability. If left untreated, stress-related mental health conditions may lead to substance abuse, suicidal tendencies, and long-term disability. Thus, the prevention and effective management of stress and anxiety have become urgent priorities for healthcare systems across the globe.

Limitations of Conventional Therapies

Conventional pharmacological treatments for stress and mental health disorders include antidepressants, anxiolytics, sedatives, and antipsychotics. While these drugs offer symptomatic relief, their prolonged use is often associated with limitations. Many patients experience adverse effects such as drowsiness, dependency, weight gain, gastrointestinal disturbances, and cognitive dullness. Furthermore, withdrawal symptoms and the risk of relapse remain significant concerns.Another important limitation is the lack of holistic action. Most

Synthetic drugs target specific neurotransmitters such as serotonin, dopamine, or gamma-aminobutyric acid (GABA). However, stress is a multifactorial condition involving hormonal imbalances, oxidative stress, immune dysfunction, and neuronal damage. This complexity cannot be addressed adequately by single-target drugs, necessitating the search for safer and more comprehensive therapeutic strategies.

Emergence of Adaptogens as Natural Alternatives

In the last few decades, there has been a paradigm shift towards the use of herbal and natural medicines for mental health management. Among these, adaptogens have gained remarkable attention. The term "adaptogen" was first introduced in the mid-20th century to describe substances that enhance the body's nonspecific resistance to stress and help maintain internal homeostasis. Adaptogens are defined as natural compounds that improve the body's ability to adapt to physical, chemical, and psychological stressors, without causing significant side effects.Unlike conventional drugs, adaptogens act through a multifaceted mechanism. They regulate the hypothalamic–pituitary–adrenal (HPA) axis, normalize stress hormone levels (particularly cortisol), and enhance the resilience of the nervous, endocrine, and immune systems. Additionally, adaptogens protect neurons from oxidative damage, modulate inflammatory pathways, and improve mitochondrial energy production, thereby enhancing mental performance under stressful conditions.

Role of Adaptogenic and Stress-Relieving Herbs in Mental Health

Traditional medical systems such as Ayurveda, Siddha, and Traditional Chinese Medicine have long recognized the therapeutic value of adaptogenic herbs. Withania somnifera (Ashwagandha), Bacopa monnieri (Brahmi), Ocimum sanctum (Tulsi), Panax ginseng (Ginseng), and Rhodiola rosea are among the most extensively studied adaptogens with clinically proven stress-relieving properties. These herbs exert anxiolytic, antidepressant, and neuroprotective effects through multiple pathways.For instance, Ashwagandha has been shown to reduce cortisol levels and improve sleep quality, while Brahmi enhances memory and reduces anxiety. Tulsi, a sacred Ayurvedic herb, supports overall resilience against emotional stress and oxidative imbalance. Similarly, Ginseng and Rhodiola are well-documented for improving mental clarity, reducing fatigue, and restoring work efficiency under stressful conditions. Importantly, these herbs provide long-term benefits with minimal adverse effects, making them suitable as complementary or alternative interventions in mental health care.

Need for Review and Future Perspectives

Despite centuries of traditional use, scientific validation of adaptogens is still evolving. Recent preclinical and clinical studies have provided strong evidence for their role in regulating neurotransmitters, protecting neurons, and improving emotional well-being. However, challenges such as lack of standardization, dosage optimization, and large-scale randomized controlled trials limit their acceptance in mainstream medicine.

Concept of Adaptogens:

Definition and Characteristics

The term adaptogen was first introduced by Russian scientist N.V. Lazarev in 1947 to describe natural substances that enhance the body's nonspecific resistance to stress. Later, Brekhman and Dardymov (1969) refined the definition, emphasizing that adaptogens are agents that increase the state of non-specific resistance in stress, have a normalizing effect regardless of the direction of change, and are essentially harmless to the physiological systems of the body. In simpler terms, adaptogens are herbal substances that help an organism adapt to various physical, chemical, or psychological stressors while maintaining homeostasis.

To qualify as an adaptogen, a substance must meet three essential criteria:

1. **Non-specific activity** – It should increase resistance to a wide range of stressors, including physical, emotional, and environmental.
2. **Normalizing effect** – It should restore physiological balance irrespective of the direction of the imbalance

(whether stress causes hyperactivity or hypoactivity).

3. **Safety** – It must not disturb normal body functions or cause harmful side effects, even during prolonged use.

Mechanisms of Action

The mechanisms through which adaptogens exert their effects are complex and multifactorial. One of the primary pathways involves modulation of the **hypothalamic–pituitary–adrenal (HPA) axis**, the central stress response system of the body. By regulating cortisol secretion and adrenal gland function, adaptogens help maintain hormonal balance under stressful conditions.

Apart from HPA axis modulation, adaptogens act through the following mechanisms:

- **Neurotransmitter regulation:** They influence gamma-aminobutyric acid (GABA), serotonin, dopamine, and norepinephrine levels, which play critical roles in mood regulation and anxiety control.
- **Antioxidant activity:** Adaptogens reduce oxidative stress by scavenging free radicals and enhancing endogenous antioxidant defenses, thereby protecting neurons from stress-induced damage.
- **Anti-inflammatory effects:** Many adaptogens inhibit pro-inflammatory cytokines, which are elevated during chronic stress and depression.
- **Mitochondrial protection:** By enhancing mitochondrial energy metabolism, adaptogens improve physical endurance and mental performance under stress.
- **Immunomodulation:** Certain adaptogens stimulate immune responses, thereby counteracting the immunosuppressive effects of chronic stress.

Historical Background

The use of adaptogenic plants is deeply rooted in traditional medical systems. In **Ayurveda**, herbs such as Ashwagandha and Brahmi were classified as Rasayana – rejuvenating agents that promote longevity, strength, and mental clarity. In **Traditional Chinese Medicine (TCM)**, Panax ginseng and Schisandra chinensis were widely used to restore energy, enhance vitality, and strengthen resistance against disease. Similarly, in Russian folk medicine, plants like Rhodiola rosea were consumed to combat fatigue and improve endurance in harsh climates.

The scientific concept of adaptogens gained recognition during World War II and the Cold War era, when researchers in the Soviet Union studied natural substances to enhance the stamina, performance, and resilience of soldiers, pilots, and athletes. Since then, the concept has evolved and gained acceptance worldwide, with increasing evidence from pharmacological and clinical studies supporting their role in stress management and mental health care.

Significance in Mental Health

Chronic stress disrupts the delicate balance between the nervous, endocrine, and immune systems, often leading to anxiety, depression, insomnia, and cognitive impairment. Adaptogens provide a holistic solution by simultaneously targeting multiple biological systems. Unlike synthetic drugs, which typically act on a single neurotransmitter pathway, adaptogens act as network pharmacology agents, offering broad-spectrum benefits. Their ability to regulate stress hormones, enhance neuronal resilience, and improve mood makes them particularly valuable in modern mental health care.

Major Adaptogenic and Stress-Relieving Herbs in Mental Health:

Adaptogenic herbs have been extensively studied for their potential role in alleviating stress and improving mental health. These herbs act through multiple pharmacological pathways, including modulation of the hypothalamic–pituitary–adrenal (HPA) axis, regulation of neurotransmitters, and reduction of oxidative and inflammatory stress. The following are some of the most widely recognized adaptogens with significant mental health benefits:

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Withania somnifera (Ashwagandha)

Ashwagandha, commonly known as Indian ginseng or winter cherry, is one of the most important Rasayana herbs in Ayurveda. It has long been used for its rejuvenating and stress-relieving properties.

Fig 1- Withania somnifera (Ashwagandha)

- **Pharmacological Actions:** Ashwagandha reduces cortisol levels, balances HPA axis function, and acts as an anxiolytic and antidepressant.
- **Mechanism:** Enhances GABAergic signaling, reduces oxidative stress, and improves sleep quality.
- **Evidence:** Clinical trials have demonstrated its effectiveness in reducing stress, improving cognitive function, and alleviating symptoms of anxiety and insomnia.

Bacopa monnieri (Brahmi)

Brahmi has been traditionally used in Ayurveda as a brain tonic for enhancing memory and concentration.

Fig : 2-Bacopa monnieri (Brahmi)

- **Pharmacological Actions:** Exhibits anxiolytic, antidepressant, and neuroprotective properties.
- **Mechanism:** Modulates serotonin and dopamine pathways, reduces free radical damage, and enhances neuronal communication.
- **Evidence:** Several studies indicate its effectiveness in reducing stress and improving learning ability, making it useful for both cognitive enhancement and stress-related mental disorders.

Ocimum sanctum (Tulsi / Holy Basil)

Tulsi is revered as a sacred plant in India and is widely recognized for its adaptogenic and therapeutic

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properties.

Fig : 3-Ocimum sanctum (Tulsi / Holy Basil)

- **Pharmacological Actions:** Acts as an anti-stress, anxiolytic, and antidepressant agent.
- **Mechanism:** Reduces cortisol levels, enhances antioxidant defenses, and stabilizes blood sugar and hormonal levels during stress.
- **Evidence:** Both experimental and clinical research highlight Tulsi's role in reducing anxiety, fatigue, and depression while promoting overall mental well-being.

Panax ginseng (Asian Ginseng)

Ginseng has been an integral part of Traditional Chinese Medicine for centuries, known for improving vitality and resilience.

Fig:4-Panax ginseng (Asian Ginseng)

- **Pharmacological Actions:** Reduces mental fatigue, enhances cognitive performance, and alleviates symptoms of depression.
- **Mechanism:** Regulates neurotransmitters (dopamine, serotonin), modulates HPA axis, and improves mitochondrial function.
- **Evidence:** Randomized controlled trials suggest ginseng's efficacy in improving mood, reducing stress, and enhancing mental clarity, especially in high-pressure environments.

Rhodiola rosea (Golden Root)

Rhodiola is a well-known adaptogen used in Europe and Russia to combat fatigue and stress.

Fig : 5-Rhodiola rosea (Golden Root)

- **Pharmacological Actions:** Improves resilience to mental stress, reduces fatigue, and enhances work performance.

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- **Mechanism:** Modulates serotonin and dopamine pathways, influences opioid peptides, and reduces stress-induced oxidative damage.
- **Evidence:** Clinical studies show that Rhodiola supplementation reduces symptoms of stress, improves attention span, and helps manage mild-to-moderate depression.

Convolvulus pluricaulis (Shankhpushpi)

Shankhpushpi is another Ayurvedic herb used traditionally to promote mental calmness and improve sleep.

Fig :6-Convolvulus pluricaulis (Shankhpushpi)

- **Pharmacological Actions:** Anxiolytic, nootropic, and mild sedative effects.
- **Mechanism:** Enhances GABAergic activity and reduces oxidative stress in the brain.
- **Evidence:** Preclinical and limited clinical evidence suggest its potential in anxiety, insomnia, and memory enhancement.

Pharmacological Mechanisms of Adaptogens in Mental Health:

Adaptogens act through multiple biological pathways that collectively enhance the body's ability to resist, adapt, and recover from stress. Unlike conventional pharmacological agents that target a single receptor or neurotransmitter, adaptogens exert multi-target actions across the nervous, endocrine, and immune systems.

Regulation of the Hypothalamic–Pituitary–Adrenal (HPA) Axis

The HPA axis plays a central role in the stress response. Stress activates the hypothalamus to release corticotropin-releasing hormone (CRH), which stimulates the pituitary gland to secrete adrenocorticotropic hormone (ACTH). ACTH then triggers cortisol release from the adrenal cortex. Prolonged activation of this pathway leads to elevated cortisol levels, causing anxiety, depression, insomnia, and impaired cognition.

- **Adaptogens such as Ashwagandha and Rhodiola** modulate HPA axis activity by reducing excessive cortisol secretion.
- This results in the normalization of stress hormone levels, promoting calmness and mental stability.

Neurotransmitter Modulation

Neurotransmitters are critical regulators of mood, cognition, and behavior. Chronic stress often disrupts neurotransmitter balance, leading to mental health disorders.

- **Serotonin (5-HT):** Adaptogens like Brahmi and Tulsi enhance serotonergic activity, reducing depression and anxiety.
- **Dopamine:** Ginseng and Rhodiola influence dopaminergic signaling, improving motivation, mood, and attention span.
- **Gamma-aminobutyric acid (GABA):** Ashwagandha and Shankhpushpi exhibit GABA-mimetic effects, producing anxiolytic and calming responses.
- **Norepinephrine:** Adaptogens restore norepinephrine balance, thereby reducing overactivation of the sympathetic nervous system during stress.

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Antioxidant and Neuroprotective Activity

Oxidative stress plays a major role in the pathogenesis of neurodegenerative diseases and mental health disorders. Excessive free radical production damages neuronal membranes, proteins, and DNA, resulting in impaired synaptic transmission.

- **Adaptogens like Brahmi, Ashwagandha, and Gotu kola** possess potent antioxidant properties that neutralize reactive oxygen species (ROS).
- They enhance the activity of endogenous antioxidant enzymes such as superoxide dismutase (SOD), catalase, and glutathione peroxidase.
- This neuroprotection supports cognitive health, prevents neuronal apoptosis, and enhances resilience against stress.

Anti-inflammatory Effects

Chronic stress activates pro-inflammatory cytokines (IL-6, TNF-α, and CRP), which are linked to depression, anxiety, and cognitive decline. Neuroinflammation also contributes to impaired neurotransmitter function.

- **Tulsi, Ashwagandha, and Licorice** demonstrate anti-inflammatory activity by inhibiting NF-κB signaling and reducing cytokine release.
- This suppression of neuroinflammation protects the brain from stress-induced damage and improves mood stability.

Mitochondrial Protection and Energy Regulation

Stress leads to mitochondrial dysfunction, reducing ATP production and causing fatigue and mental exhaustion.

- **Ginseng and Rhodiola** improve mitochondrial bioenergetics, enhance ATP synthesis, and reduce oxidative injury within mitochondria.
- This mechanism explains their effectiveness in reducing fatigue, improving alertness, and enhancing overall mental performance.

Immunomodulatory Effects

Stress suppresses immune function, making individuals more vulnerable to infections and illness. Adaptogens restore immune balance and strengthen host defense mechanisms.

- **Tulsi and Ashwagandha** stimulate immune cells (natural killer cells, T-lymphocytes) while reducing stress-induced immunosuppression.
- This dual action improves both psychological resilience and physical health.

Epigenetic and Genomic Effects (Emerging Evidence)

Recent studies indicate that adaptogens may influence gene expression related to stress response, neurotransmission, and neuroplasticity.

- **Brahmi and Ginseng** have been shown to upregulate brain-derived neurotrophic factor (BDNF), which enhances synaptic plasticity and learning ability.
- These epigenetic effects highlight the potential long-term benefits of adaptogens in preventing stress-related cognitive decline.

Clinical Evidence and Trials on Adaptogens in Mental Health:

The therapeutic potential of adaptogens in stress and mental health management has been supported by a

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growing body of preclinical and clinical research. Unlike traditional anecdotal evidence, modern studies have provided scientific validation through randomized controlled trials (RCTs), observational studies, and meta-analyses. This section highlights key clinical findings on major adaptogenic herbs.

Withania somnifera (Ashwagandha)

Ashwagandha has been extensively investigated in clinical studies for its stress-relieving and anxiolytic effects.

- **Study 1:** A double-blind, randomized, placebo-controlled trial (n=64) showed that standardized Ashwagandha root extract significantly reduced serum cortisol levels by 28% and improved scores on the Perceived Stress Scale (PSS) within 60 days.
- **Study 2:** In patients with generalized anxiety disorder (GAD), Ashwagandha supplementation demonstrated marked improvements in anxiety, fatigue, and sleep quality compared to placebo.
- **Summary:** Strong evidence supports Ashwagandha as a natural anxiolytic and adaptogen with excellent safety and tolerability.

Bacopa monnieri (Brahmi)

Traditionally used for enhancing memory, Brahmi has shown promising results in cognitive and stress-related disorders.

- **Study 1:** A randomized trial in healthy adults reported that Brahmi extract improved information processing, learning rate, and reduced anxiety scores over a 12-week period.
- **Study 2:** Clinical evidence suggests improvements in memory retention and reduced cortisol levels in students during examination stress.
- **Summary:** Brahmi demonstrates dual benefits of cognitive enhancement and stress reduction, making it useful in both healthy individuals and patients with mild anxiety.

Ocimum sanctum (Tulsi / Holy Basil)

Tulsi has been recognized as a potent adaptogen in both traditional practice and modern clinical research.

- **Study 1:** A clinical trial with 35 subjects suffering from generalized anxiety showed that Tulsi extract significantly reduced anxiety and stress symptoms, along with improvement in mood and attention span.
- **Study 2:** Another study found that Tulsi supplementation improved sleep quality and reduced fatigue in stressed adults.
- **Summary:** Tulsi shows consistent results in stress reduction, mental calmness, and enhancement of resilience.

Panax ginseng

Ginseng has been investigated widely in Asian and Western populations for fatigue, mood, and cognition.

- **Study 1:** A placebo-controlled clinical trial (n=90) demonstrated that Panax ginseng supplementation improved mental performance, working memory, and reduced perceived stress levels.
- **Study 2:** Another RCT in healthcare workers revealed improved quality of life and reduced burnout scores after 8 weeks of supplementation.
- **Summary:** Ginseng is particularly effective in stress-related fatigue and cognitive decline.

Rhodiola rosea

Rhodiola has gained attention in Europe and Russia for its anti-stress and antidepressant effects.

- **Study 1:** A clinical trial involving 80 patients with stress-related fatigue reported significant improvement in fatigue, concentration, and mood after Rhodiola extract administration.
- **Study 2:** An open-label study in patients with mild-to-moderate depression showed reduction in Hamilton Depression Rating Scale (HAM-D) scores comparable to standard antidepressants, with fewer side effects.
- **Summary:** Rhodiola is effective in stress-induced fatigue, depression, and work-related exhaustion.

Other Adaptogens with Emerging Evidence

- **Gotu kola (Centella asiatica):** Reported to improve calmness and reduce anxiety in elderly patients.
- **Valerian root:** Widely studied for insomnia and anxiety, showing improvements in sleep latency and quality.
- **Shankhpushpi:** Limited trials but positive outcomes in stress-induced insomnia and memory enhancement.

Meta-analyses and Systematic Reviews

- Several meta-analyses suggest consistent anxiolytic and antidepressant effects of Ashwagandha, Ginseng, and Rhodiola.
- Reviews highlight that adaptogens are generally well-tolerated, with fewer adverse effects compared to synthetic anxiolytics and antidepressants.
- However, heterogeneity in dosage forms, lack of standardization, and small sample sizes remain limitations.

CONCLUSION

- Adaptogenic herbs represent a valuable and scientifically validated approach to managing stress and improving mental health. Unlike conventional pharmacological treatments, which often provide only symptomatic relief and may cause adverse effects, adaptogens act holistically by enhancing the body's natural resilience to physical, psychological, and environmental stressors. Their ability to regulate the hypothalamic–pituitary–adrenal (HPA) axis, modulate neurotransmitter activity, and reduce oxidative stress underlines their unique therapeutic potential.
- Herbs such as Withania somnifera (Ashwagandha), Bacopa monnieri (Brahmi), Panax ginseng, Rhodiola rosea, and Ocimum sanctum (Tulsi) have consistently demonstrated efficacy in reducing anxiety, improving mood, enhancing cognitive performance, and preventing stress-induced neurodegeneration. Evidence from both preclinical and clinical studies strongly supports their role as safe, effective, and sustainable alternatives or adjuncts to conventional therapies.
- The integration of adaptogenic and stress-relieving herbs into modern healthcare frameworks offers a promising avenue for holistic mental health management. However, large-scale randomized clinical trials, standardized dosing protocols, and long-term safety studies are still required to fully establish their clinical utility. With growing global acceptance of herbal medicine, adaptogens may become a cornerstone in bridging traditional wisdom with contemporary psychiatric care.

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