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editorial-office@sciformat.ca

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ADAPTOGENS IN THE MANAGEMENT OF CHRONIC STRESS: A REVIEW OF WITHANIA SOMNIFERA, RHODIOLA ROSEA, AND SCHISANDRA CHINENS

Joanna Danio (Corresponding Author, Email: joanna-bystron@wp.pl)
Powiatowe Centrum Zdrowia SP. Z O.O. w Kartuzach, Poland
ORCID ID: 0009-0009-7935-8307

Katarzyna Procajlo
Medical University of Lublin, Lublin, Poland
ORCID ID: 0009-0003-8408-2049

Przemysław Szostak
Medical University of Lublin, Lublin, Poland
ORCID ID: 0009-0008-4206-9854

Martyna Rynkowska
Medical University of Lublin, Lublin, Poland
ORCID ID: 0009-0003-8976-2318

Sylvia Maj
Medical University of Lublin, Lublin, Poland
ORCID ID: 0009-0008-7215-147X

Wiktoria Sikorska
Medical University of Lublin, Lublin, Poland
ORCID ID: 0009-0006-4552-4635

Albert Sikorski
Medical University of Lublin, Lublin, Poland
ORCID ID: 0009-0007-6814-7286

Dominika Kuźmiuk
Doctoral School of the Medical University of Lublin, Lublin, Poland
ORCID ID: 0009-0003-5803-5118

Dominika Sidor
Medical University of Lublin, Lublin, Poland
ORCID ID: 0009-0004-2331-769X

ABSTRACT

Introduction and objective: Chronic stress is a serious and growing health problem associated with numerous physical and mental disorders. Traditional stress management methods often fail to deliver the expected results, increasing interest in natural alternatives. The aim of this paper is to review current data on adaptogens – Withania somnifera (ashwagandha), Rhodiola rosea and Schisandra chinensis– with particular emphasis on their stress-reducing properties.

Brief description of the state of knowledge: Chronic stress contributes to various health issues, both physical and psychological. Adaptogens such as Withania somnifera, Rhodiola rosea and Schisandra chinensis exhibit stress-reducing effects by modulating the hypothalamic-pituitary-adrenal (HPA) axis and neurotransmitter systems. Clinical studies confirm their good tolerability however, variability in product composition complicates the assessment of their efficacy. Further standardized and long-term studies are needed to confirm their benefits and safety.

Summary: Chronic stress remains a widespread health challenge linked to diverse disorders. Since conventional methods often prove insufficient, interest in plant-based adaptogens is increasing. These substances not only alleviate symptoms but also regulate key biological systems involved in the stress response. Withania somnifera, Rhodiola rosea and Schisandra chinensis show promising results, and other adaptogens may support comprehensive stress management. Future research should focus on long-term safety, clarification of mechanisms of action, and standardization of formulations. Adaptogens bridge traditional knowledge and modern science, offering natural support for mental health and well-being in today's stressful environment.

KEYWORDS

Adaptogens, Stress, Ashwagandha, Rhodiola rosea, Withania somnifera, Schisandra chinensis

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Introduction

According to the World Health Organization (WHO), stress is defined as a state of worry or mental tension caused by a difficult situation. When stress becomes excessive, it can lead to both mental and physical health problems [1]. Data from the American Institute of Stress indicate that over 70% of people regularly experience stress-related symptoms. The most common sources of stress include health and financial problems, work-related pressure, lack of sufficient sleep, relationship difficulties, and poor nutrition [2,3].

Chronic stress is recognized as a significant risk factor for a range of adverse health outcomes, including gastrointestinal disturbances, cardiovascular conditions, immune system dysregulation, and mental health disorders such as depression and anxiety [4-8]. Consequently, individuals are increasingly seeking methods to mitigate the negative effects of stress on their health. According to a 2018 report assessing the dietary habits of the Polish population, 72% of respondents admitted to using dietary supplements, with 51% reporting daily use. Furthermore, 86% of those surveyed believed that the use of dietary supplements had a beneficial impact on their health [9].

Although many of these ingredients have a long history of traditional use, the effectiveness of a large proportion of them has not been clearly confirmed by clinical studies [10]. Substances known as adaptogens are gaining increasing popularity. Adaptogens are defined as non-toxic substances of plant origin that are claimed to increase “non-specific” resistance to a broad spectrum of adverse biological, chemical, and physical factors, normalize body functions, and strengthen the system compromised by stress [11,12]. They are believed to exert a protective effect on health by counteracting a broad range of environmental stressors and emotional states [12].

To date, more than 100 adaptogenic substances have been identified, among which the most extensively studied are extracts of Withania somnifera (ashwagandha), Rhodiola rosea and Schisandra chinensis [11].

Material and methods

A thorough literature search was conducted using online scientific databases to identify studies relevant to the role of adaptogens in the management of stress, with particular emphasis on chronic stress. The search was primarily performed using the PubMed database, while Google Scholar was additionally used to identify relevant publications that may not have been retrieved through the primary database.

The search strategy employed specific keywords and phrases closely related to the research topic, including adaptogens, stress, chronic stress, ashwagandha, *Rhodiola rosea*, *Withania somnifera*, *Schisandra chinensis*, golden root, arctic root, and roseroot. Various combinations of these terms were used to broaden the search and identify potentially relevant publications.

Publications were screened for relevance to the objectives of the review. Particular attention was given to studies investigating the effects and mechanisms of action of selected adaptogenic plants in relation to physiological and psychological responses to stress. Studies providing relevant experimental, clinical, or mechanistic evidence were considered for inclusion. Publications that were unrelated to the primary research question, duplicated records, or studies with insufficient scientific relevance were excluded.

The selection process consisted of an initial assessment of publication titles and abstracts, followed, where appropriate, by an evaluation of the full text. Emphasis was placed on studies with clearly described methodology, relevant outcome measures, and scientifically supported conclusions. Both experimental and clinical evidence were considered in order to provide a comprehensive overview of the available literature.

A total of 110 articles were initially identified and reviewed. Following the screening and selection process, 55 publications were included in the final analysis based on their scientific relevance, methodological quality, and alignment with the objectives of the study. Importantly, 30 of the selected publications were published after 2020, ensuring that the review incorporated recent findings and current perspectives in the field.

Adaptogens

Adaptogens are pharmacologically active compounds or extracts derived from various classes of plants characterized by their ability to enhance the body's adaptation to stress and maintain metabolic homeostasis [13,14]. At the molecular level, these plant-derived substances regulate cellular metabolism, which facilitates a faster and more efficient response to stress, thereby supporting the maintenance of homeostasis [15,16].

The consumption of adaptogens has been associated with improvements in both physical and mental performance [16,17,18,19, 20]. Kucharska conducted a study involving 300 Polish participants, including 76% women and 24% men. The respondents answered a survey regarding the frequency of using plant-based adaptogenic supplements and their perceived impact on psychophysical well-being. Nearly two-thirds of the participants reported a general improvement in their overall functioning as a result of adaptogen use [21].

The effects of plant adaptogens are attributed to a complex mixture of biologically active compounds they contain [16]. Their mechanism of action is primarily based on the regulation of the hypothalamic-pituitary-adrenal (HPA) axis and the modulation of stress mediators [18,19,20, 22]. Due to their unique properties, these substances have been increasingly used for both therapeutic and preventive purposes, supporting overall health and well-being [16,18].

Although plant-based adaptogens have been used for centuries, their mechanisms and effects are still being investigated. Nonetheless, they demonstrate promising potential for broader application in the future [16].

Ashwagandha

Withania somnifera (L.) Dunal, commonly known as ashwagandha, belongs to the Solanaceae (nightshade) family and is recognized for its wide range of pharmacological effects [23]. Numerous studies have demonstrated its beneficial role in stress reduction [17, 22, 24, 25]. Interest in ashwagandha has been steadily increasing. The National Institutes of Health Office of Dietary Supplements reported that over 1,300 products containing *Withania somnifera* are currently available on the U.S. market [11, 26]. According to Smith et al., consumer spending on ashwagandha supplements rose by 225.9% in 2021 compared to the previous year, reaching a total of \$92,326,926—an increase of nearly \$64 million from 2020 [27].

A comprehensive review of preclinical and clinical studies indicates that ashwagandha exerts anti-stress and anxiolytic effects primarily through modulation of the hypothalamic–pituitary–adrenal (HPA) axis and the sympathoadrenal system, as well as through its influence on GABAergic and serotonergic pathways [26]. In a

randomized, double-blind trial involving 40 participants over a 42-day period, supplementation with ASVAMAN extract—containing ashwagandha—resulted in a significant reduction in serum cortisol levels and improved performance in a six-minute walk test [28]. Cortisol, a hormone released in response to stress, plays a key role in regulating inflammation and blood glucose levels [29]. A pivotal study by Lopresti et al. investigated the effects of 240 mg of standardized ashwagandha extract (Shoden®) administered daily for 60 days in 60 adults reporting high levels of stress. The results revealed a statistically significant reduction in anxiety scores, as measured by the Hamilton Anxiety Rating Scale (HAM-A), along with a marked decrease in morning cortisol and DHEA-S levels [10]. A 2023 systematic review including nine clinical trials and a total of 558 participants confirmed that ashwagandha significantly reduces stress, anxiety, and cortisol levels when compared to placebo [24].

However, it is important to note that *Withania somnifera* contains over 140 distinct compounds and requires various extraction methods, which contributes to considerable heterogeneity in formulations and complicates objective assessment of its efficacy for specific indications [30,31]. Nevertheless, future research should include long-term clinical studies and consider the effects of varying dosage regimens [32].

Table 1. Effects of Ashwagandha

Effect	References
Hematopoietic	[33]
Anti-stress	[10,33]
Antioxidant	[33]
Adaptogenic	[23,33]
Immunomodulatory	[33]
Improved physical performance	[34,35]
Fatigue reduction	[36]
Enhanced recovery	[36]
Cortisol reduction	[28]
Anti-inflammatory	[37]
Anticancer	[38]
Neuroprotective	[26,39]
Hormonal regulation	[40]
Anxiolytic	[23,26,37]

Rhodiola rosea

Rhodiola rosea L., commonly referred to as „golden root”, „arctic root” or „roseroot,” belongs to the Crassulaceae family [18, 41]. In recent years, it has gained significant popularity due to its procognitive, anxiolytic, antidepressant, and sleep-promoting properties. Its mechanisms of action involve modulation of monoaminergic neurotransmitters such as serotonin and catecholamines, as well as opioid peptides including beta-endorphins [18, 42-44]

Research has also demonstrated that low to moderate doses of *R. rosea* can stimulate serotonin, norepinephrine, and acetylcholine receptors within the central nervous system [45]. Additionally, it exhibits cardioprotective and neuroprotective effects by reducing the release of corticotropin-releasing factor (CRF) under stress conditions, lowering corticosterone levels, and enhancing the expression of stress-responsive genes, particularly in the hippocampus and prefrontal cortex [22,25,42]. Due to these effects, *Rhodiola rosea* is widely used for stress reduction [31,46]. Edwards et al. conducted a multicenter, non-randomized, open-label, single-arm clinical trial to evaluate the therapeutic effects and safety of a four-week treatment with *Rhodiola*

rosea extract in 1,375 individuals experiencing life stress. A subgroup of 111 participants received the investigational product at a dose of 200 mg twice daily for four weeks. The outcomes were assessed using seven standardized questionnaires. Clinically significant improvements in stress-related symptoms were observed, with notable effects emerging as early as three days into treatment and persisting throughout the 1- and 4-week evaluation points. The *Rhodiola rosea* WS 1375 extract was found to be safe and generally well tolerated. Adverse events were mostly mild, and no serious adverse effects were reported. These results suggest that a 200 mg dose administered twice daily is both safe and effective in clinically reducing symptoms of life stress [31, 47]. In another study, Cropley et al. investigated the effects of *Rhodiola rosea* extract on self-perceived anxiety, stress, cognitive disturbances, and mood-related issues in 80 participants. Individuals underwent self-assessment and cognitive testing during four sessions over a 14-day period. Compared to the control group, those receiving *Rhodiola rosea* experienced significant reductions in anxiety, stress, anger, confusion, and depressive symptoms, along with a noticeable improvement in overall well-being. The extract also demonstrated a favorable safety and tolerability profile [48].

To fully understand the potential therapeutic applications of *Rhodiola rosea* extract, further high-quality clinical research is needed—particularly randomized, multicenter, double-blind, placebo-controlled trials. Given its broad spectrum of biological activities, *Rhodiola rosea* may become an important tool in the treatment of various health disorders in the future [16].

Schisandra chinensis

Schisandra chinensis is a medicinal plant whose fruits have been widely used in traditional Chinese medicine for centuries. They have historically been employed to manage a variety of conditions, including gastrointestinal disorders, respiratory insufficiency, cardiovascular diseases, fatigue and general weakness, excessive sweating, and insomnia [49,50]. The fruits have also been reported to possess appetite-suppressing properties, contribute to delaying age-related decline, enhance vitality, and support mental well-being [49,51].

Xia et al. investigated the effects of *Schisandra chinensis* and *Rhodiola rosea* in a rat model of prolonged stress. The study included 40 male rats exposed to a 5-hour stress protocol. During the experiment, the animals were placed in a floating container for 10 minutes while simultaneously being exposed to a predatory threat from two cats housed in cages approximately 0.75 m away. Immediately afterward, the rats completed a 10-minute high-intensity treadmill running session. The results demonstrated that treatment with *S. chinensis* and *R. rosea* significantly attenuated the stress-induced elevation of hypothalamic corticotropin-releasing hormone (CRH) and circulating corticosterone levels [22].

Kim et al. evaluated the protective effects of *Schisandra chinensis* against heat stress using bioactivity and gene expression analyses in Sprague–Dawley (SD) rats. Heat stress markedly upregulated the expression of genes associated with the heat stress response, whereas administration of *S. chinensis* significantly suppressed the expression of these genes. Likewise, genes involved in oxidative stress were expressed at substantially lower levels in the *S. chinensis*-treated group compared with the heat-stressed controls. In addition, oral administration of *S. chinensis* resulted in a greater reduction in malondialdehyde (MDA) concentrations than heat stress alone. These findings suggest that *S. chinensis* exerts a protective effect against heat-induced stress, most likely through its potent antioxidant activity and its ability to inhibit lipid peroxidation [52].

The effects of combining *Schisandra chinensis* with other adaptogenic plants have also been investigated in the context of stress reduction. Sun et al. reported that co-administration of *Schisandra chinensis* (SC) and *Acanthopanax senticosus* (AS) alleviated anxiety-like behaviors, reduced circulating corticosterone and adrenocorticotrophic hormone (ACTH) levels, suppressed the release of the pro-inflammatory cytokines IL-1 β , IL-6, and TNF- α , modulated dopamine and serotonin concentrations in the hippocampus, and attenuated neuronal damage [53].

Another study examined the individual and combined anti-stress effects of *Schisandra chinensis* and *Scutellaria baicalensis* root extract. Mice were subjected to a 5-day stress protocol involving immobilization and repeated electric foot shocks. The herbal extracts were administered for seven consecutive days before stress exposure and again prior to each stress session. Treatment with the extracts significantly reduced serum corticosterone levels, indicating a protective effect against stress-induced activation of the hypothalamic–pituitary–adrenal (HPA) axis [54].

Discussion

Chronic stress is an important risk factor for a wide range of physical and psychological disorders, including cardiovascular and gastrointestinal disturbances, immune dysregulation, anxiety, and depression [1–8]. The growing interest in dietary supplements and plant-based products reflects the search for complementary approaches to stress management [9]. Among these, adaptogens have attracted particular attention because of their proposed ability to support the body's adaptation to stress and maintain physiological homeostasis [11–16].

The mechanisms of action of adaptogens appear to be multidirectional and involve modulation of the hypothalamic–pituitary–adrenal (HPA) axis, neurotransmitter systems, oxidative stress, and inflammatory processes. These properties may explain their potential effects on both the psychological and physiological manifestations of stress [13–20,22].

Among the adaptogens reviewed, *Withania somnifera* (ashwagandha) has one of the strongest bodies of clinical evidence. The plant has traditionally been used for its broad range of pharmacological properties [23], while contemporary studies suggest anti-stress, anxiolytic, antioxidant, anti-inflammatory, neuroprotective, and physical performance-related effects [26,33–40]. Clinical trials have demonstrated reductions in perceived stress, anxiety, and cortisol concentrations following supplementation with standardized ashwagandha preparations [10,24,28]. These effects are consistent with the proposed influence of *Withania somnifera* on the HPA axis and sympathoadrenal system, as well as on GABAergic and serotonergic pathways [26]. However, considerable variability in the chemical composition of *Withania somnifera* extracts remains an important limitation. The plant contains numerous biologically active compounds, and differences in extraction methods and standardization may affect the efficacy and reproducibility of individual preparations [30–32].

Rhodiola rosea also demonstrates promising anti-stress properties. The plant, commonly referred to as „golden root”, „arctic root,” or „roseroot” has been investigated for its effects on stress, mood, cognitive function, and fatigue [18,41]. Its proposed mechanisms of action include modulation of serotonergic and catecholaminergic neurotransmission, effects on opioid peptides, and regulation of neuroendocrine mechanisms involved in the stress response [42–45]. Clinical studies have reported reductions in stress, anxiety, anger, confusion, and depressive symptoms, together with improvements in overall well-being [31,47,48]. The generally favorable tolerability observed in these studies is encouraging; however, the relatively limited number of high-quality randomized controlled trials and methodological differences between studies limit the strength of the available evidence [31,48].

In contrast to *Withania somnifera* and *Rhodiola rosea*, the evidence concerning *Schisandra chinensis* is less extensive and is derived predominantly from experimental studies. The fruits of this plant have been used in traditional Chinese medicine for centuries, including for fatigue, insomnia, respiratory and cardiovascular disorders, and general weakness [49–51]. Experimental studies suggest that *Schisandra chinensis* may attenuate stress-induced increases in CRH and corticosterone and may exert antioxidant and neuroprotective effects [22,52]. Studies investigating combinations of *Schisandra chinensis* with other adaptogenic plants have additionally demonstrated reductions in anxiety-like behavior, corticosterone and ACTH levels, pro-inflammatory cytokines, and neuronal damage [53,54]. Although these findings support its potential anti-stress activity, the predominance of animal studies means that their clinical relevance in humans requires further confirmation.

An important finding from the reviewed literature is that adaptogens may affect both subjective manifestations of stress and biological markers associated with the stress response. Changes in cortisol, corticosterone, ACTH, CRH, pro-inflammatory cytokines, and oxidative stress markers have been reported in clinical and experimental studies [10,22,28,52–54].

The present review has several limitations. The literature search was conducted primarily using PubMed, with additional publications identified through Google Scholar, which may have resulted in the omission of some relevant studies. Furthermore, the included publications differed considerably in methodology, sample size, intervention duration, dosage, and outcome measures. Evidence concerning *Schisandra chinensis* is also less clinically developed than that for *Withania somnifera* and *Rhodiola rosea* [22,52–54]. These limitations highlight the need for larger, randomized, double-blind, placebo-controlled clinical trials using standardized preparations and clinically meaningful outcome measures.

Overall, the available evidence supports the potential role of *Withania somnifera*, *Rhodiola rosea*, and *Schisandra chinensis* as complementary agents in stress management. The strongest evidence currently concerns *Withania somnifera* and *Rhodiola rosea*, particularly regarding perceived stress, anxiety, fatigue, and cortisol regulation [10,24,28,31,47,48]. *Schisandra chinensis* remains a promising candidate, particularly

because of its potential antioxidant and neuroprotective properties, but further human studies are required [22,52–54]. Future research should focus not only on efficacy but also on long-term safety, optimal dosage, potential drug interactions, mechanisms of action, and standardization of extracts [30–32]. Adaptogens may therefore represent a valuable component of a comprehensive approach to stress management, but they should not replace established psychological, behavioral, or medical interventions [4–8].

Conclusions

The present review indicates that *Withania somnifera*, *Rhodiola rosea*, and *Schisandra chinensis* show promising potential as complementary agents in stress management. Their effects are likely mediated through multiple mechanisms, including modulation of the hypothalamic–pituitary–adrenal (HPA) axis, neurotransmitter systems, oxidative stress, and inflammatory processes [13–20,22].

The strongest evidence currently supports the use of *Withania somnifera* and *Rhodiola rosea*, particularly for reducing perceived stress, anxiety, and fatigue and for regulating cortisol levels [10,24,28,31,47,48]. *Schisandra chinensis* also demonstrates potential anti-stress, antioxidant, and neuroprotective effects; however, the available evidence is predominantly based on experimental studies, and further clinical research in humans is required [22,52–54].

Despite the promising findings, substantial differences in the composition and standardization of preparations, dosage, intervention duration, and study methodology limit definitive conclusions regarding the efficacy of individual adaptogens [24,30–32,48]. Future research should therefore focus on long-term efficacy and safety, optimal dosing, potential drug interactions, mechanisms of action, and the standardization of extracts [30–32].

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