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Family and health

Investigating the effect of adaptogens on anxiety, stress and injury: a systematic review

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Abstract:

Introduction: Adaptogens are a group of plants known for their innate ability to fortify the body's nervous system. They achieve this by influencing the hypothalamus-pituitary-adrenal axis, regulating cortisol secretion (stress hormone) and enhancing endorphin production. By bolstering the body's resilience against fatigue, adaptogens hold promise in improving the overall quality of life. However, it is imperative to substantiate their efficacy through rigorous scientific investigation, thereby fostering tranquility and enhancing societal well-being. Consequently, this study aims to examine the impact of utilizing plant adaptogens on three key phenomena: anxiety, stress, and fatigue.

Method: The current study takes the form of a comprehensive systematic review, where an assortment of trials and studies were meticulously gathered using well-defined search terms. These were sourced from both internal and external databases, with a particular emphasis on article titles. The inclusion criteria encompassed articles published in either English or Farsi between the years 2000 to 2023. Moreover, the focus primarily revolved around the clinical trial aspect. Additionally, the articles selected for analysis were those that involved a combined intervention of chemical medicine. To aid in the screening and management of resources, EndNote version 7 software was employed diligently.

Findings: Out of the 2707 pertinent articles, a meticulous examination led to the inclusion of 27 fully qualified articles in this study. The comprehensive evidence substantiates the efficacy of botanical adaptogens in bolstering performance, enhancing the body's resilience against fatigue, and fostering mental well-being in the face of stress.

Conclusion: By affording appropriate opportunities for the utilization of these plants in the human diet or medicinal formulations, a significant stride is taken towards enhancing the collective mental well-being of society.

Keywords: adaptogens, anxiety, fatigue, stress

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Introduction:

The term "adaptogen" emerged in the clinical and scientific realm in the late 1940s, attributed to a Russian toxicologist named Lazarus. In 1947, Lazarus defined an adaptogen as a synthetic compound that enhances resistance to stress. The essence of an adaptogen lies in its ability to: a) augment the body's resilience against physical, chemical, and biological stressors such as anxiety, fatigue, and stress; b) exert a normalizing influence regardless of the stressor's origin; and c) ensure its effects are harmless, without disrupting normal bodily functions beyond necessity [3].

An adaptogen, by definition, refers to a plant-derived substance possessing antioxidant properties that fortify the body's resistance against stressors, injuries, blood sugar imbalances, anxiety, weakness, and fatigue [4]. These adaptogens fall into two main categories: plant-based adaptogens and synthetic adaptogens, the latter also known as active preservatives. While plant adaptogens have been employed since ancient times [5], herbalists commonly use phytoadaptogens (often referred to as "adaptogens") as herbal remedies to mitigate the adverse impact of chronic stress on overall health [6]. Herbal adaptogens serve to enhance the body's stamina and mitigate stress and anxiety-related disorders. By regulating stress hormones, such as cortisol, and other detrimental psychological factors, these adaptogens aid in maintaining equilibrium [7].

On the other hand, humans have long grappled with challenges such as anxiety, stress, and fatigue, seeking remedies to alleviate and overcome these issues [8]. A survey reveals that a significant percentage of individuals experience social anxiety disorder (ranging from 20% to 70%), panic disorder (50%), post-traumatic stress (48%), and general anxiety (43%) at some point in their lives [9]. The urgency to discover novel and natural solutions to manage and reduce these afflictions arises from the fact that they all have detrimental effects on overall quality of life, causing profound harm to the body, mind, social relationships, and professional and educational pursuits. They hinder the attainment of holistic well-being [8].

Anxiety and stress manifest through various symptoms, including premature fatigue, irritability, muscle tension, sleep disturbances, impaired social and occupational functioning, apathy, anhedonia, diminished concentration and attention, palpitations, and restlessness [10]. Moreover, stress and anxiety are recognized as triggers for numerous conditions, such as neurological disorders (e.g., Alzheimer's disease), cardiovascular ailments (e.g., hypertension and heart disease), and lifestyle diseases (e.g., diabetes and obesity). Given our current stress-laden lifestyles, effective management strategies should encompass a range of adaptogens devoid of adverse effects. Conventional pharmaceuticals, on the other hand, have demonstrated side effects and the potential for dependency [11]. Thus, interventions for these phenomena necessitate the utilization of adaptogens, which offer a promising avenue with minimal side effects [12].

While adaptogens are presently utilized in traditional practices by a segment of the population, their effectiveness necessitates scientific and systematic studies and research to validate their efficacy. Given the aim of minimizing side effects and drug resistance, it appears more reasonable to explore the utilization of these natural medicinal substances as opposed to artificial compounds. Additionally, considering the extensive historical usage of medicinal and herbal plants spanning thousands of years, investigating the role of these plants in anxiety, stress, and fatigue has captivated the attention of numerous researchers. However, comprehensive investigations are required to ascertain the effects of these plants. Should they prove efficacious, these plants may serve as suitable alternatives to chemical drugs, given their minimal or nonexistent side effects. Moreover, with the growing

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population and the emergence of numerous challenges in people's daily lives, culminating in anxiety and stress with their deleterious consequences, it becomes imperative to regulate and attenuate their effects in order to foster tranquility and ultimately enhance societal quality of life. Notably, no comprehensive study has been conducted in this realm thus far, and disparate studies have identified various adaptogens as influential factors in anxiety, depression, and fatigue. Consequently, this study endeavors to conduct a systematic review of prior research to identify effective adaptogens.

Method:

The present study constitutes a systematic review that encompasses a comprehensive examination of various trials and studies conducted on the effects of adaptogens on stress, anxiety, and fatigue. The search for relevant literature included English sources and information databases such as PubMed, EMBASE, SCIENCE DIRECT, MEDLINE, SCOPUS, CHEMICAL ABSTRACTS, Google Scholar, Web of Science, as well as Persian sources in the SID information bank. The search utilized specific keywords such as Adaptogen, Ectoprotectors, plant adaptogens, Panax ginseng, adaptogen hydroxyecdysone, Eleutherococcus senticosus, Schisandra chinensis, Leuzea carthamoides, Rhodiola rosea, Rhaponticum carthamoides, Eukaryota, Viridiplantae, Streptophyta, Embryophyta, Tracheophyta, Magnoliopsida, Araliaceae, Eleutherococcus, and various combinations thereof. Additionally, the search included terms like Adaptogenic properties of ginseng, adaptogenic properties, adaptogenic properties of carthamoid, adaptogenic properties of ecdysterone, Fatigue, Mental Fatigue, Alert Fatigue, Health Personnel, Compassion Fatigue, Overtraining Syndrome, Psychological Stresses, Stresses, Life Stresses, Psychological Stressor, Crowding, Life Change Events, Behavior and Behavior Mechanisms, Behavioral Symptoms Stress, Burnout Psychological, Burnout Professional, Caregiver Burden, Stress, Occupational Stress, Historical Trauma, along with their Persian equivalents. The search spanned the years 2000 to 2023, encompassing all articles published during this 23-year period. This meticulous approach aimed to retrieve a comprehensive collection of records pertaining to the history, properties, and applications of plant adaptogens.

In the initial phase of the screening process, our focus was on identifying eligible studies that met specific criteria. Articles with language restrictions were taken into consideration. The study selection criteria included the following:

1. The presence of trials and studies on adaptogens.

2. Examination or explanation of the effects of trials and studies on fatigue, anxiety, and stress.

3. Conducted within the timeframe of 2000 to 2023.

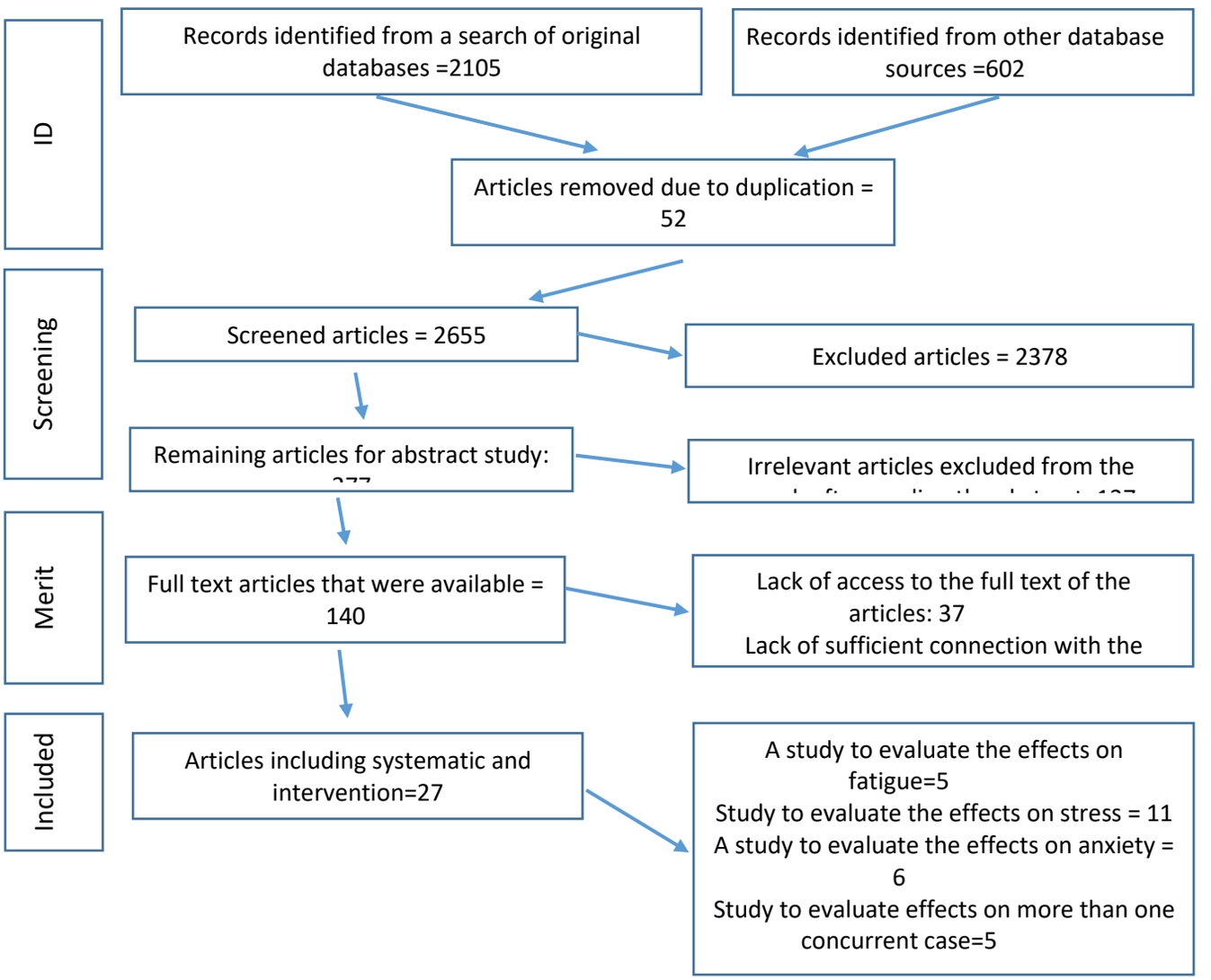
4. Emphasis on clinical trial studies.

5. Publication in either English or Farsi.

On the other hand, we excluded studies that involved interventions combining chemical drugs. Our aim was to solely focus on adaptogenic plants and their therapeutic dimensions and effects.

Moving to the second step, we followed the systematic review framework outlined by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) as our guide [13]. This

framework ensured a structured and comprehensive approach to conducting the systematic review, as depicted in the following:



In the third stage of our study, we proceeded to select articles deemed worthy for inclusion. Out of the total of 2707 articles identified (2112 in English and 595 in Persian), we carefully screened 277 related articles based on their abstracts. After thorough screening, 137 articles were excluded due to their focus on irrelevant outcomes, leaving us with 140 full-text articles. Ultimately, 27 articles met the eligibility criteria and were included in our systematic review.

Findings:

Based on our findings, we discovered that studies conducted on adaptogens, particularly the cow's tongue flower extract, have demonstrated reduced anxiety-like behaviors in rats [14-15]. Sayah and colleagues found that the use of cow's tongue plant also led to a reduction in anxiety symptoms in mice [14]. Furthermore, research has indicated that the aqueous extract of cow's tongue flower can reduce blood pressure and heart rate [16]. These studies collectively suggest that cow's tongue has

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potential in reducing anxiety, stress, blood pressure, and heart rate.Additionally, Erfani et al. explored the effects of the herbal drug Hyperian on students' anxiety and stress, revealing a positive impact in reducing anxiety in the experimental group [17]. Similarly, Rezaei et al. found that flower extract of Rai possesses calming, anti-anxiety, and stress-relieving effects [18]. Stanley et al. conducted a study demonstrating that lavender scent can effectively reduce anxiety and pre-operative stress in cataract surgery patients [19]. Kuchta et al. discovered that kava plant can alleviate anxiety disorders in elderly individuals [20].Holy basil, known for its various chemical compounds, including oleanolic acid, rosmarinic acid, ursolic acid, eugenol, linalool, carvacrol, elemen, caryophyllene, and germacrene, has been shown to improve swimming time and exhibit anti-stress effects in a study by Maitio and colleagues [22]. This adaptogen is revered as the "queen of plants," "unique," and the "mother of nature's medicine" due to its numerous advantages. Holy basil aids in adapting to stimuli and maintaining physiological homeostasis [23].Rhodiola rosea, a traditional medicine with significant antioxidant properties, has been extensively studied in clinical treatments. Phytochemical analysis has revealed the presence of phenylpropanoids, phenylethanol/benzyl alcohol derivatives, flavonoids, cyanogenic glycosides, and terpenoids in this plant [24]. Parisi et al. conducted a placebo-controlled study to investigate the long-term effects of Rhodiola rosea supplementation on physical performance and endurance. The results showed that Rhodiola rosea significantly improved physical performance by reducing free fatty acids in the body plasma [25]. Cropley et al. found that individuals with mild anxiety responded positively to Rhodiola rosea [26]. In a study by Mao et al., participants with anxiety and stress disorders were administered adaptogenic herbs in supplement and tablet forms, resulting in significant anti-anxiety and stress effects [27].

The study conducted by Talbot et al. reveals that daily supplementation with Tongat root extract enhances stress hormone regulation and improves certain mood parameters. Traditional treatment studies also support the notion that this approach of safeguarding the body against the detrimental effects of stress aids in combating chronic and modern-day stressors, including those arising from diet and lack of sleep. Extensive laboratory research, animal nutrition studies, and human supplementation have confirmed the wide range of health benefits associated with Tongat Ali root extract, including improved physical performance, reduced fatigue, increased energy, enhanced mood, and a sense of well-being. Consequently, Tongat Ali has been utilized in traditional medicine and Southeast Asian medical systems for centuries to alleviate lethargy, manage stress, and enhance psychological well-being in individuals facing various modern stressors. Moreover, Tongat Ali aids in restoring hormonal balance by regulating cortisol and testosterone levels [28].

The primary aromatic compound in saffron is safranal, which constitutes approximately 60% of the volatile components of saffron. While this substance exists as stable picrocrocin in fresh saffron, it decomposes into the volatile safranal aldehyde over time and when exposed to heat [29]. Akhundzadeh et al. compared the efficacy of saffron plant extract with imipramine, a commonly prescribed antidepressant, in the treatment of mild to moderate depression. The research findings demonstrated that saffron extract exhibited comparable effectiveness to imipramine without the associated side effects [30]. Studies have also confirmed the anti-anxiety, stress-reducing, and fatigue-alleviating effects of saffron through the consumption of both aqueous and ethanol extracts, as well as saffron petals. These effects can be attributed to the presence of compounds such as crocin and safranal, which play a pivotal role in the antidepressant effect of saffron extract. Crocin inhibits

the reabsorption of dopamine and norepinephrine, while safranal inhibits the reabsorption of serotonin [31].Ashwagandha, a well-known adaptogen, exerts a significant impact on stress management and has the potential to restore a balanced lifestyle by reducing stress and preventing the onset of various life-threatening diseases. Recent studies have extensively explored the effects of Ashwagandha. Vitania et al. conducted a study on mice to evaluate the anti-stress properties of Ashwagandha root extract, and the results demonstrated that Ashwagandha enhanced the body's resistance to stress and improved immunity [32]. Another article revealed that rats pre-treated with an aqueous suspension of Ashwagandha root extract exhibited reduced levels of adrenal cortisol and ascorbic acid, indicating decreased stress levels [33]. Ashwagandha holds significant medicinal value and consistently affects human health. Research findings indicate that eight weeks of Ashwagandha root aqueous extract consumption significantly reduces stress levels and improves overall quality of life. Therefore, utilizing this medicinal plant as a supplement to manage stress and anxiety proves to be an excellent alternative [11].Ginseng extract is widely available in numerous products, with many being utilized as food supplements and others in medicinal forms. Ginseng root is included in European and US pharmaceuticals, and it typically possesses a cylindrical shape, occasionally branching, with a length of up to 20 cm and a diameter of 2.5 cm. In white ginseng, the surface appears pale yellow or cream, while red ginseng exhibits a red-brown hue. The lower portion of white ginseng is abundant in roots, which are generally absent in red ginseng. When transformed into powder form, it assumes a bright yellow color [34]. Additionally, Siberian ginseng, introduced by Porfiry Krylov in the 19th century, is among the other adaptogens that have been discovered. Its extract aids in adapting to external factors, improving mental and physical conditions, and enhancing memory functions [36-37]. The extensive research conducted on potent adaptogens such as ginseng, Maral plant, and Rhodiola rosea underscores their remarkable and multifaceted roles. Further details regarding adaptogen studies can be found in the provided tables.

Table 1 provides a summary of various studies that highlight the primary benefits associated with the consumption of white ginseng and Siberian ginseng extracts.

Table 1*:* Panax ginseng studies.

Study Objectives	Study Design	Main Results	References
Evaluation of the effects on subjective mood and memory of a single and sub-chronic *Panax ginseng* dose.	Thirty adults, aged 22.87 ± 4.01 years, participated in the study. They received a placebo, 200 or 400 mg *Panax ginseng* extract per day for 3 treatments—8 days with 6 days washout. Period of the study—32 days.	Improved calmness, mood, and mental health.	[38]
Examine the effects on endurance performance of acute supplementation of *Panax ginseng*.	Twelve men, aged 20–24 years, participated in the study. All participants received 200 mg ginseng extract or a placebo one hour before the exercise.	Increased endurance time, blood glucose and insulin levels, catalase, superoxide-dismutase, and total	[39]

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Study Objectives	Study Design	Main Results	References
Evaluation of benefits on fatigue in multiple sclerosis with *Panax ginseng* treatment.	Fifty-two women, aged 18–50 years, participated in the study. There were 26 participants who received 500 mg daily of Korean ginseng tablets and 26 were in the placebo group.Period of the study—3 months.	Reduced fatigue. Improved quality of life.	[40]
Evaluation of the efficacy of a combination of *Panax ginseng* and vitamins on physical and mental stress.	One-hundred and fourteen women and men, aged 30–60 years, participated in the study. There were 59 participants who received 200 mg daily of ginseng dried extract and vitamins; 55 were in the placebo group. Period of the study—8 weeks.	Increased quality of life, without a difference in blood pressure and heart rate.	[41]
Evaluation of the effects of *Panax ginseng* on sleep.	Fifteen men, aged 19–25 years, participated in the study. There were eight participants who received 4.5 g of ginseng extract daily; seven participants were in the placebo group. Period of the study—2 weeks.	Increased deep sleep. Decreased shallow sleep.	[42]
Evaluation of anti-fatigue effects of *Panax ginseng*.	Eighty-eight men and women 20–60 years of age participated in the study. There were 30 participants who received 1 g of ginseng extract daily; 29 participants had an intake of 2 g of ginseng extract daily. There were29 participants who were in the placebo group. Period of study—2 months.	Reduced the severity of fatigue. Increased glutathione reductase and total glutathione.	[43]
Examine the effects of Eleutherococcus senticosus extract on physical working capacity.	Six men, aged 21–22 years, participated in the study. They were in the control group, placebo group, and the group that received 2 mL ethanol extract (125 mg dried extract) Eleutherococcus senticosus twice daily. Period of study—8 days.	Increased maximal oxygen uptake, oxygen pulse, total work, and exhaustion time.	[44]
Examine the effects of a dietary supplement containing Eleutherococcus senticosus extract on burnout symptoms.	Eighty-seven volunteers, aged 27–63 years, participated in the study. There were 44 participants who had an intake of 100 mg dry extract from Eleutherococcus senticosus; 43 were in the placebo group. Period of study—12 weeks.	Decreased fatigue score and Beck depression.	[45]

Study Objectives	Study Design	Main Results	References
Assessment of the impact of Eleutherococcus senticosus on quality of life.	Twenty volunteers, aged over 65 years, participated in the study. There were 10 participants who received 300 mg/day Siberian ginseng extract and 10 participants who were in placebo group. Period of study—2 months.	Improved mental health and social functioning, but prolonged use decreased these improvements. Blood pressure was not affected.	[46]

The research findings indicate that the consumption of white ginseng extracts yields numerous benefits, including heightened energy levels, increased strength, and reduced fatigue. Moreover, the consumption of white ginseng extract not only enhances physical power but also improves cognitive function and memory, while alleviating conditions such as physical and mental stress and anxiety. Importantly, the consumption of white ginseng extract is not associated with any significant side effects [38 and 47]. Similarly, the findings highlight that the consumption of Siberian ginseng supports physical performance, reduces fatigue, and promotes mental well-being by mitigating the effects of stress and anxiety. Furthermore, long-term consumption of Siberian ginseng extract does not pose any serious side effects [44-48].

Another noteworthy adaptogenic plant is the Maral plant extract, known by its scientific name. This extract offers various beneficial effects on human health, such as increased physical endurance and performance against fatigue, neuroprotective properties, and the ability to facilitate adaptation to diverse stressors that the body may encounter [49].

Table 2 provides a comprehensive overview of studies investigating the utilization and effects of Maral plant extract.

Table 2: Rhaponticum carthamoides studies.

Study Objectives	Study Design	Main Results	References
Evaluation of the effects of an increased dose of *Rhaponticum carthamoides* during the training process.	Twenty women, aged 25–40 years, participated in the study. There were 12 of them whoreceived 5–15 mg/kg/day ecdysterone; 8 were in controlled group.	Decreased body weight. Increased physical endurance and performance. Improvement of cardiac and cognitive function.	[50]
Examine the effect of ecdysterone-containing products on sport physical exercises.	Forty-six men, aged 25.6 ± 3.7 years, participated in the study. There were 12 participants whohad an intake of 200 mg ecdysterone; 10 participants received 800 mg ecdysterone, 12 participants received the placebo, and 12 of the participants were in the control group—they had an	Ecdysterone increased body weight, muscle mass. Increased power and strength of performance. Without negative effects on creatinine, glutamate–oxaloacetate transaminase, gamma-glutamyl transferase,	[51]

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Study Objectives	Study Design	Main Results	References
	intake of 200 mg ecdysterone without training. Period of study—10 weeks.	and glutamate–pyruvate transaminase. Did not affect steroid profile.	
Evaluation of the effectiveness of ecdysterone in athletes.	Twenty-six women aged 18–22 years participated in the study. There were 12 participants who received ecdysterone from 37.5 to 50 mg; 14 participants were in the controlled group. Period of study—9 moths.	Increased VO2 lactate, performance activity.	[52]
Evaluation of the effectiveness of ecdysterone from *Rhaponticum carthamoides* leaves in athletes.	No information—number of participants. The age of the participants ranged between 27–58 years. Participants received 2–3 g *Rhaponticum carthamoides* tea, infusion, tincture, fermented tea without bitterness. Period of study—15 years.	Increased resistance to disease, physical, and mental endurance.	[53]
Assessment of effects of methoxyisoflavone, 20-hydroxyecdysone, and sulfopolysaccharides intake on training adaptation and markers of muscle anabolism and catabolism.	Forty-five men, aged 20.5 ± 3 years, participated in the study. The participants were divided randomly into four groups: the placebo group, the group that received methoxyisoflavone—800 mg daily, the group that received 20-hydroxyecdysone—200 mg/day, and the group that received sulfo-polysaccharides—1000 mg daily. Period of study—8 weeks.	No change in training adaptation and in anabolic and catabolic effect in training.	[54]
Evaluation of the effects of the combination of *Rhaponticum carthamoides* and *Rhodiola rosea* on performance fatigability and reactions before and after training.	Twenty-seven men, aged 22.3 ± 4.1 years, participated in the study. The participants received a 350 mg tablet which contains 70:30 *Rhaponticum carthamoides* extract and *Rhodiola rosea* extract, or a tablet containing	No change in muscle strength and total work.	[55]

Study Objectives	Study Design	Main Results	References
	175 mg maltodextrin, and 175 mg *Rhaponticum carthamoides* and *Rhodiola rosea* extract in ratio 70:30 or placebo.		

The data reveals that the consumption of Maral plant extract elicits anabolic effects, leading to an increase in body mass, augmented muscle strength, and a positive impact on fatigue reduction [56].

Rhodiola Rosea, on the other hand, serves as an adaptogen and exerts its influence by enhancing body endurance, mitigating fatigue, stress, anxiety, and various other disorders [57]. The beneficial effects of Rhodiola Rosea, as supported by studies, have been succinctly summarized in Table 3.

Table 3: Rhodiola rosea studies.

Study Objectives	**Study Design**	**Main Results**	**References**
Studying the effects of short-term supplementation with *Rhodiola rosea*.	Eleven women, aged 19.4 ± 0.8 years, participated in the study. They had an intake of 1.5 g/day *Rhodiola rosea* extract or placebo for 3 days. A 500 mg additional dose of *Rhodiola rosea* extract was taken before each trial.	Increased anaerobic capacity, anaerobic power, and total work. No change in fatigue index.	[58]
Examine hormonal and oxidative stress of *Rhodiola rosea* supplementation and the effects on mental and physical performance.	Twenty-six men participated in the study. Thirteen of them had an intake of 600 mg/day extract of *Rhodiola rosea* and 13 were in placebo group. Period of study—4 weeks.	Improved reaction and response time. Increased antioxidant capacity. Without changes in hormone profile and endurance exercise capacity.	[59]
Examine the levels of inflammatory C-reactive protein and creatinine kinase in blood after intake of *Rhodiola rosea*.	Thirty-six volunteers aged 21–24 years participated in the study. Twelve of them had an intake of 340 mg *Rhodiola rosea* extract twice a day, 12 participants were in the placebo group, and 12 participants were in the control group. Period of study—36 days.	Increased levels of C-reactive protein and creatinine kinase.	[60]
Examine the effects and safety of *Rhodiola rosea* extract for 4 weeks of treatment.	There were 101 women and men, aged 30–60 years, who participated in study. All participants had an intake	Improved mood, stress symptoms, and quality of life.	[61]

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	of *Rhodiola rosea* extract 400 mg/day. Period of the study—1 month.		
Examine the effects of a single dose of standardized *Rhodiola rosea* extract.	There were 121 men aged 19–21 years participated in the study; 41 participants received 370 mg dry extract *Rhodiola rosea*, 20 participants received 555 mg dry extract of *Rhodiola rosea* before test, 40 of participants were in the placebo group, 20 participants were in the controlled group.	Improvement in the anti-fatigue index.	[62]
Examine the effects of standardized *Rhodiola rosea* extract in patients suffering from depression.	Eighty-nine women and men, aged 18–70 years, participated in the study. Thirty-one participants received 340 mg/day extract of *Rhodiola rosea*, 29 participants received 680 mg/day extract of *Rhodiola rosea*, and 29 participants were in the placebo group. Period of study—42 days.	Improved in overall depression, insomnia, somatization, and emotional instability. No improvements in self-belief.	[63]
Evaluating the changes of *Rhodiola rosea* supplementation on muscle damage and inflammation.	There were 48 men and women, aged 25–60 years, who participated in the study. Twenty-four participants received a 300 mg capsule per day containing *Rhodiola rosea* extract, and 24 participants were in the placebo group. Period of study—38 days.	Increased myoglobin, creatine phosphokinase, aspartate aminotransferase, alanine aminotransferase, and interleukin (IL-6, IL-8, IL-10) without a difference in both groups.	[64]
Examine the effects of *Rhodiola rosea* supplementation on selected redox parameters in athletes.	Twenty-two men aged 20.4 ± 1.2 participated in the study. Eleven of them had an intake of 200 mg/day *Rhodiola rosea* extract, and 11 were in the placebo group.Period of study—4 weeks. Decreased levels of superoxide dismutase.	Decreased levels of superoxide dismutase. Increased total antioxidant capacity.	[65]

	Increased total antioxidant capacity.		
Examine the effects of chronic intake of *Rhodiola rosea* on physical performance and antioxidant capacity during exercise in athletes.	Fourteen men, aged 25 ± 5 years, participated in the study. All of the participants received a placebo; after that, all of them received 170 mg *R. rosea* extract for 1 month.	Decreased free fatty acids levels, blood lactate, and creatinine kinase levels. No change in VO2max.	[66]
The efficacy of *Rhodiola rosea* in generalized anxiety disorder.	Ten men and women, aged 34–55 years, participated in the study. All participants had intake 340 mg *Rhodiola rosea* extract per day for 10 weeks.	Decreased scores in Hamilton Anxiety Rating Scale and Hamilton Depression Rating Scale.	[67]

The research findings reveal that Rhodiola Rosa possesses antioxidant and adaptogenic properties. The extract of Rhodiola Rosa not only proves highly beneficial in combating fatigue but also demonstrates great potential for individuals with heart conditions. Notably, the consumption of Rhodiola Rosa does not entail any significant side effects [58-67].

Another noteworthy plant is Schisandra Chinsing, recognized for its adaptogenic qualities and its ability to enhance physical endurance and alleviate bodily fatigue [68-69]. Studies indicate that the use of Schisandra Chinsing extract positively impacts the overall well-being of the body, particularly in mitigating fatigue. Furthermore, the consumption of Schisandra Chinsing extract does not pose any serious side effects [70-71]. Additionally, other studies affirm the positive therapeutic effects of these plants in addressing anxiety, stress, and mood disorders [72-73]. The systematic study conducted by Ishak et al. further establishes the favorable effects of these plants on physical and mental performance, as well as various psychological conditions experienced by individuals [74-75].

Animal studies conducted on these plants demonstrate that, in addition to their anxiety-reducing, stress-relieving, and fatigue-alleviating properties, they possess therapeutic effects, including antioxidant, anti-cancer, anti-diabetic, anti-depressant, neuroprotective, anti-inflammatory, and anti-addictive qualities. The results of various studies also confirm the safety of these plants, with rare and mild side effects, if any. However, caution is advised regarding high doses and long-term usage of medicinal forms and adaptogenic plants due to potential safety risks [76].

In conclusion, there is a growing trend in the use of adaptogens among the general public. Adaptogens have been utilized for medicinal purposes for centuries as natural substances that aid the body in coping with physical and psychological stress, anxiety, and fatigue, while enhancing endurance, strength, and overall performance. Consequently, adaptogens serve as powerful natural remedies for combating stress, anxiety, and fatigue. These natural adaptogens possess the ability to enhance the body's resistance to stress and adapt to various stressors, thereby improving physical endurance against fatigue. The inclusion of these plant extracts in human diets or medicinal products holds great potential for treating chronic fatigue, cognitive disorders, and boosting the immune

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system. Overall, it can be concluded that adaptogenic plants offer favorable therapeutic effects, as demonstrated by individuals participating in various studies and interventions, particularly those suffering from mild anxiety who have benefited from herbal supplements. Furthermore, studies indicate that the use of adaptogenic plant supplements has had positive anti-anxiety and stress-reducing effects. Therefore, incorporating these medicinal plants as supplements to manage stress and anxiety can serve as a valuable alternative option [11].

Considering the fact that modern society is exposed to numerous stressors, anxiety-inducing factors, and excessive fatigue resulting from physical exertion, providing accessible means of utilizing treatment methods, including adaptogens, can significantly improve the mental and physical well-being of society. By reducing stress, anxiety, and fatigue, adaptogens can contribute to a healthier and more balanced society.

Research Limitations:

1. There was a scarcity of studies and clinical trials pertaining to the subject matter of this article. However, comprehensive research from diverse sources was conducted within the defined time frame to minimize this limitation.

2. Studies that involved the use of chemical sedative drugs in addition to adaptogenic plants were excluded from the research.

3. Language limitations were encountered, with articles in languages other than English and Farsi being excluded.

Application of Research:

Given the absence or minimal side effects of adaptogenic plants, their positive effects should be incorporated into people's diets. As a treatment method, they can be utilized as an alternative to chemical drugs in reducing stress, anxiety, and fatigue, thereby promoting better health and well-being within society.

Conflict of Interest:

The responsible author, on behalf of all the authors, affirms that ethical principles were upheld throughout the writing and publication of this article, ensuring the avoidance of plagiarism and data falsification. The authors have not received any financial benefits or compensation for their work. The responsible author further declares that this work has not been published elsewhere and has not been simultaneously submitted to other publications. Additionally, all rights to use the contents, tables, images, etc. have been transferred to the publisher.

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