

HERBAL MEDICINES AS A SAFE ALTERNATIVE TO SYNTHETIC ANXIOLYTICS IN THE TREATMENT OF STRESS AND ANXIETY AMONG SERVICEMEN

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Introduction. According to the recent sociological survey data, 77% of Ukrainians have felt stressed or very nervous, particularly those with manifestations of post-traumatic stress disorder. Respondents name a full-scale war as the dominant reason for this feeling. According to the results of a survey conducted during the first year of the full-scale invasion, 6% fewer respondents reported feeling stressed. Benzodiazepines are the most commonly used class of anxiolytic medications for treating stress and anxiety. However, prolonged use is associated with numerous risks. In this way, doctors and patients are increasingly turning to herbal remedies as a safe alternative to benzodiazepines. This becomes particularly important for military personnel in wartime conditions. Prolonged stress and emotional strain can lead to the development of serious mental disorders. Safe herbal anxiolytics can reduce anxiety, promote psychological resilience, improve the quality of life for military personnel, and allow them to perform their combat missions more effectively without the risk of addiction or impaired concentration caused by the side effects of synthetic preparations.

Purpose. To study and analyse the state of pharmacological research on herbal objects, considering their anxiolytic actions and related constituents. To assess the prospects for practical application of plant-based medications in the treatment of stress and anxiety, for both civilians and military personnel.

Materials and Methods. The bibliosemantic method was used in conducting the research. The study materials included scientific publications in professional journals.

Results. An analysis of the pharmacodynamic and clinical studies on plant-based medicines derived from *Passiflora incarnata* L., *Crataegus* species, *Valeriana officinalis* L., *Matricaria chamomilla* L., and *Withania somnifera* L. was conducted. It was determined that the studied plant-based remedies exhibit anxiolytic activity and demonstrate clinical efficacy in treating anxiety, stress, and related disorders.

Conclusions. Based on the results of the analysis, herbal medicines appear promising for use in the treatment and prevention of stress-related conditions. Depending on the severity of the condition, these herbal remedies could present a safe alternative to synthetic anxiolytics, especially for long-term use. The next phase of research should focus on developing a final medicinal formulation, defining its target quality profile, and outlining a conceptual plan for the manufacturing process.

Keywords: stress, anxiety, anxiolytics, benzodiazepines, plant-based medications, flavonoids.

РОСЛИННІ ЛІКАРСЬКІ ЗАСОБИ ЯК БЕЗПЕЧНА АЛЬТЕРНАТИВА СИНТЕТИЧНИМ АНКСІОЛІТИКАМ В ЛІКУВАННІ СТРЕСУ ТА ТРИВОГИ У ВІЙСЬКОВОСЛУЖБОВЦІВ

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Вступ. Згідно з даними соціологічного опитування, проведеного в 2024 році, 77% опитаних українців відчувають стрес або сильну знервованість, особливо це характерно у осіб із проявами посттравматичного стресового розладу. Домінантною причиною цього відчуття, респонденти називають повномасштабну війну. За результатами опитування проведеного в період першого року повномасштабного вторгнення, про відчуття стресу заявляли на 6% менше опитаних. Бензодіазепіни є найбільш застосовуваним класом анксіолітичних лікарських засобів для лікування стресу та тривоги. Однак з їх тривалим застосуванням пов'язано багато ризиків. Таким чином, лікарі та пацієнти все частіше звертаються до рослинних лікарських засобів в якості безпечної альтернативи безодіазепінам. Особливої важливості це набуває для військовослужбовців у воєнний час. Це пов'язано з тим, що тривалий стрес та емоційне перенапруження можуть призвести до розвитку серйозних психічних розладів. Безпечні рослинні анксіолітики можуть зменшити тривожність, підтримати психологічну стійкість, покращити якість життя військовослужбовців і дозволити їм ефективніше виконувати свої бойові завдання без ризику звикання або погіршення концентрації уваги, викликаних побічними ефектами синтетичних препаратів.

Мета. Вивчити та проаналізувати стан фармакологічних досліджень рослинних об'єктів, з огляду їх анкіолітичної дії та пов'язаних з нею конституантами. Оцінити перспективність практичного застосування рослинних препаратів в лікуванні стресу та тривоги як для цивільного населення, так і для військовослужбовців.

Матеріали і методи. При проведенні дослідження було використано бібліосемантичний метод. Матеріалами дослідження були наукові публікації в фахових виданнях.

Результати. Проведено аналіз фармакодинамічних та клінічних досліджень рослинних препаратів, одержаних з рослин *Passiflora incarnata* L., *Crataegus species*, *Valeriana officinalis* L., *Matricaria chamomilla* L. та *Withania somnifera* L. Встановлено, що досліджувані рослинні об'єкти здатні проявляти анкіолітичну активність та забезпечувати клінічну дію їх препаратів в лікуванні тривоги, стресу та його супутніх захворювань.

Висновки. За результатами проведеного аналізу, можна говорити про перспективність застосування рослинних препаратів в лікуванні та профілактиці стресових станів. В залежності від тяжкості захворювання, дані засоби можуть виступати безпечною альтернативою синтетичним анкіолітикам, особливо за умов довгострокового застосування. Наступним етапом досліджень має стати розробка складу готового лікарського засобу, його цільовий профіль якості та концептуальна схема технологічного процесу.

Ключові слова: стрес, тривога, анкіолітики, бензодіадепіни, рослинні препарати, флавоноїди.

Introduction. Stress is the body's physiological or psychological reaction to internal or external stressors. It can be induced by physical (hunger, thirst, infection) and/or emotional factors (perceived threat, anxiety, concern). Physiologically, the initial response to stress triggers the adrenergic system and the sympathetic-adrenal-medullary (SAM) axis, followed by the activation of the hypothalamic-pituitary-adrenal (HPA) axis. Chronic stress can lead to affective disorders such as depression, schizophrenia, and post-traumatic stress disorder [1].

According to the latest survey report of Ukrainians conducted by Gradus Research from January 10 to 15, 2024, as part of the initiative to establish a National Program for Mental Health and Psychosocial Support, 77% of respondents (N = 2423) reported recently experiencing stress or severe nervousness. The primary cause for feeling stressed or severe nervousness was the full-scale war (72%), indicating that the war can be attributed to the dominant cause of stress. The key aspects of the war identified stress are the safety of loved ones (70%), the risk to life and a high probability of injury (51%), and the threat of property loss (35%). Concerning recent negative mental states, the largest share of respondents mentioned anxiety and tension (52%), low mood (47%), deteriorating sleep (47%), irritation, and anger (42%). According to a survey of experts (N = 73) conducted in the first wave of this study in September 2022, those who experienced changes in physical and emotional functioning most often sought professional help. These changes were manifested through feelings of internal anxiety and tension (90%), emotional instability (80%), worsening sleep quality (73%), physical and emotional exhaustion (70%), irritation and anger

(70%), and panic attacks (69%). It is noteworthy that, based on the results of a survey conducted during the first year of the full-scale invasion, 71% of respondents reported experiencing stress, which is 6% lower than in 2024. Therefore, the search for an effective and safe method to mitigate this indicator remains an urgent issue [2].

Among the most commonly administered classes of anxiolytic medications globally for managing stress and anxiety is the benzodiazepine class. However, prolonged usage of these medications is associated with several risks, including dependence, withdrawal syndrome, and diminished cognitive functions and motor reflexes. Emerging evidence indicates a potential increase in mortality associated with extended use. Due to tolerance and withdrawal symptoms, long-term benzodiazepine administration may result in dose escalation and exacerbation of the underlying condition [3].

Consequently, physicians and patients are increasingly considering plant-based medications as a safer alternative to benzodiazepines for the treatment of stress and anxiety [4]. This is particularly significant for military personnel during wartime, as sustained stress and emotional strain can precipitate severe mental health disorders. The use of herbal anxiolytics assists in reducing anxiety levels, supporting psychological resilience, and enhancing the quality of life for service members. These agents facilitate the effective fulfilment of combat duties without the risk of dependence or impaired concentration commonly associated with prolonged use of synthetic drugs.

Objective. The purpose of this study is to examine and analyse the current state of pharmacological research on plant-derived agents, with a particular focus on their anxiolytic

properties and related active constituents. Additionally, the study seeks to assess the practical potential of plant-based medicines in managing stress and anxiety.

Materials and Methods. This research utilised a bibliosemantic approach, drawing upon peer-reviewed scientific publications in specialised journals.

Results of the Study and Discussion. One of the plant-based agents that may be employed to mitigate the effects of stress is *Passiflora incarnata* (Passionflower). This perennial plant belongs to the Passifloraceae family and possesses documented therapeutic properties. Literature indicates that preparations derived from this plant aid in reducing stress and may thus be beneficial in treating its manifestations, such as insomnia, anxiety, and depression [5]. The majority of published research findings suggest that the anxiolytic effects of the plant's extracts are associated with its phenolic compounds, particularly those within the flavonoid class. The mechanism of action is likely linked to the modulation of the GABAergic system, as flavonoids from Passionflower act as partial agonists at GABA receptors and inhibit the uptake of [3H]-GABA in cortical synaptosomes [6].

Animal studies have shown that prolonged administration of the plant's extracts correlates with decreased stress levels, leading to increased motivation for action and improved locomotor activity [7]. Additionally, positive effects on memory function have been confirmed [8]. The use of Passionflower by individuals with chronic insomnia may have therapeutic effects in treating sleep disorders, memory loss, and neurodegenerative diseases. Preparations derived from this plant may be beneficial in managing insomnia due to their sedative properties, thereby significantly improving the likelihood that individuals experiencing sleep difficulties will fall asleep more readily [9]. Overall, Passionflower extracts demonstrate positive effects during episodes of anxiety, unease, insomnia, and depressive states [10].

Hawthorn (*Crataegus* species) is one of the most important and well-known representatives of the Rosaceae family, commonly used in traditional medicine. This plant is characterised by a variety of pharmacological effects due to the presence of numerous biologically active compounds with antioxidant properties, such as epicatechin, quercetin, rutin, vitexin, and chlorogenic acid [11]. As a rich source of flavonoids, Hawthorn preparations are anticipated to be effective in the treatment and

prevention of oxidative stress-related diseases, including hypertension, hypercholesterolaemia, thrombosis, heart failure, and atherosclerosis [12, 13, 14, 15]. However, it is equally significant to highlight its effective application in relation to stress and associated disorders [16].

It is suggested that oleic acid (OA) from hawthorn can enhance cognitive dysfunction. In an animal experiment, the incorporation of OA into the diet resulted in increased phosphorylation levels of the ERK-cAMP protein, phosphoinositide 3-kinase, and protein kinase B in the hippocampus of mice [17]. It is likely that the aforementioned neuroprotective effects of hawthorn preparations act through the Akt-GSK3 β signalling pathway [18]. Therefore, oleic acid present in hawthorn represents a promising active ingredient in medicinal products aimed at delaying the development of cognitive impairments through the modulation of the Akt-GSK3 β signalling pathway [19].

Valerian (*Valeriana officinalis* L.) is a botanical remedy widely used in medical practice for sedation and anxiolytic purposes. Valerian's typical constituents include iridoids, flavonoids, and mono- and sesquiterpenes from its essential oils [20]. Foundational research on Valerian's pharmacological effects has primarily focused on the interaction of its components with the GABA receptor system, related to its traditional use as a sedative, anticonvulsant, and anti-migraine treatment [21]. Later studies, however, have demonstrated Valerian's ability to alleviate experimentally induced stress [22]. Valerenic acid, a key marker compound in the plant, displays protective effects against both physical and psychological stress by reducing serotonin and noradrenaline metabolism. It has been reported that the administration of valerenic acid can attenuate both physical and psychological responses to stress by reducing the conversion of serotonin (5-HT) to 5-hydroxyindoleacetic acid and noradrenaline (NE) to 3-Methoxy-4-hydroxyphenylglycol sulphate in the hippocampus and amygdala [23]. A randomised, double-blind, placebo-controlled study involving 64 non-clinical volunteers experiencing psychological stress revealed that Valerian extract alters brain connectivity associated with anxiety [24]. Systematic reviews and meta-analyses have affirmed that Valerian could serve as a safe and beneficial source of active pharmaceutical ingredients for use in mono- and combination therapies aimed at treating sleep disorders, anxiety, stress, and related conditions [25].

Chamomile (*Matricaria chamomilla* L.), another widely studied member of the Asteraceae family, has long been used in traditional medicine. Chamomile contains a substantial array of therapeutically active compounds, including sesquiterpenes, flavonoids, coumarins, and polyacetylenes, all considered significant for its medicinal use [26]. Numerous preclinical and clinical studies have examined Chamomile preparations, focusing on their antioxidant, anti-inflammatory, hypoglycaemic, hypolipidaemic, cardioprotective, neuroprotective, and anti-cancer properties, as well as their effectiveness for conditions such as anxiety, sleep deprivation, and depression [27]. In animal models, pilot studies suggest that Chamomile treatment restored behavioural states in stress-exposed mice [28]. Additionally, a study investigating the effects of Chamomile essential oil components on stress, anxiety, and sleep quality found that these compounds reduced measures of these factors. Stress, anxiety, sleep quality, and cortisol levels significantly decreased in the post-study phase compared with pre-test results in the experimental group ($p < 0.05$). Significant effect sizes were noted for anxiety ($d = 1.203$; $\Delta = 1.246$), moderate effect sizes for stress ($d = 0.701$; $\Delta = 0.633$) and sleep quality ($d = 0.888$; $\Delta = 0.732$), while cortisol changes were minimal ($d = 0.374$; $\Delta = 0.357$) [29]. Findings from a randomised, double-blind, placebo-controlled trial assessing the efficacy and tolerability of Chamomile extract in 61 patients with mild to moderate generalised anxiety disorder (GAD) showed a significantly greater reduction in total HAM-A scores for the Chamomile group compared to placebo ($p = 0.047$) [30]. These findings indicate that Chamomile preparations may exert moderate anxiolytic effects in individuals with mild to moderate GAD, providing clinically relevant antidepressant benefits in addition to anxiolytic effects [31].

Ashwagandha (*Withania somnifera* L.), also known as Indian ginseng, is a plant used within the traditional Ayurvedic medicine system of India as an adaptogen, promoting overall physiological homeostasis. Its properties include enhancing concentration, memory, and mood, along with an ability to withstand or adapt to biological, physical, or chemical stressors [32, 33]. As a modulator of stress and anxiety, Ashwagandha has been studied in multiple human trials. Clinical research indicates the beneficial effects of Ashwagandha extracts on stress, anxiety, depression, sleep quality, memory, and concentration, including comparisons with placebo [34, 35, 36, 37]. Consequently, the use of

this plant's medicaments can improve physiological, cognitive, and psychological responses to stress.

In contemporary wartime conditions, military personnel are subject to substantial psychological burdens due to persistent stress, uncertainty, and physical exhaustion. Given these factors, herbal preparations gain importance as a safer alternative to synthetic anxiolytics for reducing stress and anxiety in military populations. Unlike synthetic medications, plant-based treatments present several advantages. Primarily, their safety for long-term use is associated with minimal dependency risk and a reduced incidence of adverse effects, which is particularly crucial for soldiers who may endure stressful conditions over extended periods.

Herbal anxiolytics also present a lower risk of cognitive or physical side effects, enabling military personnel to maintain the high performance and concentration necessary for executing operational tasks. Moreover, the natural origin and accessibility of many plants with anxiolytic properties diminish military personnel's reliance on medical aid in field settings. Specifically, plants such as lemon balm, valerian, passionflower, and lavender can improve sleep, sustain energy levels, and even reduce blood pressure, all of which positively impact overall health under intense physical and psychological pressures.

Incorporating plant-based medications into military field kits may also serve as an effective component of initial psychological support, helping to reduce anxiety without the need for synthetic medications. Thus, herbal anxiolytics not only alleviate anxiety levels but also support the body's resilience to stress factors, aiding military personnel in managing psychological demands more effectively.

Several plant-derived preparations, including *Passiflora incarnata*, hawthorn, *Valeriana officinalis*, *Matricaria chamomilla*, and *ashwagandha*, demonstrate substantial therapeutic potential in mitigating stress-related symptoms. Their therapeutic effect is attributed to bioactive compounds interacting with various bodily systems: influencing GABA receptors, exhibiting antioxidant properties, and engaging in signalling pathways that uphold cognitive and psycho-emotional functions. Research has confirmed that these plants can reduce anxiety levels, enhance sleep quality, alleviate symptoms of depression, and bolster resilience against stress, which positions them as promising interventions for military personnel.

Conclusions:

The full-scale war has led to a notable rise in stress and anxiety levels among the Ukrainian population, emphasising the need for optimal pharmacological interventions.

1. Benzodiazepines remain the most widely used class of anxiolytics for stress and anxiety management among military personnel worldwide. However, prolonged usage is associated with significant side effects and risks.

2. Findings from published pharmacological studies underscore the potential of plant-based medications as a safe alternative to

benzodiazepines for treating stress and anxiety, particularly for long-term application.

Prospects for Further Research. The results from pharmacological studies of plant-based preparations highlight their potential for practical application in managing and preventing stress and anxiety. The next research phase should focus on selecting active pharmaceutical ingredients, formulating the final medicinal product, defining its target quality profile, and establishing a conceptual process design for production.

References

- Lupien, S.J., McEwen, B.S., Gunnar, M.R., Heim, C. (2009). Effects of stress throughout the lifespan on the brain, behaviour and cognition. *Nat. Rev. Neurosci.*, 10, 434–445.
- Mental Health and Attitudes of Ukrainians Towards Psychological Assistance during the War (2024). Gradus Research Company. 2024. URL: <https://gradus.app/en/open-reports/mental-health-and-attitudes-ukrainians-towards-psychological-assistance-during-war/>.
- Brett, J., Murnion, B. (2015). Management of benzodiazepine misuse and dependence. *Aust Prescr.*, 38(5), 152–155.
- Carlini, E.A. (2003). Plants and the central nervous system. *Pharmacology Biochemistry and Behavior*, 75, 501–512.
- Janda, K., Wojtkowska, K., Jakubczyk, K., Antoniewicz, J., Skonieczna-Zydecka, K. (2020). Passiflora incarnata in Neuropsychiatric Disorders – A Systematic Review. *Nutrients*, 12(12), 3894.
- Da Fonseca, L.R., de Rodrigues, R.A., de Ramos, A.S., da Cruz, J. D., Ferreira, J.L.P., de Silva, J.R.A. Amaral, A.C.F. (2020). Herbal Medicinal Products from Passiflora for Anxiety: An Unexploited Potential. *The Scientific World Journal*, 2020, 6598434.
- Jawna-Zbońska, K., Blecharz-Klin, K., Joniec-Maciejak, I., Wawer, A., Pyrzanowska, J., Piechal, A., Mirowska-Guzel, D., Widy-Tyszkiewicz, E. (2016). Passiflora Incarnata L. Improves Spatial Memory, Reduces Stress, and Affects Neurotransmission in Rats. *Phytother. Res.*, 30(5), 781–789.
- Kim, G.H., Lim, K., Yang, H.S., Lee, J.K., Kim, Y., Park, S.K., Kim, S.H., Park, S., Kim, T.H., Moon, J.S. et al. (2019). Improvement in neurogenesis and memory function by administration of Passiflora Incarnata L. extract applied to sleep disorder in rodent models. *J. Chem. Neuroanat.*, 98, 27–40.
- Miroddi, M., Calapai, G., Navarra, M., Minciullo, P.L., Gangemi, S. (2013). Passiflora Incarnata L.: Ethnopharmacology, clinical application, safety and evaluation of clinical trials. *J. Ethnopharmacol.*, 150(3), 791–804.
- Kim, M., Lim, H.S., Lee, H.H., Kim, T.H. (2017). Role Identification of Passiflora Incarnata Linnaeus: A Mini Review. *J. Menopausal. Med.*, 23, 156–159.
- Dai, H.J., Lv, Z.P., Huang, Z.W., Ye, N.W., Li, S.M., Jiang, J.L., Cheng, Y., Shi, F.X. (2021). Dietary hawthorn-leaves flavonoids improves ovarian function and liver lipid metabolism in aged breeder hens. *Poultry Science*, 100 (12), 101499.
- Habtemariam, S., Varghese, G. (2014). The antidiabetic therapeutic potential of dietary polyphenols. *Curr Pharm Biotechnol.*, 15(14), 391–400.
- Dahmer, S., Scott, E. (2010). Health effects of hawthorn. *Am Fam Physician*, 81, 465–468.
- Wang, J., Xiong, X., Feng, B. (2013). Effect of crataegus usage in cardiovascular disease prevention: an evidence-based approach. *Evid Based Complement Alternat Med.*, 2013, 149363.
- Topal, G., Koc, E. (2013). Effects of crataegus microphylla on vascular dysfunction in streptozotocin-induced diabetic rats. *Phytother Res.*, 27(3), 330–337.
- Can, O., Ozkay, U., Ozturk, N., Ozturk, Y. (2010). Effects of hawthorn seed and pulp extracts on the central nervous system. *Pharm Biol.*, 48(8), 924–931.
- Ishii, D., Matsuzawa, D., Kanahara, N., Matsuda, S., Sutoh, C., Ohtsuka, H., Nakazawa, K., Kohno, M., Hashimoto, K., Iyo, M., Shimizu, E. (2010). Effects of aripiprazole on MK-801-induced prepulse inhibition deficits and mitogen-activated protein kinase signal transduction pathway. *Neuroscience Letters*, 471 (1), 53–57.
- Jeon, S.J., Kim, E., Lee, J.S., Oh, H. K, Zhang, J., Kwon, Y., Jang, D.S., Ryu, J.H. (2017). Maslinic acid ameliorates NMDA receptor blockade-induced schizophrenia-like behaviors in mice. *Neuropharmacology*, 126, 168–178.
- Li, T., Fu, S., Huang, X., Zhang, X., Cui, Y., Zhang, Z., Ma, Y., Zhang, X., Yu, Q., Yang, S., Li, S. (2022). Biological properties and potential application of hawthorn and its major functional components: A review. *Journal of Functional Foods*, 90, 104988.
- European Union herbal monograph on Valeriana officinalis L., radix. Final. (2016). EMA/HMPC/150848/2015, Corr.1. <https://www.ema.europa.eu>.
- Trauner, G., Khom, S., Baburin, I., Benedek, B., Hering, S., Kopp, B. (2008). Modulation of GABAA Receptors by Valerian Extracts is Related to the Content of Valerenic Acid. *Planta Medica*, 74(1), 19.

23. Kennedy, D.O., Little, W., Haskell, C.F., Scholey, A. B. (2006). Anxiolytic effects of a combination of *Melissa officinalis* and *Valeriana officinalis* during laboratory induced stress. *Phytotherapy research*, 20(2), 96-102.
24. Jung, H. Y., Yoo, D. Y., Nam, S. M., Kim, L. W., Choi, J. H., Yoo, M., Lee, S., Yoon, Y. S. and Hwang, I. K. (2025). Valerenic Acid Protects Against Physical and Psychological Stress by Reducing the Turnover of Serotonin and Norepinephrine in Mouse Hippocampus-Amygdala Region. *Journal of Medicinal Food*, 18(12), 1333-1339.
25. Roh, D., Jung, J. H., Yoon, K.H., Lee, C.H., Kang, L.Y., Lee, S.K., Shin, L Kim, D.H. (2019). Valerian extract alters functional brain connectivity: A randomized double-blind placebo-controlled trial. *Phytotherapy research*, 33(4), 939-948.
26. Shinjo, N., Waddell, G., Green, J. (2020). Valerian Root in Treating Sleep Problems and Associated Disorders – A Systematic Review and Meta-Analysis. *Journal of Evidence-Based Integrative Medicine*, 25.
27. Singh, O., Khanam, Z., Misra, N., Srivastava, M.K. (2011). Chamomile (*Matricaria chamomilla* L.): An overview. *Pharmacogn Rev.*, 5(9), 82-95.
28. El Joumaa, M.M., Borjac, J.M. (2022), *Matricaria chamomilla*: A valuable insight into recent advances in medicinal uses and pharmacological activities. *Phytochem Rev.*, 21, 1913-1940.
29. Pinto, S.A. G., Bohland, E., Coelho, C.P., Morgulis, M.S., Bonamin, L.V. (2008). An animal model for the study of chamomilla in stress and depression: pilot study. *Homeopathy*, 97(3), 141-144.
30. Alvarado-García, P.A, Soto-Vásquez, M.R., Rodrigo-Villanueva, E.M., Gavidia-Valencia, J.G., Rodríguez, N.M., Rengifo-Penadillos, R.A. et al. (2024). Chamomile (*Matricaria chamomilla* L.) Essential Oil and its Potential Against Stress, Anxiety, and Sleep Quality. *Pharmacognosy Journal*, 16(1), 100-107.
31. Amsterdam, J.D., Li, Y., Soeller, I., Rockwell, K., Mao, J.J., Shults, J. (2009). A randomized, double-blind, placebo-controlled trial of oral *Matricaria recutita* (chamomile) extract therapy for generalized anxiety disorder. *J Clin Psychopharmacol.*, 29(4), 378-82.
32. Amsterdam, J.D., Shults, J., Soeller, I., Mao, J.J., Rockwell I. K., Newberg, A.B. (2012). Chamomile (*Matricaria recutita*) may provide antidepressant activity in anxious, depressed humans: an exploratory study. *Altern Ther Health Med.*, 18(5), 44-49.
33. Panossian, A.G., Efferth, T., Shikov, A.N., Pozharitskaya O.N., Kuchta K. et al. (2021). Evolution of the adaptogenic concept from traditional use to medical systems: Pharmacology of stress- and aging-related diseases. *Med Res Rev.*, 41(1), 630-703.
34. Gerontakos, S., Wardle, J., Casteleijn, D. (2019). A Critical Review to Identify the Domains Used to Measure the Effect and Outcome of Adaptogenic Herbal Medicines *Advances in Int. Med.*, 6(1), 133-134.
35. Lopresti, A.L., Smith, S. J. (2021). Ashwagandha (*Withania somnifera*) for the treatment and enhancement of mental and physical conditions: A systematic review of human trials external link disclaimer. *Journal of Herbal Medicine*, 28, 100434.
36. Remenapp, A., Coyle, K., Orange, T., Lynch, T., Hooper, D. et al. (2022). Efficacy of *Withania somnifera* supplementation on adult's cognition and mood. *J Ayurveda Integr Med.*, 13(2), 100510.
37. Gopukumar, K., Thanawala, S., Somepalli, V., Rao, T.S. S., Thamam, V.B. et al. (2021). Efficacy and Safety of Ashwagandha Root Extract on Cognitive Functions in Healthy, Stressed Adults: A Randomized, Double-Blind, Placebo-Controlled Study. *Evid Based Complement Alternat Med.*, 2021, 8254344.
38. Baker, C., Kirby, J.B., O'Connor, J., Lindsay, K.G., Hutchins, A. et al. (2022). The Perceived Impact of Ashwagandha on Stress, Sleep Quality, Energy, and Mental Clarity for College Students: Qualitative Analysis of a Double-Blind Randomized Control Trial. *J Med Food*, 25(12), 1095-1101.

Конфлікт інтересів: відсутній.

Conflicts of Interest: authors have no conflict of interest to declare.

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