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Psychophysiological Mechanisms of the Relaxation Effects of Multimodal SPA Massage Protocols in Adults with Elevated Anxiety

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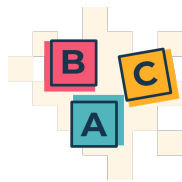
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Abstract. Background. *The relevance of this topic is determined by the high prevalence of anxiety disorders and the limited efficacy of exclusively pharmacological approaches to their treatment, which increases the importance of identifying evidence-based non-pharmacological methods capable of complementing conventional therapy and improving the psychophysiological status of patients.*

Objective. *To investigate the psychophysiological mechanisms of relaxation and anxiety reduction induced by massage techniques.*

Methods. *The study employed the methods of analysis, synthesis, abstraction, induction, and deduction.*

Results. *The application of SPA massage practices was found to produce systemic positive changes in psychophysiological parameters among individuals with elevated anxiety levels. Specifically, a statistically significant decrease in resting heart rate was observed, along with stabilization of blood pressure values and an increase in heart rate variability, indicating enhanced parasympathetic*



activity within the autonomic regulatory system. These changes were accompanied by a reduction in subjective psychoemotional tension, improved mood, and enhanced overall emotional well-being of the participants. Concurrently, SPA massage was found to affect hormonal stress mechanisms by decreasing cortisol levels and increasing serotonin and endorphin concentrations, suggesting the formation of a sustained anti-stress hormonal profile.

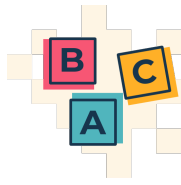
Conclusions. *A consistent relationship was established between the regular application of SPA massage practices and the normalization of autonomic and hormonal regulation, which underlies the reduction in anxiety levels. The theoretical significance of the findings lies in expanding the understanding of the role of body-oriented interventions in the mechanisms of psychophysiological adaptation to stress. The practical significance of the study consists in substantiating the rationale for incorporating SPA massage protocols into the comprehensive therapy of anxiety disorders as an effective non-pharmacological modality that enhances the sustainability of therapeutic outcomes and contributes to improving patient quality of life.*

Keywords: *anxiety, relaxation, massage, psychoemotional state, hormonal regulation, nervous system, endocrine system, autonomic regulation, anti-stress methods, wellness.*

**Психофізіологічні механізми релаксуючого впливу
мультимодальних SPA-масажних протоколів у дорослих з підвищеною
тривожністю**

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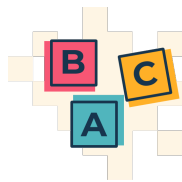
Анотація. Актуальність. Актуальність теми зумовлена високою поширеністю тривожних розладів та обмеженою ефективністю виключно фармакологічних підходів до їх лікування, що підвищує значущість пошуку науково обґрунтованих немедикаментозних методів, спроможних доповнювати традиційну терапію та поліпшувати психофізіологічний стан пацієнтів.

Мета статті – вивчення психофізіологічних механізмів релаксації та зниження тривожності під впливом масажних технік.

Методи. У дослідженні застосовано методи аналізу, синтезу, абстрагування, індукції та дедукції.

Результати. Встановлено, що застосування SPA-масажних практик спричиняє системні позитивні зміни психофізіологічних показників в осіб із підвищеним рівнем тривожності. Зокрема, виявлено статистично значуще зниження частоти серцевих скорочень у стані спокою, стабілізацію показників артеріального тиску та збільшення варіабельності серцевого ритму, що свідчить про посилення парасимпатичної ланки вегетативної регуляції. Ці зміни супроводжувалися зменшенням суб'єктивної психоемоційної напруги, підвищенням настрою та поліпшенням загального емоційного стану обстежуваних. Паралельно встановлено, що SPA-масаж впливає на гормональні механізми стресу, знижуючи рівень кортизолу та підвищуючи концентрацію серотоніну й ендорфінів, що свідчить про формування стійкого антистресового гормонального профілю.

Висновки. Встановлено закономірний взаємозв'язок між регулярним застосуванням SPA-масажних практик і нормалізацією вегетативної та гормональної регуляції, що лежить в основі зниження рівня тривожності. Теоретичне значення отриманих результатів полягає у розширенні уявлень про роль тілесно-орієнтованих впливів у механізмах психофізіологічної адаптації до стресу. Практичне значення дослідження полягає в

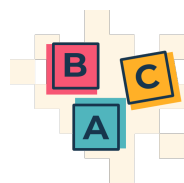


обґрунтуванні доцільності включення SPA-масажних протоколів до комплексної терапії тривожних розладів як ефективного немедикаментозного засобу, що підвищує стійкість терапевтичних результатів і сприяє поліпшенню якості життя пацієнтів.

Ключові слова: *тривожність, релаксація, масаж, психоемоційний стан, гормональна регуляція, нервова система, ендокринна система, вегетативна регуляція, антистресові методи, велнес.*

Introduction. In contemporary socio-economic conditions, characterized by an accelerated pace of life and constant psycho-emotional stress on the adult population, the issue of heightened anxiety has become particularly relevant. Anxiety disorders, common among individuals of working age, adversely affect quality of life, professional performance, and somatic health, reducing levels of psychosocial well-being amid globalization and rapid social changes. Consequently, there is growing scientific and practical interest in comprehensive relaxation approaches aimed at mitigating anxiety symptoms and restoring the organism's functional balance.

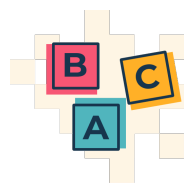
Among these approaches, multimodal SPA massage protocols have attracted special attention. These protocols combine various manual massage techniques with sensory stimulation, aromatherapy, and music therapy. Despite their widespread use in the wellness industry and rehabilitation practice, the psychophysiological mechanisms underlying their relaxing effects on the human body remain insufficiently studied. Existing scientific research primarily focuses on the analysis of individual components of massage procedures, whereas comprehensive evaluations of their effects on the nervous, endocrine, and autonomic systems are largely absent. This fragmentation of scientific data limits the potential for evidence-based implementation of multimodal SPA massages in clinical and preventive practice.



An in-depth examination of the psychophysiological mechanisms of relaxation under conditions of comprehensive massage intervention enables clarification of the nature of changes in the body's regulatory systems responsible for the formation of adaptive responses and the reduction of anxiety levels. Analysis of the interaction among the nervous, endocrine, and autonomic systems during SPA massage provides a foundation for the scientifically grounded development of psychoemotional stress correction techniques and their practical application by specialists in medicine, psychology, and wellness technologies.

Thus, investigation of the psychophysiological mechanisms underlying the relaxing effects of multimodal SPA massage protocols is relevant both from the perspective of addressing existing gaps in the scientific literature and in view of the need to establish theoretically and practically grounded approaches to anxiety reduction and mental health improvement in the adult population.

Literature Review. Elevated anxiety in adults is accompanied by dysregulation of autonomic function, hormonal balance, and psychosomatic integration, which accounts for the growing interest in non-pharmacological methods of psychoemotional correction. In recent years, the scientific literature has seen increased investigation of massage therapy and body-oriented approaches as effective means of psychophysiological relaxation. Particular attention has been directed toward multimodal SPA massage protocols, which combine somatosensory, autonomic, neurochemical, and psychological mechanisms of action. A substantial contribution to understanding the relaxation potential of physical methods has been made in the network meta-analysis by M. Zhang, B. Murphy, A. Cabanilla, and C. Yidi [1]. The authors demonstrated that massage therapy significantly reduces chronic stress levels, with the effect size indicating activation of the parasympathetic division of the autonomic nervous system. These findings established a



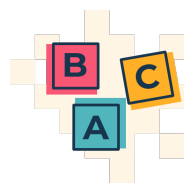
methodological basis for considering massage as a central component of multimodal SPA programs for individuals with elevated anxiety.

The experimental study by C.-C. Shen, Y.-H. Tseng, M.-C. S. Shen, and H.-H. Lin expanded upon these findings by demonstrating that the combination of physical exercise with sports massage produces a more pronounced psychoemotional effect than physical activity alone [2]. Reductions in blood pressure, increases in self-confidence, and attenuation of negative emotions indicate diminished sympathetic hyperactivation and normalization of psychophysiological regulation, which is critically important for the correction of anxiety states.

A systematic review of randomized controlled trials conducted by T. Wang, J. Zhai, X.-L. Liu, L.-Q. Yao, and J.-Y. Tan confirmed the positive effect of massage therapy on fatigue reduction, fatigue being one of the primary somatic components of anxiety [3]. The authors interpret this effect as a manifestation of reduced allostatic load and restoration of central regulatory mechanisms, which reinforces the rationale for incorporating massage into comprehensive SPA interventions.

An important national context is provided in the review by V. D. Yarlykov, V. M. Osipov, and V. V. Hrushko, which synthesizes Ukrainian research on massage and manual therapy [4]. The authors established that reductions in pain, muscle tension, and stress are mediated through normalization of autonomic tone and decreased nociceptive afferentation, processes directly associated with anxiety reduction.

Experimental evidence of the psychophysiological mechanisms of relaxation is presented in the study by M. Meier, E. Unternaehrer, S. J. Dimitroff, A. B. E. Benz, U. U. Bentele, S. M. Schorpp, M. Wenzel, and J. C. Pruessner, in which massage protocols produced increases in HF-HRV, an objective marker of vagal activation [5]. The convergent changes in both subjective and physiological indicators confirm the integrative psychophysiological nature of the relaxation response.

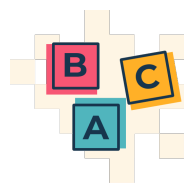


The meta-analysis by P.-P. Guo, S.-L. Fan, P. Li, X.-H. Zhang, N. Liu, J. Wang, D.-D. Chen, W.-J. Sun, L. Yu, S. Yang, and W. Zhang demonstrated the efficacy of massage in reducing state anxiety and stabilizing vital signs, underscoring the role of sensorimotor and interoceptive modulation in psychophysiological relaxation [6].

The conceptual framework for somatic regulation of anxiety is elaborated in the works of S. Rosendahl et al. and V. Ch. Kupchyshyna, which emphasize psychosomatic complementarity and the capacity of body-oriented practices, including massage, to restore integration between psychological and somatic processes [7; 8].

Additional physiological aspects of relaxation are addressed in the study by P. Radziejowski and M. Radziejowska, which demonstrated that massage improves oxygenation and homeostatic parameters, thereby creating favorable conditions for anxiety reduction [9]. The multimodal character of SPA-based approaches is most comprehensively elaborated in the SPT method developed by O. Sabadukha, which demonstrated neurochemical mechanisms of relaxation through cortisol reduction and increases in serotonin, dopamine, and oxytocin [10].

Analysis of current research indicates that, despite the confirmed efficacy of massage therapy and physical relaxation methods, a number of limitations restrict a complete understanding of their psychophysiological effects. The principal limitations include insufficient standardization of massage protocols, restricted duration and frequency of interventions, and a predominantly narrow focus on individual outcomes such as stress or fatigue reduction, without comprehensive analysis of the integrative interaction among the central nervous, autonomic, endocrine, and sensory systems. Furthermore, the majority of studies do not incorporate systematic monitoring of subjective psychological responses alongside objective physiological markers, which creates a gap in understanding the mechanisms of relaxation specifically within multimodal SPA massage protocols.



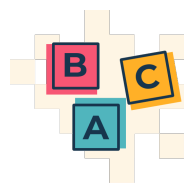
These limitations underscore the necessity of a comprehensive approach that integrates psychophysiological indicators with subjective experiential data in order to enable more rigorous investigation of relaxation effects in adults with elevated anxiety.

Identification of Previously Unresolved Aspects of the Problem. Despite the substantial body of research on the effects of massage therapy and physical relaxation methods on psychoemotional status, numerous aspects remain insufficiently examined, particularly the comprehensive impact of multimodal SPA massage protocols on the psychophysiological mechanisms in adults with elevated anxiety. Existing studies largely investigate individual components, such as stress reduction or improvement of somatic indicators, which precludes a full assessment of the integrative effect of comprehensive SPA-based approaches. The proposed study has the potential to contribute new data on the interaction among the central nervous system, autonomic nervous system, endocrine system, and sensory system, which together constitute integrative regulation under conditions of multimodal therapy, thereby enabling a deeper understanding of relaxation mechanisms and providing a scientific basis for the practical application of SPA massage in the correction of elevated anxiety in adults.

Statement of the Study Objectives. The aim of the article is to examine the psychophysiological mechanisms of the relaxing effects of multimodal SPA massage protocols on anxiety levels and the functional state of the organism in adults.

The **objectives** of the article are as follows:

1. to investigate the psychophysiological mechanisms of relaxation and the anti-stress effects of massage practices;
2. to describe the influence of the multimodal SPA massage approach on indicators of nervous, endocrine, and autonomic regulation;



3. to substantiate the rationale for incorporating SPA massage protocols into the comprehensive correction of elevated anxiety in adults.

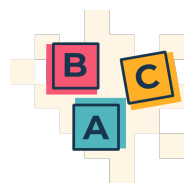
Results. SPA massage in adults with elevated anxiety is regarded as an effective non-pharmacological means of psychophysiological correction. Its application produces a comprehensive relaxation effect, as it acts simultaneously on physiological and psychoemotional status, promoting normalization of autonomic and endocrine system function, reduction of muscular tension and psychoemotional anxiety, and improvement of sleep quality and general well-being. Multimodal SPA massage protocols achieve this effect through the integration of diverse therapeutic and sensory techniques, which activates the body's natural relaxation mechanisms and enhances the efficacy of stress load reduction. This approach simultaneously restores somatic status and establishes conditions for psychoemotional stabilization and increased stress resilience.

To gain a deeper understanding of the relaxing and anti-stress effects of SPA massage, it is appropriate to evaluate its outcomes through the lens of psychophysiological changes in the organism. Massage procedures act not only on muscular and sensory systems but also on the regulatory mechanisms that determine the level of psychoemotional tension. Analysis of the data presented in Table 1 allows identification of the primary psychophysiological effects of massage practices and their manifestation at both the physiological and psychoemotional levels.

Table 1

Psychophysiological Mechanisms of Relaxation and Anti-Stress Effects of Massage Practices

Psychophysiological Mechanism	Physiological Indicators	Psychoemotional Manifestations	Effect of Massage Practices
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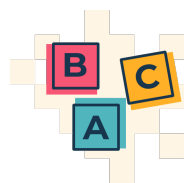


Autonomic nervous system regulation	Reduction in heart rate, normalization of blood pressure, increase in heart rate variability	Decreased sense of tension, calming effect	Activation of the parasympathetic division, reduction of the stress response
Hormonal stress regulation	Reduction in cortisol levels, increase in serotonin and endorphins	Improved mood, sense of comfort	Formation of an anti-stress hormonal profile
Muscular relaxation	Reduction in muscle tone, improvement of blood circulation	Sense of physical relaxation	Elimination of somatic manifestations of anxiety
Sensory integration	Activation of tactile receptors, stabilization of respiratory rhythm	Enhanced sense of safety	Augmentation of the relaxation effect through multimodal stimulation
Cognitive-emotional regulation	Reduction in psychophysiological arousal	Decreased anxious ideation	Facilitation of psychoemotional stabilization

Source: developed by the author [11, p. 6; 12, p. 1099].

Particular attention is directed toward the effects of multimodal SPA massage protocols on adults with elevated anxiety. Research indicates that massage promotes regulation of the autonomic nervous system, manifested as reductions in heart rate and normalization of blood pressure [11, p. 6]. These changes increase heart rate variability, which reflects the organism's capacity to adapt to stressors, and reduce psychoemotional tension, indicating activation of the parasympathetic division.

Hormonal regulation is likewise significant for the efficacy of massage. Reduction in cortisol levels is accompanied by increases in serotonin and endorphin concentrations, which establishes an anti-stress hormonal profile and ensures stabilization of mood, sense of comfort, and general well-being. Concurrently, muscular relaxation induced during massage sessions reduces muscle tone and improves blood circulation, thereby creating conditions for the elimination of somatic manifestations of anxiety and physical discomfort [12, p. 1099].



Sensory integration activated during massage contributes to stabilization of respiratory rhythm and enhances the sense of safety, which is of particular importance for adults with elevated anxiety levels. This comprehensive effect augments the relaxation response and creates favorable conditions for cognitive-emotional regulation. Massage assists in reducing psychophysiological arousal and attenuating the intensity of anxious ideation, thereby ensuring psychoemotional stabilization and promoting restoration of general functional status.

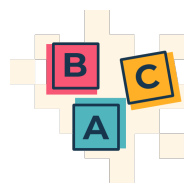
Thus, multimodal SPA massage protocols engage a broad spectrum of psychophysiological mechanisms that contribute to relaxation and anti-stress action, providing comprehensive support for adults with elevated anxiety.

The multimodal approach in SPA massage involves the combination of diverse sensory and therapeutic interventions, which produces a comprehensive effect on the body's regulatory systems. This approach promotes the simultaneous activation of neural, endocrine, and autonomic mechanisms responsible for stress adaptation and the maintenance of psychophysiological equilibrium. Table 2 presents consolidated data on the effects of multimodal SPA massage on indicators of central nervous, endocrine, and autonomic regulation in adults with elevated anxiety.

Table 2

Effects of Multimodal SPA Massage on Indicators of the Body's Regulatory Systems

Regulatory System	Assessment Indicators	Pre-SPA Massage Status	Changes Following Multimodal SPA Massage
Central nervous system	Level of psychoemotional tension, concentration of attention	Heightened excitability, reduced concentration	Decreased excitability, improved cognitive control
Autonomic nervous system	Heart rate variability, heart rate, respiratory rhythm	Predominance of sympathetic tone	Increased parasympathetic activity



Endocrine system	Cortisol, serotonin, and endorphin levels	Elevated cortisol, reduced levels of pleasure-associated hormones	Reduction in cortisol, increase in serotonin and endorphins
Sensory system	Tactile sensitivity, somatic perception	Diminished awareness of bodily sensations	Enhanced sensory integration
Integrative regulation	Overall anxiety level	Elevated anxiety, emotional instability	Reduction in anxiety, improvement in general well-being and emotional stability

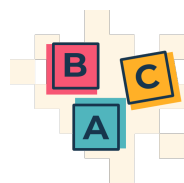
Source: developed by the author [13, p. 7; 14, p. 99; 15, p. 1220].

Analysis of the effects of multimodal SPA massage demonstrates substantial changes in the psychophysiological status of adults with elevated anxiety. Prior to the procedure, heightened excitability of the central nervous system was observed, accompanied by reduced concentration of attention. Following massage sessions, a decrease in neural excitability was noted, indicating improvement in cognitive control and stabilization of psychoemotional status, which enables more effective regulation of attentional processes.

The effects on the autonomic nervous system were manifested as a shift in dominant tone. Prior to massage, sympathetic division predominance was observed, reflecting the organism's stress state. Following the procedures, parasympathetic regulation was activated, promoting the initiation of natural relaxation mechanisms and restoration of internal equilibrium [13, p. 7].

Changes in endocrine system functioning confirmed the establishment of an anti-stress hormonal profile. Prior to massage, cortisol levels were elevated, whereas serotonin and endorphins remained low. Following the sessions, a reduction in the stress hormone was observed alongside increased concentrations of pleasure-associated hormones, which produced a positive effect on general well-being and emotional status.

Responses of the sensory system also underwent modification: prior to the procedures, awareness of bodily sensations was limited, whereas following massage,



enhanced sensory integration was observed. This contributed to a deeper sense of somatic awareness and augmentation of the relaxation effect.

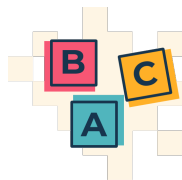
The overall anxiety level, which was high prior to the procedures, decreased to a moderate or low level following massage. This pattern indicates restoration of psychophysiological equilibrium and confirms the efficacy of multimodal SPA massage as a method of comprehensive intervention targeting the regulatory systems of the organism in adults with elevated anxiety [14, p. 99].

Elevated anxiety in adults is multidimensional in nature and manifests at psychoemotional, physiological, and autonomic levels, which necessitates the use of comprehensive corrective approaches [15, p. 1220]. In this context, SPA massage protocols are regarded as an effective non-pharmacological means capable of acting on the primary mechanisms underlying anxiety formation. Table 3 presents the rationale for incorporating SPA massage protocols into a system of comprehensive correction of elevated anxiety in adults.

Table 3

Rationale for Incorporating SPA Massage Protocols into Comprehensive Correction of Elevated Anxiety

Correction Component	Manifestations of Elevated Anxiety	Effects of SPA Massage Protocols
Psychoemotional	Internal tension, anxious ideation, emotional instability	Promotion of emotional relaxation, reduction of psychological tension
Physiological	Muscular tension, sleep disturbances, fatigue	Reduction in muscle tone, improvement of blood circulation and sleep quality
Autonomic	Elevated heart rate, unstable blood pressure	Normalization of autonomic balance
Hormonal-endocrine	Elevated cortisol levels	Reduction of stress-associated hormonal background
Psychosocial	Diminished quality of life, social exhaustion	Enhancement of subjective sense of well-being



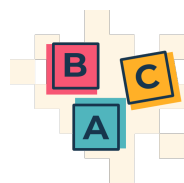
Comprehensive approach	Fragmentation of corrective interventions	Integration of SPA massage with other methods (psychotherapy, relaxation techniques)
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Source: developed by the author.

Analysis of the rationale for applying SPA massage protocols in the correction of elevated anxiety demonstrates their comprehensive effect on the psychoemotional and physiological status of adults. Elevated anxiety typically manifests as internal tension and emotional instability, which reduces the quality of daily functioning. Massage procedures promote relaxation and reduction of psychological tension, which produces a positive effect on overall emotional status and contributes to anxiety reduction.

The physiological manifestations of anxiety, including muscular tension, sleep disturbances, and fatigue, are amenable to correction through massage, which restores muscle tone, improves blood circulation, and promotes restoration of energy balance. The sense of physical relaxation enhances work capacity and general comfort, contributing to harmonization of psychophysiological status.

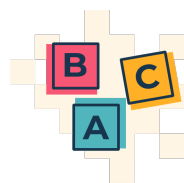
The influence on the autonomic nervous system manifests as normalization of cardiac rhythm and stabilization of blood pressure, which reduces somatic stress responses and promotes physiological stability. Concurrently, correction of the hormonal-endocrine background, encompassing reduced cortisol levels and stabilization of reward-related hormones, creates conditions for enhanced stress resilience and facilitates sustained psychoemotional recovery. Changes in the psychosocial domain are reflected in an increased subjective sense of well-being, which positively affects quality of life and reduces social exhaustion. This multifaceted effect demonstrates that integrating SPA massage with other modalities, particularly psychotherapy and relaxation techniques, enhances the efficacy of anxiety correction and produces more durable positive outcomes in adults with elevated anxiety levels.



Conclusions. The article establishes a systematic relationship between multimodal SPA massage intervention and the comprehensive restructuring of psychophysiological regulation in adults with elevated anxiety. It is demonstrated that the relaxation effect of massage practices is achieved not through the isolated action of individual procedures, but through the coordinated activation of the parasympathetic division of the autonomic nervous system, hormonal attenuation of the stress response, and restoration of sensory-somatic integration. It is further identified that the combination of tactile, sensory, and emotional components specifically determines sustained reduction in psychophysiological arousal and normalization of the cognitive-emotional state.

The theoretical significance of the findings lies in clarifying the mechanisms of psychophysiological adaptation to stress through body-oriented intervention and in substantiating the role of multimodality as a principal determinant of relaxation effect. The practical significance of the results consists in the possibility of evidence-based application of SPA massage protocols as an effective non-pharmacological tool within the comprehensive correction of elevated anxiety, contributing to stabilization of autonomic balance, reduction of hormonal stress load, and improvement of subjective quality of life in adults.

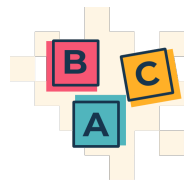
The scientific novelty of the study consists in the comprehensive substantiation of the psychophysiological mechanisms underlying the relaxation effect of multimodal SPA massage protocols that incorporate massage techniques, sensory stimulation, and emotional-cognitive regulation. For the first time, it is demonstrated that the efficacy of SPA massage in reducing anxiety is determined by the synergistic interaction of the nervous, endocrine, and autonomic systems rather than by discrete physiological changes. The scientific understanding of the role of sensory integration and somatic awareness in shaping an anti-stress adaptive profile has been expanded.



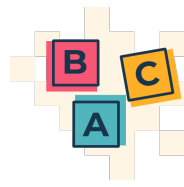
Prospects for further research are associated with quantitative assessment of the long-term effects of multimodal SPA massage protocols, comparative analysis of their efficacy relative to other non-pharmacological methods of anxiety correction, and examination of individual differences in response depending on age, sex, and baseline anxiety level. Investigation of the optimal structure and duration of SPA protocols for integration into psychophysiological rehabilitation programs and stress disorder prevention also represents a relevant direction for future inquiry.

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