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SCIENTIFICALLY BASED STRATEGIES FOR PREVENTING EMOTIONAL STRESS: A REVIEW OF NEUROBIOLOGICAL AND CLINICAL STUDIES

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Abstract:
This article reviews the neurobiological mechanisms of emotional stress and evidence-based methods for preventing it. Recent studies have shown that resilience to stress is associated with the activity of specific brain structures that can be strengthened through targeted psychological and physiological interventions. In particular, the interaction between the vagal interoceptive pathways, the prefrontal cortex, and the amygdala is considered a key neuronal substrate for emotional regulation. This work highlights the effectiveness of mindfulness-based stress reduction (MBSR) programs, yoga, and breathing techniques based on meta-analysis data, and discusses the prospects for their application in clinical practice.

Keywords: emotional stress, stress resilience, MBSR, yoga, vagus nerve, neuroplasticity, interoception

Introduction

Emotional stress has become one of the most common psychological problems in modern society. According to a 2026 study, stress remains a major catalyst for chronic diseases and negatively affects representatives of different professional groups, age groups, and cultures. Studies conducted in Uzbekistan also show high levels of emotional stress and burnout in various groups, such as students of specialized schools and professors.

In the last decade, the number of studies aimed at studying the neurobiological basis of stress resilience has increased dramatically. Stress resilience is the ability of some people to maintain or quickly recover from mental health when faced with difficulties. Understanding the mechanisms of this phenomenon is important for developing preventive interventions.

Main part

1. Neurobiological Basis of Emotional Distress

Recent studies have shown that emotional regulation is governed by complex neuronal networks. In studies conducted using fMRI, it has been found that emotional regulation strategies such as reappraisal and acceptance have both common and distinct neurofunctional signatures in the brain. In particular:

- Default mode network – contributes to both strategies
- Amygdala, somatomotor and attention networks – are activated in the acceptance strategy
- Frontoparietal control network – is activated in the reappraisal strategy

The interoceptive pathways of the vagus nerve play an important role in emotional regulation. Signals transmitted from peripheral organs to the brain via the vagus nerve not only ensure blood pressure and nutrient homeostasis, but also participate in the regulation of emotions. Impairment of vagal interoceptive feedback may be an important risk factor for emotional disorders.

Studies investigating the neurobiological mechanisms of stress resilience suggest that hippocampal-based pattern separation and prefrontal-cognitive control functions protect against the development of pathological fears. These mechanisms work by facilitating the perception of safety. Also, the ability to seek and enjoy positive stimuli based on the reward system protects against dysfunctions in the depressive-anxiety spectrum.

2. The Effectiveness of Mindfulness-Based Interventions

Mindfulness-Based Stress Reduction (MBSR) is an 8-10 week group training program developed by Dr. Jon Kabat-Zinn that includes techniques such as breathing, sitting meditation, body scan, and mindful yoga.

The Effectiveness of MBSR in PTSD and Depression

A 2025 meta-analysis evaluated the effectiveness of the MBSR intervention in patients with post-traumatic stress disorder (PTSD). 9 randomized controlled trials studied 832 participants.

Depression scores as measured by the PHQ-9 were significantly lower in the MBSR group than in the control group (SMD = -0.16). The effectiveness was maintained when assessed with other measures (SMD = -0.74).

3. Mind-Body Practices and Yoga

Mind-body practices combine physical exercise with deep breathing and mindfulness-based practices. These include yoga, qigong, tai chi, meditation techniques, muscle relaxation, and biofeedback techniques.

Results of a Network Meta-Analysis

A network meta-analysis of 23 studies on reducing occupational stress in healthcare workers included The results showed that:

-Mind-body practices were the most effective intervention, with a Standardized Mean Difference (SMD) = -0.90 and SUCRA (Surface Under the Cumulative Ranking) = 99%.

- Mindfulness-based therapies are in second place (SMD = -0.48, SUCRA = 66.5%).

A 2026 integrative review of non-pharmacological therapies for stress management in healthcare workers was conducted. 14 articles were selected and the effectiveness of the following methods was studied:

Meditation and yoga
Interaction with dogs
Self-care and relaxation techniques
Mindfulness-based physical activity
Art therapy
Auriculotherapy
Forest therapy
Sensory body massage

All methods showed positive results in reducing subjective and/or objective stress indicators. Relaxation, mindfulness, and self-care therapies were found to be effective in managing stress in healthcare workers.

Preventive Measures and Practical Recommendations

The following measures are recommended to prevent emotional stress in the conditions of Uzbekistan:

At the individual level:

- Regular yoga and meditation practices (at least 2-3 times a week)
- Daily use of deep breathing techniques (especially the 4-7-8 breathing method that activates the vagus nerve)
- Increased physical activity
- Compliance with the work and rest regime

At the organizational level:

- Introduction of mindfulness programs in the workplace
- Creation of conditions for yoga and relaxation sessions
- Expansion of opportunities for psychological services

Special recommendations for professors and teachers: compliance with voice hygiene, proper organization of the workplace, maintaining correct posture, performing simple exercises for the spine, neck and eyes, timely medical examinations.

Conclusion

Prevention of emotional stress is one of the important tasks of modern society. Recent scientific studies show that it is possible to increase stress tolerance and that the neuroplasticity of the brain plays an important role in this process. The balance between interoceptive signals carried out through the vagus nerve, the prefrontal cortex and the amygdala is the main mechanism of emotional regulation.

Meta-analyses have confirmed that mind-body practices, in particular yoga and mindfulness-based stress reduction programs, are the most effective methods for preventing emotional stress. Yoga has the highest efficiency rate in the SUCRA rating with 97.5%, followed by muscle relaxation and meditation techniques.

The introduction of comprehensive programs for the prevention of emotional stress in educational and medical institutions of Uzbekistan will serve to maintain the mental health of employees and increase labor productivity. Future research should be directed towards the development of intervention programs tailored for different professional groups.

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