

## Research Article

# The Impact of Physical Activity on Stress: An Overview of Key Mechanisms

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### Abstract

Stress can lead to a range of physical and mental health issues, such as heart disease, obesity, diabetes, anxiety, depression, chronic pain, and sleep problems. It also influences healthy behaviors, including dietary choices, sleep patterns, and substance use. This study examines how physical activity affects stress levels. There is considerable evidence that engaging in regular exercise is an effective strategy for coping with stress, enhancing mental well-being, especially for individuals living with chronic conditions like diabetes, coronary artery disease, and cancer. Moreover, exercise is an accessible and economical approach to managing daily stress. It improves the body's ability to handle stress and affects the central nervous system through hormonal changes, including increased endorphin production after physical exertion. Furthermore, physical activity boosts the transmission of neurotransmitters such as serotonin, dopamine, and adrenaline, which contribute to improved mood and alleviate feelings of depression. Exercise also provides a distraction from stressors, fostering a sense of calm and promoting positive thought patterns. Participating in recreational physical activities cultivates positive emotions and is beneficial for effective stress management, which can further enhance health behaviors and overall well-being. Physical activity is recognized as a crucial strategy for managing stress, as it effectively reduces stress levels and enhances overall quality of life through multiple biochemical, physiological, and social pathways. Regular incorporation of exercise into one's lifestyle can serve as a natural and accessible way to mitigate and manage stress.

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## Introduction

Research consistently indicates that engaging in regular physical activity—when done with the right intensity, volume, and duration—enhances overall physical health [1, 2]. Notably, exercise plays a crucial role in alleviating stress [3]. It achieves this by boosting the production of endorphins, which are neurotransmitters associated with feelings of happiness [4]. Additionally, physical activity serves as a distraction from everyday stressors, allowing individuals to immerse themselves in the movements of exercise [5]. Regular participation in physical activity can lead to a decrease in daily tensions, thereby improving focus and concentration across various tasks. Furthermore, engaging in consistent exercise positively impacts mood and boosts self-esteem, while also fostering relaxation and mitigating symptoms of mild depression and anxiety [6]. Physical activity can aid in enhancing sleep quality by addressing issues related to stress, depression, and anxiety [7].

The specific type and intensity of exercise can yield varying effects on stress levels. The Department of Health and Human Services generally recommends that healthy adults aim for a minimum of 150 minutes of moderate aerobic activity or 75 minutes of vigorous aerobic activity weekly, or a mix of both. It's also advised to incorporate strength training exercises for all major muscle groups at least twice a week. There is a distinct difference in the impact of short bursts of intense exercise compared to sustained long-term exercise on stress levels [8]. This study explores these differences, focusing on the key molecular mechanisms involved in how exercise influences stress.

### **The difference between the effect of acute and chronic activity on stress and performance of athletes**

The impact of acute versus chronic physical activity on athlete stress levels and performance differs significantly. Physical exercise can be categorized into acute and chronic activity, each influencing athletes in unique ways [9].

Acute physical activities, like intense training sessions or competitions, can lead to a short-term spike in stress hormones, such as adrenaline and cortisol [10, 11]. However, these activities can also trigger the release of endorphins, which promote feelings of happiness and help alleviate stress [11]. Consequently, a singular, high-intensity workout can enhance performance by providing a boost in energy and concentration, thereby allowing athletes to perform at their peak. Such acute experiences are often perceived as beneficial stressors, enhancing motivation and vitality [11, 12].

In contrast, chronic physical activity, developed through regular training over time, tends to lower stress and anxiety levels in athletes [9]. Those who engage in consistent exercise typically exhibit greater resilience to stress [13]. Regular workouts can improve the body's ability to manage stress hormones and decrease overall cortisol levels, which contributes to the athlete's mental and physical well-being [6]. Moreover, sustained training yields long-lasting enhancements in performance, allowing for gains in strength, endurance, and technique. In summary, while acute activities primarily serve as immediate triggers for energy and stress, chronic activities effectively contribute to stress reduction and sustained performance enhancement [14-16].

### **Molecular mechanisms of the effect of physical activity on stress**

The influence of physical activity on stress levels is linked to various molecular and physiological processes, primarily involving the regulation of biochemical and hormonal activities in the body. Below are the essential factors and processes that clarify how exercise contributes to stress reduction.

Firstly, the relationship between physical activity and hormone secretion is significant. Engaging in exercise triggers changes in the levels of certain neurotransmitters, including endorphins, serotonin, and dopamine. Endorphins, often referred to as "happy hormones," not only alleviate pain but also enhance overall feelings of joy. Meanwhile, serotonin and dopamine play crucial roles in elevating mood and mitigating anxiety and depression symptoms [17, 18]. Additionally, physical activity influences the levels of stress hormones, notably cortisol. Regular exercise can lead to lower cortisol levels, which is essential since elevated cortisol, produced during stressful situations, can yield adverse effects, such as heightened anxiety and diminished cognitive performance [19-21].

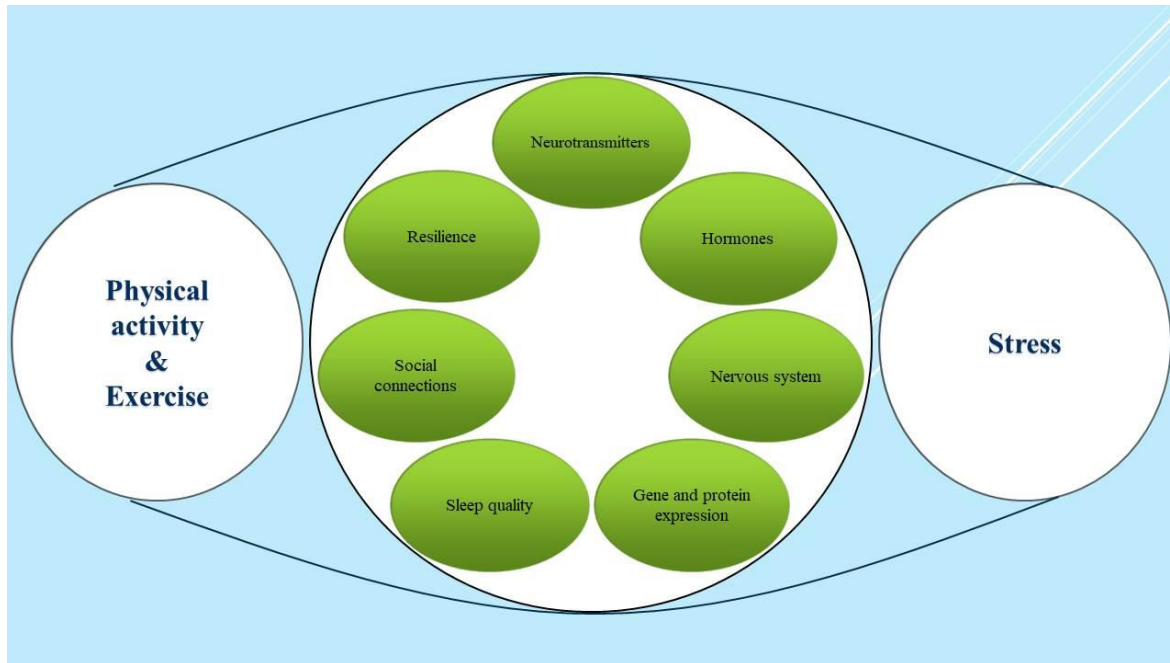
Secondly, physical activity positively impacts the nervous system. It promotes the activation of the parasympathetic nervous system, which is responsible for relaxation. This activation helps improve how the body responds to stress, thereby alleviating both physical and mental tension [22, 23].

The third aspect involves changes in gene and protein expression related to stress. Exercise can modify how stress-related genes are expressed, influencing processes such as inflammation and blood vessel constriction. These modifications can enhance immune function and reduce inflammation [24], contributing to lower stress levels overall [25-27].

The fourth factor pertains to sleep quality. Regular exercise is associated with improved sleep, while inadequate or poor-quality sleep can exacerbate stress and anxiety. Therefore, better sleep can be a beneficial outcome of engaging in physical activity [7, 28].

Lastly, regular physical activity can strengthen social connections and increase resilience. Participating in group exercise fosters a sense of belonging and community, which can help alleviate stress. Furthermore, it equips individuals with better coping mechanisms to handle everyday challenges, enhancing their mental resilience as a result [9, 29, 31] (Figure 1).

Figure 1. Main mechanisms related to the effect of physical activity and exercise on stress.



## Conclusion

Engaging in physical activity is widely recognized as a beneficial strategy for managing stress. It contributes to lowering stress levels and enhancing overall quality of life through various biochemical, physiological, and social processes. Incorporating regular exercise into your routine can serve as a natural and readily available approach to mitigating and managing stress in day-to-day life.

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## Compliance with ethical standards

**Conflict of interest** None declared.

**Ethical approval** the research was conducted with regard to the ethical principles.

**Informed consent** Informed consent was obtained from all participants.

## Author contributions

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