Tamara Stevanovic[1], Slobodan Subotic[1], Marko Kimi Milic[1]

PHYSICAL EXERCISE AS A STRESS MANAGEMENT MECHANISM

Abstract: The way of reacting to potentially stressful situations is individual and depends on two basic factors. The first is the way a person perceives and interprets the situation, and the second factor relates to the state of the body itself, or the organism. Chronic stress, burnout syndrome and post-traumatic stress disorder often lead to the development of diseases. Stress can affect health directly, through the autonomic and endocrine reactions it causes, but also indirectly, through changes in health behavior that can occur due to stress.

Physical exercise is often recommended as part of a stress management program. It has been proven that exercise reduces stress hormones and stress reactivity. Exercises adapted to the degree of physical capabilities and the levels of motivation of the person are considered an excellent initial approach to managing psychological stress. Physical activity is important not only as a primary prevention of many chronic diseases, but also as a secondary prevention that slows down and reduces the symptoms of chronic diseases. In addition to its impact on chronic diseases, physical activity also has a beneficial effect on improving self-confidence, social skills, cognitive functioning, and reducing symptoms of stress, which, together with other positive effects, contributes to a better quality of life.

The results of existing research show that physical exercise can affect cognitive functioning throughout the lifespan directly, through physiological mechanisms and structural changes in the brain, and indirectly through its impact on mood and stress reduction. Physical exercise, through various mechanisms, has a strong impact on the manifestation of stress levels.

Keywords: stress, physical activity, physical exercise, health

[1] Tamara Stevanovic, High Medical College of Professional studies “Milutin Milanković”, Belgrade, Serbia. E-mail: fizioterapeutamara@gmail.com

Introduction

In recent decades, the modern way of life has implied an extremely demanding and fast pace, insufficient physical activity, inadequate nutrition, and daily stress. Stress is described as an autonomous non-specific response of the body to physical, mental, and constant environmental demands placed on a person [1]. On the other hand, there is a significant lack of time and resources which would enable the adoption of mechanisms for effectively managing stress and engaging in physical activity. All of these factors lead to the deterioration of health. Almost on a daily basis, a person experiences minor or major stressful event, which often has chronic stress as its underlying cause. Therefore, stress not only threatens personal experience of happiness and well-being, but it also represents a serious health risk [2]. Although the health benefits of moderate exercise, i.e., moderate physical activity, are well established, more than 60% of adults globally do not exercise regularly, and 25% lead a sedentary lifestyle [3].

Stress

Stress can be defined as a disruption of the body's homeostasis, excessive emotional and physiological arousal that is experienced in a threatening situation. "Stress is a non-specific biological response (both physical and mental) to any unusual demand that exceeds the adaptive capacity of the body" [4]. Stress is described as an autonomous non-specific response of the body to physical, mental, and constant environmental demands [1].

Harmful agents, also called stimuli, which cause stress, are called stressors. Stressors are categorized into several types: psychological (frustration, sadness, fears, bullying), physical (trauma, noise, extreme effort), and social (divorce, job loss, financial crisis). Stress is often viewed negatively, but it is important to note the two existing types: eustress and distress. Eustress represents positive stress, which keeps the body alert. It is characterized by excitement, short duration, and increased efficiency. Positive stressors, or eustressors, may include job changes, promotions, marriage, or vacations. Distress is negative stress, which results from prolonged stress exposure, leading to overload. Distress features include anxiety, worry, reduced efficiency, and various somatic symptoms such as headaches, hypertension, and chest pain. Common distress sources are the death of a loved one, divorce, illness, and financial difficulties [5].

Based on its duration and frequency, stress can be classified as:

a) Acute stress – arises from recent environmental pressures of future expectations, and triggers a "fight or flight "response, which brings the body to either a reactive or adaptive state towards the stressor;

b) Episodic acute stress – caused by frequent recurrence of acute stress episodes;

c) Chronic stress – results from prolonged exposure to stressful situations, especially in family or work life;

d) Post-traumatic stress disorder– occurs when a stressor persists within the body for years, with repeated traumatic events [6].

Mechanisms of Stress Development

Understanding brain regions involved in physiological responses to stress is an important endeavor, as a growing number of studies link neuronal activity during exposure to stressors with resulting physiological reactions. In the recent few decades, scientific research has explained the physiological mechanisms of stress and its impact on health. Stress activates the sympathetic nervous system and the hypothalamic-pituitary-adrenal axis, triggering inflammatory processes that correlate with weakened immunity and various chronic diseases [2]. From the perception of a stressor to the response in the nervous system, the following five levels are involved in the following order:

Input and interpretation of sensory information (associative and prefrontal cortex, hippocampus);

Emotional evaluation (prefrontal-amygdala activity);

Initiation of neuroendocrine responses (hypothalamus and paraventricular nuclei);

Feedback from autonomic and endocrine systems (aminergic nuclei of the brainstem);

Autonomic and endocrine response (pituitary gland and adrenal glands).

Physiological stress responses are mainly regulated by the sympatho-adrenal-medullary system and the hypothalamic-pituitary-adrenal cortical axis. Due to the effects of the stressors, the hypothalamus sends sympathetic impulses to various organs and releases adrenaline and noradrenaline into the bloodstream. During intense stress, the body is flooded with these hormones, amplifying sympathetic effects and increasing secretion of adrenocorticotropic hormone via feedback with the hypothalamus. Adrenocorticotropic hormone stimulates the adrenal cortex to produce cortisol. Cortisol provides extra energy by increasing amino acids in the blood, releasing fatty acids, and generating glucose. However, prolonged high cortisol levels can reduce glucose utilization, increase fat accumulation, impair memory, and weaken the body`s immune function. B-endorphin is also released to prepare the body for potential pain. Stress also alters thyroid-stimulating hormone levels, usually reducing them. All of these mechanisms trigger further bodily responses [7].

Body's Response to Stress

The response to a potentially stressful situation is individual and depends on two main factors. The first factor regards the person`s perception and interpretation of the situation, and the second one regards the state of the body itself [8].

Selye (1975) noted that stressors lead to the development of the general adaptation syndrome. He noted that regardless of stressor intensity, the body develops one unspecific response, during which cortex activity is being increased and thymus, spleen, lymph nodes, and other lymphatic structures are being reduced. The general adaptation syndrome consists of three phases:

Alarm phase, which lasts from few hours to a few days, and brings increased adrenal, cardiovascular, and respiratory activity;

Resistance phase, in which the stressor stays relatively present, but resistance to other stressors decreases;

Exhaustion phase, which means prolonged or repeated exposure to a strong stressor reduces the neuroendocrine system's capacity, potentially leading to disease or death. Decreased cortisol levels impair the inhibitory response of the sympathetic nervous system, resulting in chronic stress, burnout, or post-traumatic stress disorder [4].

Šupe et al. (2011) categorized stress responses into physiological/physical and psychological:

Physical/physiological reactions consist of: tachycardia, arrhythmia, high blood pressure, rapid breathing, sweating, constipation/diarrhea, muscle tension, headaches, vasoconstriction, elevated glucose and cholesterol, weakened blood-brain barrier, reduced pain sensitivity, sexual dysfunction, altered immune response.

Psychological reactions can include:

Cognitive reactions: attention, memory, concentration issues, altered reasoning and judgment;

Emotional reactions: fear, sadness, depression, aggression, hypersensitivity, irritability, helplessness, hopelessness, appetite changes, sexual desire changes, insecurity, and social withdrawal;

Behavioral reactions: neglect of responsibilities/hygiene, loss of motivation, addictive behaviors, physical inactivity, and sedentary lifestyle [6].

Impact of Stress on Health

Chronic stress, burnout, and post-traumatic stress disorder frequently lead to disease. Stress affects health directly via autonomic and endocrine responses and indirectly through health behavior changes. Long-term stress causes allosteric load,

or simply put, overuse of physiological systems. This causes a shift in the dominance in the autonomic nervous system toward sympathetic over parasympathetic activity, contributing to mental disorders, hypertension, coronary heart disease, and diabetes [9].

Chronic stress is linked to gastrointestinal disorders (irritable bowel disease, peptic ulcer, ulcerative colitis). Furthermore, there is a 40% increased risk of ulcers in individuals with stress-induced poor habits (e.g., irregular diet, smoking, alcohol, poor sleep). Stress causes immune dysregulation, reducing wound healing, antibody response, and increasing susceptibility to infections.

Due to the stress induced catecholamine release, the heart rate, cardiac output, and peripheral vasoconstriction increase, causing hypertension. Sympathetic activation leads to platelet aggregation, vascular hypertrophy, and left ventricular hypertrophy, potentially resulting in a heart attack, atherosclerosis, or a stroke. Stress is associated with increased psychiatric morbidity, as well as with an increased relapse risk in many psychiatric disorders. It has been proven that prolonged cytokine production due to stress causes depression [10].

Stress Management

There are many stress management techniques (with varying levels of empirical support), including psychotherapy, massage, meditation, yoga, and relaxation techniques such as autogenic training, progressive muscle relaxation, and diaphragmatic breathing. Physical exercise is frequently recommended as part of stress management programs. It reduces stress hormones and stress reactivity. Exercises tailored to physical ability and motivation levels are an excellent starting point for managing psychological stress. Moderate activity like walking for 15–20 minutes three times a week is sufficient. A single 20-minute session can reduce acute stress, while the improvement in a chronic stress patient typically requires a minimum of 10 weeks of regular exercise [10].

Physical Activity

Physical activity includes any body movement which increases energy expenditure above resting levels, while being performed in various forms and intensities [11]. This includes daily activities like walking, stair climbing, and housework [12].

Accurately assessing physical activity in natural settings remains a topic of discussion among researchers. It involves various devices such as both direct and indirect calorimetry, tracking of physiological markers, mechanical/electronic monitoring, motion sensors, and direct observation. However, variability in activity type and individual differences create limitations in data reliability, validity, intrusiveness, cost, and purpose [3].

Physical activity is important not only for primary prevention of many chronic diseases but also for secondary prevention, helping reduce symptoms. It also improves self-confidence, social skills, cognitive functioning, and reduces stress symptoms, contributing to better quality of life [13].

Effects of Physical Exercise

Physical exercise is a planned, purposeful physical activity aimed at maintaining or improving health and fitness.

Existing research shows that exercise can impact cognitive functioning across the lifespan both directly, through physiological mechanisms and brain structure changes, and indirectly, by improving mood and reducing stress. However, effects vary based on intensity—moderate-intensity improves cognition, while high-intensity may have the opposite effect. Effects also vary by type of activity. Overall, physical exercise benefits various cognitive processes, but no clear mechanism has yet been identified. It's also unclear to what extent different activities affect specific versus general cognitive functioning [14].

It has been proven that regular physical exercise has positive effects in cognitive, emotional, and motor domains, along with stress reduction and the mitigation of negative influences. It also plays a preventive role in anxiety and depressive states and facilitates psychological well-being in both adolescents and adults [15].

Milani and Lavie (2009), in a study conducted on patients with coronary artery disease, identify stress as an independent risk factor for mortality, and exercise can effectively reduce its prevalence. They emphasize that exercise reduces mortality in these patients, which is mediated by the beneficial effects of physical exercise on stress [16].

Kim and McKenzie (2014), in the conclusion of a study conducted on a group of students, state that physical exercise contributes to effective problem coping, while improved stress management influences the regulation of health behavior related to well-being, leading to overall wellness [17].

The goal of a study conducted in Serbia was to examine the importance of physical exercise and stress management mechanisms in the context of mental health indicators during social isolation caused by the COVID-19 lockdown. The sample consisted of 680 adults (66% women), with an average age of 35.91 years. The results indicated a significant connection between physical exercise and a reduced stress response [18].

Physical exercise, through various mechanisms, has a strong impact on the manifestation of stress levels. The biological mechanism relates to the regulation of cortisol and adrenaline hormone secretion and the improvement of autonomic nervous system function. The release of endorphins leads to improved mood and reduced anxiety [19]. Finally, the social effect is reflected in the strengthening of social bonds,

especially through organized group activities, as this increases social interaction, creating a strong support network and further reducing stress [20].

In a study conducted in the United States in 2013, 70% of men and 56% of women reported exercising at least once a week. One of the reasons for such a low level of engagement in physical exercise among women includes social obligations and daily challenges, as well as a higher sense of stress. As many as 43% of women, compared to 34% of men, stated that they avoided exercising due to stress. However, despite this, more women reported positive effects from exercising—57%, compared to 48% of men [21].

Conclusion

Physical activity, through various aspects, influences stress reduction. Although different life stages bring various challenges and stressors, physical activity is a universal strategy for improving physical and mental health [22].

Given that many studies have highlighted gender and individual differences, it is advisable to define a clear approach to planning and implementing physical activities. In doing so, it is also important to consider the lack of time, motivation, and economic constraints that significantly affect the rate of participation in physical exercise, making it crucial to develop an approach that eliminates these barriers.

Since it is a review paper, the permission of the ethics committee is not required. There is no conflict of interest.

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