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THE INFLUENCES OF PHYSICAL EXERCISES ON THE NERVOUS SYSTEM

BY

PETRONELA PARASCHIV*

“Gheorghe Asachi” Technical University of Iași,
Department for Teacher Training - Physical Education Sport Department

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Abstract. Exercise is fundamental to a healthy life, positively influencing not only the body but also the mind. In addition to the obvious benefits for physical health, sporting activities have a significant impact on the brain, contributing to the development and maintenance of neuronal functions. The relationship between physical exercise and the nervous system is bidirectional: on the one hand, movement stimulates neurogenesis and brain plasticity, and on the other hand, neural adaptations optimize physical performance. In an increasingly sedentary world, knowledge of these benefits is becoming essential to prevent both physical and mental health problems.

Keywords: engineering, students, neuronal system, health.

1. Introduction

Physical exercises are fundamental to a healthy life, positively influencing not only the body but also the mind. Beyond the obvious benefits to

*Corresponding author; *e-mail*: petronela.paraschiv@academic.tuiasi.ro

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physical health, sports activities significantly impact the brain, contributing to the development and maintenance of neural functions. The relationship between physical exercises and the nervous system is bidirectional: on one hand, movement stimulates neurogenesis and brain plasticity, and on the other, neural adaptations optimize physical performance. In an increasingly sedentary world, understanding these benefits becomes essential for preventing both physical and mental ailments.

2. Effects of Learning a Physical Exercise on the Brain

Learning a physical exercise involves a complex process of motor coordination and the formation of neural connections. The brain activates regions responsible for motor planning and execution, such as the motor cortex and cerebellum. This process stimulates neuronal plasticity, which consists of forming new synaptic connections. Thus, repeating movements leads to their automation, conserving cognitive resources for other tasks (Danaila, 2023).

A notable example is neurogenesis in the hippocampus, the region responsible for memory and learning. Through sports activities, this part of the brain becomes more active, contributing to improved memory and concentration. Additionally, the motor learning process increases levels of dopamine and serotonin, neurotransmitters that play a crucial role in mood regulation. Moreover, engaging the brain in new activities, such as learning a sport or choreography, helps enhance cognitive flexibility, a vital element in preventing mental decline (<https://institutulbrainmap.ro/ce-este-neuroplasticitatea-si-beneficiile-ei>).

Repeating a physical exercise also stimulates the development of the prefrontal cortex, responsible for decision-making and emotional self-regulation. Thus, exercises not only improve physical performance but also contribute to managing stress and anxiety. This enhancement of cognitive functions is essential in a world where daily stress affects more and more people.

3. The Connection Between the Muscular System and the Brain

Muscles and the brain work closely together through the nervous system. Signals transmitted from the brain via motor nerves cause muscle contraction, while information from the environment is sent to the brain through sensory nerves. This bidirectional communication is essential for coordinating movements and adjusting them in real-time.

Beyond motor signals, muscles release proteins such as BDNF (brain-derived neurotrophic factor), which supports neurogenesis and neuronal protection. These proteins contribute to the brain's adaptation to new demands and reduce the risk of neurodegenerative diseases. Additionally, intense muscle

contractions stimulate the release of myokines, molecules that reduce inflammation in the body and support brain health.

Furthermore, physical exercises improve blood circulation to the brain, ensuring optimal oxygenation. This increase in blood flow promotes the elimination of toxins and supports cellular regeneration. The relationship between the muscular system and the brain demonstrates the importance of integrating regular movement into daily life to maintain mental health (Harris, 2014).

Moreover, active muscles send signals to the brain that enhance alertness and increase energy levels, contributing to greater productivity. Another aspect is the role of muscles in reducing oxidative stress, a factor that contributes to the deterioration of nerve cells.

4. The Nervous System and Adaptation to Effort

The body's adaptation to effort is possible due to the involvement of the nervous system. The central nervous system (CNS) coordinates complex reactions, such as adjusting heart rate and pulmonary ventilation, while the peripheral nervous system (PNS) transmits signals to muscles to optimize movement.

An important aspect of adaptation is increasing fatigue tolerance. By repeating exercises, the CNS reduces the perception of effort, allowing for more intense or longer-duration activities. This process is supported by the release of endorphins, which diminish pain and enhance well-being. Additionally, the autonomic nervous system plays a crucial role in regulating body temperature and blood pressure during physical effort, preventing physiological imbalances.

In the long term, physical exercises lead to increased density of neural networks involved in coordination and motor control. This adaptation not only optimizes movements but also enhances the body's ability to respond to external stimuli, which is essential in complex physical activities. Moreover, this adaptation supports the reduction of chronic fatigue and the improvement of sleep quality, aspects closely related to the functioning of the nervous system (Crosley, 2021).

5. Energy Resources for Endurance Energy

To support physical activities, the body utilizes various energy sources. These include muscle glycogen, fats, and, in extreme cases, proteins. The choice of energy source depends on the intensity and duration of the exercise.

Energy control during sports activities is an essential process that requires a combination of nutritional measures, proper hydration, stress control, exercises intensity monitoring. During intense or long-duration exercise, the body can go into an energy collapse that can disrupt sports performance.

There are a few measures that can help avoid this:

Before training, eating a light but nutritious snack, fruit or energy bars;
Maintaining adequate hydration both before, during and after physical exertion;

The post-workout meal should be a complete meal within 30-60 minutes after exercise, containing protein for muscle repair and carbohydrates to replenish glycogen stores;

Quality sleep is important for recovering physical and mental energy (https://www.ethicsport.ro/blog-ethicsport?journal_blog_post_id=48).

Aerobic metabolism predominates during moderate-intensity and long-duration exercises, using oxygen to break down fats and carbohydrates. On the other hand, high-intensity exercises activate anaerobic metabolism, which rapidly generates energy but produces lactic acid, contributing to the sensation of muscle fatigue.

The nervous system plays an essential role in optimizing these processes, adjusting blood flow and metabolic rate as needed. Regular exercises increase the efficiency of mitochondria, the cellular structures responsible for energy production. By increasing their number and capacity, the body becomes more resistant to effort, contributing to improved physical and mental performance.

Moreover, metabolic adaptation includes optimizing the use of available resources, thereby reducing the risk of energy depletion during long-duration activities (Sbenghe, 2008).

6. Conclusions

Physical exercises are a cornerstone of general health, having a profound impact on the nervous system. They stimulate neurogenesis, brain plasticity, and stress resilience, contributing to the maintenance of long-term cognitive health. Additionally, physical exercises strengthen the connection between the muscular system and the brain, highlighting the role of movement in supporting mental and emotional balance.

In a world where sedentary lifestyles are increasingly prevalent, physical activity is not just an optional choice but a necessity for maintaining a balanced and active life. Therefore, adopting an active lifestyle should be viewed as an essential investment in physical and mental health, with benefits that influence all aspects of our existence. From improving memory and concentration to enhancing well-being and preventing diseases, physical exercises are the foundation of a healthy life.

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**INFLUENȚELE EXERCIȚIILOR FIZICE ASUPRA
SISTEMULUI NEURONAL**

(Rezumat)

Învățarea unui exercițiu fizic implică un proces complex de coordonare motorie și de formare a conexiunilor neuronale. Creierul activează regiunile responsabile de planificare și execuție motorie, cum ar fi cortexul motor și cerebelul. Acest proces stimulează plasticitatea neuronală, care constă în formarea de noi conexiuni sinaptice.