BRAIN. Broad Research in Artificial Intelligence and Neuroscience
e-ISSN: 2067-3957 | p-ISSN: 2068-0473
Covered in: Web of Science (ESCI); EBSCO; JERIH PLUS (hkdir.no); IndexCopernicus; Google Scholar; SHERPA/RoMEO; ArticleReach Direct; WorldCat; CrossRef; Peeref; Bridge of Knowledge (mostwiedzy.pl); abcdindex.com; Editage; Ingenta Connect Publication; OALib; scite.ai; Scholar9; Scientific and Technical Information Portal; FID Move; ADVANCED SCIENCES INDEX (European Science Evaluation Center, neredataltics.org); ivySCI; exaly.com; Journal Selector Tool (letpub.com); Citefactor.org; fatcat!; ZDB catalogue; Catalogue SUDOC (abes.fr); OpenAlex; Wikidata; The ISSN Portal; Socolar; KVK-Volltitel (kit.edu)
2025, Volume 16, Issue 2, pages: 178-185.
Submitted: February 21st, 2025 | *Accepted for publication:* May 10th, 2025

Examining Philosophical Origins of the Physical Culture Problem in a Historical-Retrospective Manner: Neuroscientific Research into the Impact of Physical Culture on the Human Brain

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Abstract: *The significance of the article lies in its exploration of the historical aspects related to the genesis of physical education and the shaping of its content, which the authors believe have philosophical roots in the development of one's physical culture. This historical journey can be divided into two distinct periods. The first period, from the emergence of primitive communal systems to the 19th century, can be tentatively described as a pre-scientific phase. During this time, two phases are discernible: empirical and experimental, which reflect the initial stages of physical culture development. The second period, spanning roughly a century and a half from the late 19th century to the early 21st century, represents the era when the problem evolved into a more scientifically focused field of study. Within this timeframe, four distinct stages can be identified, illustrating the evolution of the scientific, theoretical, methodological and technological foundations of physical education, sports, as well as the management of physical education. Currently, sports are the dominant culture in many areas of human activity. It directly influences the material, social, and spiritual values of society and individuals. Therefore, the impact of physical culture on brain function is of paramount importance as physical activity is intrinsically linked to the body's functioning through the brain. The article studies the history of one's physical culture development, discussing the role of the state system, lifestyle and specific state requirements in organising physical education. It also explores the current development of one's physical culture and its impact on brain development.*

Keywords: *spirituality; health; personality; morality; self-esteem; sports; physical education; neuroscience.*

How to cite: Ovcharuk, V., Yurchyshyn, Y., Pavlyuk, Y., Polishchuk, R., Kernas, A., & Lohvynenko, O. (2025.). Examining philosophical origins of the physical culture problem in a historical-retrospective manner: Neuroscientific research into the impact of physical culture on the human brain. *BRAIN. Broad Research in Artificial Intelligence and Neuroscience*, *16*(2), 178-185. https://doi.org/10.70594/brain/16.2/14

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1. Introduction

The issues surrounding the development of physical culture have gained significant prominence in recent times. This is primarily attributed to the crucial role that physical culture, health, and active longevity play in unlocking human potential, which are now assessed in several key criteria for measuring social progress. The state of people's health is on the decline, highlighted by more individuals engaging in substance abuse, a rise in psychological issues, and failing health overall.

The advancement of physical education standards underscores the significance of a historical analysis of philosophical principles. These principles inform the development and progression of personal physical culture. Physical culture and sports have a pivotal function in enhancing the general quality of life and promoting a wellness-focused environment. Embracing a wide range of values and methods in the world of sports promotes self-discovery, personal growth, and overall life satisfaction.

Sport has become a dominant force in many areas of human activity today, shaping the material, social, and spiritual values of society and individuals. The influence of physical culture on brain function is particularly significant since the brain receives signals from various body systems, including the muscles that play a crucial role in supporting cognitive performance. A sedentary lifestyle often leads to insufficient physical activity, causing not only muscle atrophy but also a notable decline in brain function. Physical activity is essential for helping the brain develop mechanisms to adapt to psychological stress. For students, in particular, the lack of movement due to a sedentary lifestyle can result in both muscle deterioration and a significant reduction in cognitive efficiency. However, maintaining regular physical activity is key to ensuring the brain can effectively respond to stress.

Zavydivska (2013) demonstrates that the emergence of new ideas in the organisation of physical education in various ancient societies was influenced by changing life conditions in ancient times. She provides comprehensive insights into the physical education systems of the Ancient East, Ancient Greece (Sparta and Athens), and Ancient Rome, highlighting that the distinctive feature of physical culture in the Ancient East was its military orientation. As noted by Howson (2004), during the latter half of the 18th century, certain countries witnessed the emergence of gymnastics directions, benefactors, groups, and associations. However, despite the active development of physical education, nationally significant systems of physical education did not come into existence until the conclusion of the Napoleonic Wars in the early 19th century, a fact that became evident in subsequent wartime experiences.

Kuznetsova and Zubrytskyi (2017) further substantiate significant changes that occurred in the organisation of physical education within the universities of their country after the war. This transformation involved the restoration of physical education and sports departments in 1951, curriculum and programme updates, as well as an intensified process of development, scientific-theoretical advancements, and experimental-practical enhancements of the physical education system, particularly during the 1970s and 1980s.

As noted by Sheremet et al. (2019), with each passing year, there are progressively fewer healthy children. This statistic is a result of the absence of effective physical education. Everyone can choose the most suitable exercise for their health and physical characteristics. However, it is essential not to overstrain one's body, especially if it is not prepared for that type of training. Overexertion does not have a positive impact on the human brain and can lead to fatigue and a decrease in cognitive performance.

Hence, the article aims to explore the historical evolution of one's physical culture, reveal the role of psychical culture on brain development, and carry out research on the effects of physical exercise on the brain and nervous system.

2. Tracing the Origins and Growth of One's Physical Culture

To gain a deeper understanding of the philosophical foundations of physical culture, it is necessary to look back at the history of tribal society, in which physical education was of great importance and was an integral part of the communal lifestyle. An essential characteristic of physical education in this historical era was its compulsory nature. It was obligatory for everyone, with distinctions based solely on gender, and it was a shared societal value. In primitive society, physical exercises used for physical education primarily served an applied function closely aligned with labour, essentially reflecting the nature of the tribal community's work activities.

Subsequent historical development led to the replacement of the primitive communal system with a new social structure known as the slave system. While the slave-owning society was marred by its injustices and cruelty, it represented a more progressive step forward in comparison to the original communal society. The slave system alleviated a substantial portion of the population from arduous physical labour, facilitated a more pronounced specialisation of labour, the establishment of state institutions, the construction of significant architectural works, the advancement of writing and an overall cultural upswing, including the development of physical culture (Mowling et al., 2004).

The advent of new living conditions sparked the emergence of fresh concepts in the realm of physical education within various ancient states. The most comprehensive insights into the physical education systems of that era are gleaned from the annals of civilisations in the Ancient East (including Egypt, Assyria, Persia, India, and China), Ancient Greece (Sparta and Athens), and Ancient Rome. A salient feature characterising the physical culture of the Ancient Far East was its military orientation. Notably, Ancient Greece played a pivotal role in shaping the contours of physical culture and the structure of physical education systems.

Many elements from ancient Greek physical culture have endured through time, encompassing physical exercises, the organisation of competitions, and even the Olympic Games. During the zenith of ancient Greek culture in the 5th to 4th centuries BC, the city-states of Athens and Sparta emerged as prominent examples. The physical education systems of these ancient Greek city-states most vividly underscore the intricate interplay between the conditions of human existence and the methodologies employed for adapting to these societal circumstances, including through physical education.

Sparta's political system, characterised by perpetual warfare and the exploitation of a vast slave army, necessitated Spartans to meet a paramount requirement, i.e., to maintain a constant state of preparedness for conflicts and to exert dominion over 250,000 slaves. Under these circumstances, the state assumed responsibility for education, with the primary objective of moulding children into Spartan warriors and future slaveholders. In Spartan society, state oversight of a child's education commenced from the very inception of their life. Following a child's birth, the father would present them to the Council of Elders, who, after assessing the child's physical well-being, would determine the course of the child's future.

Up to the age of seven, family members were entrusted with the physical education of the child to instill resilience. Starting at the age of seven, Spartan boys were sent to state-run educational institutions known as Aggels, where they received instruction and upbringing until they reached eighteen years of age. In contrast, Athenian education followed a different path. During the 5th to 4th centuries BC, Athens experienced rapid developments in culture, trade, art, and craftsmanship. The Athenians held the ideal individual to be one who was physically and morally beautiful and sought a blend of spiritual, moral, aesthetic, and physical education (Verkhovskaia, 2016).

The Athenian educational ideal revolved around the comprehensive development of an individual, emphasising the cultivation of a wide range of virtues. It aimed at shaping individuals in a multifaceted manner. An initial examination of the focus and content of the educational systems in these two ancient Greek states, characterised by different social structures, already reveals the reflection of underlying social processes.

3. Examining the Impact of Physical Culture on Brain Development

Physical exercises and sports activities have a significant impact on human cognitive functions. They contribute to the development and enhancement of numerous mental functions, including memory, attention span, thinking, and willpower. They promote both the stability and improvement of cognitive performance. Furthermore, during physical activity, there is an increased blood flow to the brain, ensuring an ample supply of oxygen to brain cells. As a result, the mind becomes more focused and attentive. Moderate physical activity stimulates the functioning of nerve cells in the brain and facilitates the rapid development of neural processes.

According to Nerubasska & Maksymchuk (2020), engaging in sports contributes to the development of dendrites not only in the brain regions responsible for motor skills but also in areas associated with learning, thinking, and memory. The growth and development of nerve cells and their consequences are fundamental to one's intellectual abilities. Exercise helps to sharpen focus, as it requires keeping track of the technique being used as well as counting repetitions. As an example, when practising rhythmic breathing, the individual focuses on inhaling and exhaling.

Physical activity also has an impact on one's mood. People who participate in sports often feel happier and emotionally more stable. This can be attributed to the fact that, in addition to serotonin, physical activity promotes increased production of dopamine, namely, a substance responsible for one's mental and emotional state. Dopamine supports brain and heart function and weight control, enhances productivity, and improves mood. Regular physical exercise is the key to maintaining a normal dopamine level.

Interestingly, anaerobic training causes an increase in the size of the hypothalamus and the cerebral cortex. Strength training is designed to increase heart rate and focus on specific exercises, which is why it does not have the same effect.

Nerubasska et al. (2020) claim that sports and physical activities lead to the improvement of many sensory organs, especially the human skeletal system, vision, and hearing. Through physical activity, one can concentrate on what is essential and disregard secondary tasks that may arise in the future.

Most people begin training to become more flexible, enduring, and strong, while also providing the necessary energy for exercises. This energy deficiency can result in a decrease in attention and cognitive performance throughout the day. Therefore, when choosing the optimal level of physical exertion, it is essential to understand that a specific set of exercises should be performed: firstly, not to interfere with psychological functions and perception, and secondly, to enhance these functions and cognitive performance.

The effectiveness of brain function is directly related to the number of impulses sent to one's muscles from various parts of the body. When muscle groups function smoothly, the brain receives a significant amount of nerve impulses, which enhances its functionality and efficiency in human cognitive activities. All mental activities, such as attention, focus, memory and perception, are contingent upon how well one adapts physically.

The process of these psychophysiological functions depends on the manner of physical preparation, its flexibility, strength, and other physical parameters. It is of utmost importance for everyone to be aware that minimal physical activity does not result in positive effects on brain functioning. On the other hand, too much physical activity can cause serious exhaustion, which negatively impacts mental performance.

At the same time, physical activity also helps combat many brain-related disorders. Indeed, there is evidence that physical exercise can significantly reduce cognitive impairments in conditions like schizophrenia and Parkinson's disease. It is also known that stressful situations and nervous tension have a detrimental effect on the body, causing neuronal atrophy, loss of connections between nerve cells, and the creation of new nerve cells.

A decrease in the number of these neural networks can lead to a decline in one's cognitive abilities, as well as memory and perception. However, there are mechanisms to counter these drawbacks. As is known, neurons are more efficient in coping with stressful situations in people

with an active lifestyle and can also facilitate the organisation of new connections with a greater number of cells (Nerubasska et al., 2020).

Therefore, engaging in sports and physical culture not only improves well-being but also has a positive impact on the activation of the human brain, strengthening it and protecting it from the negative effects of stress and similar situations.

There is no doubt that physical activity enhances brain function. During training, the body sends a series of stimulating signals to the brain, promoting the production of necessary proteins that train and improve brain function. An active lifestyle during physical activities enhances mood, provides a protective mechanism, and safeguards processes in the brain.

Regular physical activity not only improves cardiovascular, respiratory, immune, and muscular systems but also helps control the delivery of cellular energy and strengthens and develops cognitive abilities of the human brain. All of this reaffirms that physical activity occupies a crucial place in the daily routine of every individual.

4. Research on the Effects of Physical Exercise on the Brain and the Nervous System

A key benefit of physical activity on brain function is enhanced blood circulation. During cardio workouts, the heart pumps blood more vigorously, delivering more oxygen and nutrients to the brain, which are essential for optimal functioning. Additionally, exercise helps remove waste products and toxins from the brain, which can otherwise accumulate and impair cognitive performance (Kuznetsova, 2014; 2017).

Improved blood flow to the brain occurs not only during exercise but also after it. Regular physical activity promotes the development of new blood vessels in the brain, especially in areas linked to memory, attention, and other cognitive functions. Consequently, exercise boosts brain performance and helps protect it from aging (Bodnar, 2013).

Physical activity also significantly stimulates neurogenesis, the process of creating new neurons (brain cells) and their connections (synapses). Although neurogenesis continues throughout life, its rate slows with age. Exercise can enhance and speed up this process (Liu & Nusslock, 2018).

The impact of physical activity on neurogenesis involves the production of specific proteins in the body. One such protein is BDNF (brain-derived neurotrophic factor), essential for the growth and survival of new neurons and synapses, as well as for transferring information from short-term to long-term memory. BDNF levels rise during muscle activity and in response to the exercise hormone irisin (FNDC5), which is released by muscles during physical exertion.

BDNF also activates the brain's reward system, enhances motivation, supports learning, and may serve as a natural antidepressant (Shilling, 2013).

With the help of BDNF and irisin, the brain can undergo physical changes as one acquires new skills or exercises one's cognitive functions. This phenomenon, known as brain plasticity, enables the brain to adapt to various conditions and challenges, improve its functionality, and recover from injury.

Physical exercise not only strengthens muscles and enhances brain function but also significantly elevates mood and helps alleviate stress. It stimulates the production of endorphins, hormones associated with happiness that induce feelings of joy, satisfaction, and euphoria. Additionally, endorphins are recognised for their ability to reduce pain and increase pain tolerance.

Regular fitness activities boost the levels of various hormones and neurotransmitters, chemicals that carry signals between brain cells. These substances have a positive impact on mood: serotonin, often referred to as the "happiness hormone", helps regulate emotional well-being, appetite, sleep and libido; dopamine, known as the "pleasure and motivation hormone", enhances feelings of satisfaction and drive; norepinephrine, the "alertness hormone", improves concentration and the stress response.

Exercise is particularly beneficial for mood disorders such as depression, which is marked by chronic sadness, loss of interest in life, diminished self-esteem, and low energy. Depression is

linked to imbalances in brain hormones and neurotransmitters. Exercise can help restore this balance by increasing levels of serotonin, dopamine, and norepinephrine. Additionally, physical activity can reduce inflammation in the body, which is associated with the development of depression (Cieza et al., 2021).

Moreover, exercise enhances memory, the ability to retain information, attention, and the ability to concentrate on tasks. These improvements positively affect the hippocampus, a brain region vital for forming and maintaining long-term memory. Given that the hippocampus is particularly vulnerable to stress and aging, exercise can offer protection against these adverse effects.

Exercise also enhances the function of the prefrontal cortex, which governs executive functions such as planning, problem-solving, impulse control, and attention regulation. As the prefrontal cortex deteriorates with age, regular physical activity helps preserve its volume and functionality (Erickson, Leckie, & Weinstein, 2014).

Studies have demonstrated that consistent physical activity improves various types of memory: working memory, which involves holding and manipulating information temporarily; episodic memory, which pertains to recalling personal experiences; and procedural memory, which relates to remembering skills and actions. Additionally, exercise boosts attention, concentration, and the speed of information processing.

Beyond logical reasoning, exercise stimulates creative thinking, i.e., the ability to generate original and valuable ideas, solutions, or products. Being physically fit contributes to a positive and relaxed state, fostering openness to new ideas and perspectives. Fitness raises dopamine levels in the brain, which encourages creative activities. Regular physical activity enhances cognitive functions such as memory, attention, and executive skills essential for creativity. It also stimulates the growth of new neurons and their connections, improving brain plasticity and learning ability. Exercise helps establish connections between various brain regions involved in processing different types of information, such as visual, auditory, and motor (Honchar et al., 2021).

Sports expand one's life and social experiences, offering opportunities for meaningful interaction. Engaging in team sports and competitive activities helps people connect with new individuals, share ideas, learn from others, and work together successfully. Both training and competitions act as sources of inspiration, whether through observing the accomplishments of other athletes or surpassing personal records.

5. Conclusion

The significance of this article is rooted in its exploration of the historical evolution of one's physical culture. This journey into the development of individual physical culture traces its origins back to tribal society, where physical education served as a pivotal function within the tribal community. A key characteristic of physical education during this historical epoch was its universal mandate. In primitive society, physical exercises, employed as tools for physical education, held a distinctly practical purpose closely intertwined with the labour activities that mirrored the communal work patterns of the tribe.

Research has shown that participating in sports and physical activities not only enhances overall well-being but also positively affects brain function by activating and strengthening it, as well as protecting it from the negative impacts of stress and similar factors. Physical activity offers several benefits to brain function. Recent studies have found that regular aerobic exercise, such as running, can increase hippocampal size and improve spatial memory and cognitive functions. Additionally, consistent physical exercise can enhance sleep quality, facilitate the removal of metabolic waste from the brain, and aid in memory consolidation. Moreover, physical activity raises levels of norepinephrine and endorphins, which help reduce the brain's response to stress and promote feelings of pleasure.

Acknowledgement

Author 1 conducted a study on the historical evolution of one's physical culture. Authors 3 and 4 investigated how physical culture influences brain development. Authors 5 and 6 explored the impact of physical exercise on the brain and the nervous system.

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