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Critiques

What does the current evidence reveal about the effects of exercise on cognitive functions in young adults? Insights from a critiques article

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ABSTRACT
This study provides an overview of the effects of exercise on cognition in young adults. Most studies have focused on the benefits of exercise in older adults, likely because of the higher incidence of Alzheimer's disease and other forms of cognitive decline associated with aging. In this article, we analyze current evidence from previous studies and discuss how a study published in the *Brazilian Journal of Motor Behavior* contributes to this body of knowledge.

INTRODUCTION

Cognition refers to the mental processes of thoughts, knowledge, and experiences. Traditionally associated with attention, memory, and intelligence, cognition is a broader concept tied to the specific functions of the tertiary areas of the brain. It includes several abilities such as learning, problem-solving, language skills, decision-making, processing speed, judgment, thinking, and planning [1].

The brain is divided into the sensory, motor, and cognitive regions. The sensory and motor regions are further subdivided into primary and secondary areas. When a sensory stimulus reaches the brain, it is first processed in the primary sensory area, where the sensory input is identified. Damage to the primary sensory area impairs the ability to sense stimuli, leading to conditions such as anesthesia for somatosensory inputs and amaurosis for visual inputs. In the secondary sensory area, stimuli undergo further processing, enabling its interpretation. This allows individuals to not only detect stimuli but also to understand their nature. Dysfunction in the secondary sensory area results in a condition called agnosia, where a person can sense a stimulus but he/she is unable to interpret it [2].

Motor responses in the brain follow a pathway that is essentially the reverse of that of sensory stimuli. While the primary sensory area receives sensory information, motor responses originate from the secondary motor area. The secondary motor area is important for planning movements. Unlike reflexes and other specific visceral movements that are involuntary, most body movements are voluntary and require deliberate planning. The secondary motor area is responsible for formulating movement plans and transmitting the information to the primary motor area (located in the precentral gyrus). The primary motor area executes the movement plan by activating specific motor pathways such as the lateral corticospinal tract. Damage to the secondary motor area leads to apraxia, a condition in which the motor system remains functional, but the individual is unable to plan movements. By contrast, damage to the primary motor area is common in conditions such as stroke and results in paralysis of the upper and lower limbs [3].

Motor and cognitive regions constantly interact with each other. Nearly all daily life situations require both cognitive and motor action. For example, in the imminence of rain, cognitive regions process information about the risk of getting wet, help individuals recall the location of the umbrella, and prompt them to walk quickly to a shelter. An exception to this interaction is reflex arc. When the patellar tendon is stimulated by a percussion hammer, a response occurs without cognitive involvement. Similarly, when a person accidentally touches a hot plate, the motor reaction is an automatic reflex triggered by pain sensory receptors. Figure 1 provides an overview of the primary, secondary and tertiary areas of the brain.

Movement sciences professionals acknowledge the importance of studying cognitive functions. All voluntary motor activities depend on effective cognitive processing to ensure proper execution. Given the essential role of cognition in everyday tasks, numerous studies have been conducted to better understand cognitive mechanisms and to explore ways to enhance cognition across all age groups. However, since most research focuses on older adults, due to age-related changes in the brain and the higher prevalence of cognitive and neurological disorders, studies on young adults remain relatively limited.

In this critiques article, we conducted a bibliometric analysis of the 100 most recent studies that assessed the benefits of exercise on cognitive functions in young adults. We then provided an in-depth review of the study of Croce and Horvat [4], which examined the cognitive benefits of high- and low-volume circuit training in this population.

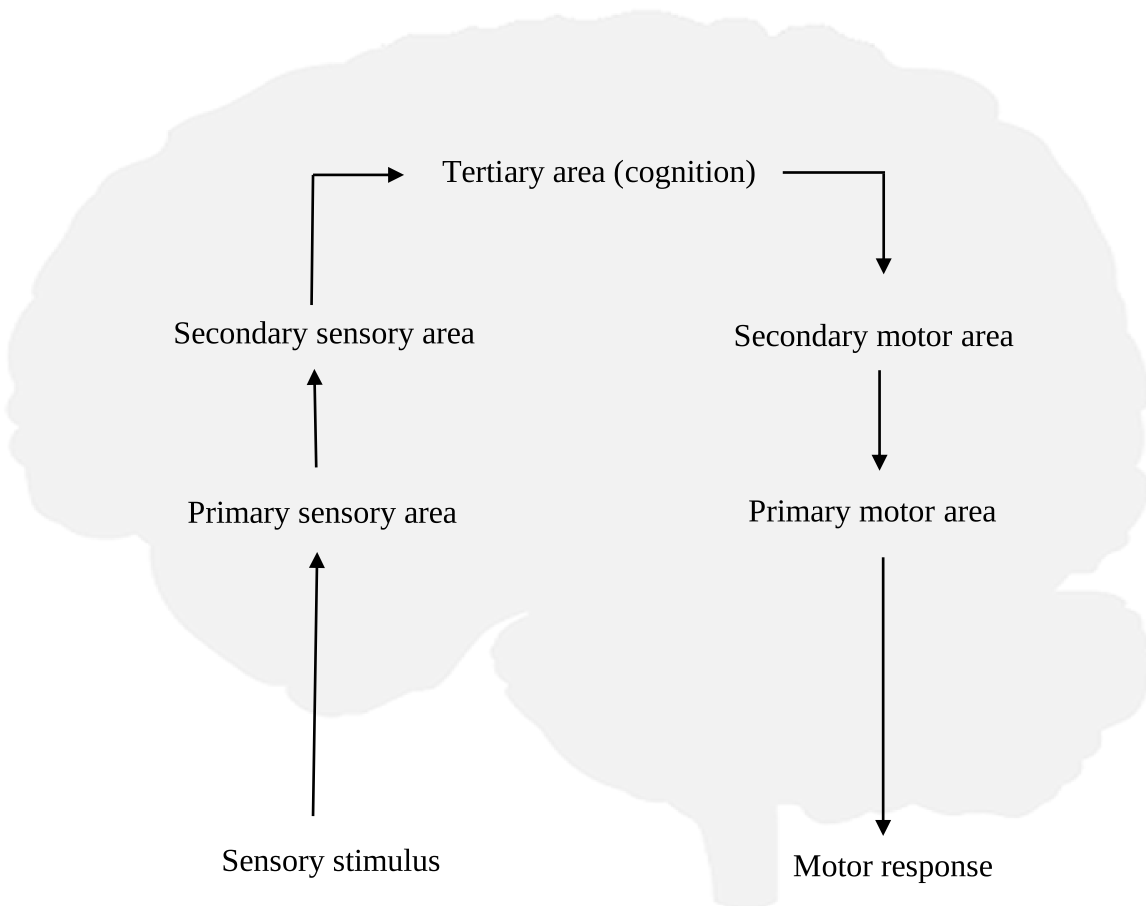

Figure 1. Scheme of primary, secondary, and tertiary areas of the brain. Note. This is a didactic scheme and does not necessarily represent the exact location of the areas in the brain.

NOVEL PERSPECTIVE

This critiques article focused on the 100 most recent studies that assessed the benefits of exercise on cognition in young adults. The inclusion criteria were articles containing the keywords 'exercise', 'cognition', and 'young adults', and featured in scientific journals indexed in PubMed. The exclusion criteria comprised manuscripts published without a prior evaluation by editors and/or reviewers (classified as pre-prints), as well as those that did not use motor exercises for improving cognitive functions.

With respect to the manuscripts analyzed, the studies were unanimous in demonstrating the benefits of exercise on cognitive functions in young adults. The methods used to assess cognitive functions varied. Table 1 summarizes the mechanisms employed by the studies to evaluate cognition. Figure 2 provides a detailed breakdown of studies by continent.

Croce and Horvat recently published a study in the *Brazilian Journal of Motor Behavior* that has made significant contributions to the understanding of the effects of exercise on cognition in young adults [4]. In this study, 30 young adults were assigned to one of the three groups: high-volume circuit training, low-volume circuit training, or a control group with no exercise. All participants underwent cognitive assessments (Trail Making Test) and a stimulus-response apparatus that measured response times under single-choice, multiple-choice, and dual-task conditions. The results were noteworthy, as both the high- and low-volume training groups exhibited reduced reaction and response times compared to the control group, and the high-volume training group showed improvements in the Trail Making Test. These findings highlight the positive effects of exercise on cognition in young adults.

Table 1. Mechanisms used by the studies to assess cognition in young adults.

Methods for assessing cognitive functions	n
Chemical biomarkers (brain derived neurotrophic factor)	10
Brain instruments (functional near-infrared spectroscopy, neuroimaging)	12
Cognitive tests and questionnaires	78

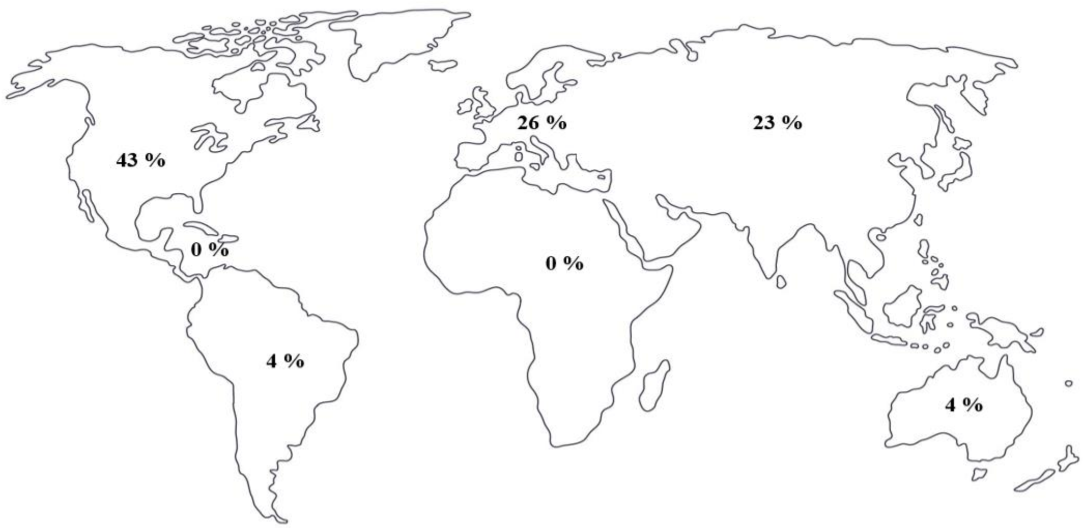

Figure 2. Distribution of studies assessing the benefits of exercise on cognition in young adults by continent.

DISCUSSION

The scientific community recognizes the importance of studying the effects of exercise on cognitive functions in young adults. While research has historically focused on older adults, justified by age-related changes in brain function as well as the prevalence of dementia and other cognitive conditions, there is now a growing interest in assessing cognition in younger populations. This shift aims to determine whether exercise can serve as an effective neuroprotective factor, fostering cognitive reserve and helping safeguard the brain against natural changes over time [5].

Through this critiques article, we identified evidence supporting the role of exercise as a neuroprotective factor in young adults. The benefits highlight the importance of initiating exercise programs as early as possible, rather than waiting until brain function is affected by aging or disease. However, research on this topic remains limited, particularly in certain regions of the world. Moreover, studies predominantly use cognitive tests and questionnaires often justified by the high costs associated with incorporating chemical biomarkers (e.g., brain-derived neurotrophic factor) and advanced neuroimaging tools to assess brain functions, such as functional near-infrared spectroscopy and other brain imaging technologies.

In summary, this critique article encourages young adults to engage in exercise and recommends that future research continue exploring the cognitive benefits of exercise in this population while seeking funding and grants to implement more sophisticated methods for assessing brain functions.

REFERENCES

1. Harvey PD. Domains of cognition and their assessment. *Dialogues Clin Neurosci*. 2019;21(3):227-237. doi: 10.31887/DCNS.2019.21.3/pharvey.
2. Burns MS. Clinical management of agnosia. *Top Stroke Rehabil*. 2004;11(1):1-9. doi: 10.1310/N13K-YKYQ-3XX1-NFAV
3. Sathian K, Buxbaum LJ, Cohen LG, et al. *Neurorehabil Neural Repair*. 2011;25(5 Suppl):21S-32S. doi: 10.1177/1545968311410941
4. Croce RV, Horvat M. Acute low- and higher-volume resistance circuit training improves immediate and short-term cognition in young adults. *BJMB*. 2024: 18(1): e445. doi: 10.20338/bjmb.v18i1.445
5. Mahalakshmi B, Maurya N, Lee SD, et al. Possible neuroprotective mechanisms of physical exercise in neurodegeneration. *Int J Mol Sci*. 2020;21(16):5895. doi: 10.3390/ijms21165895

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