

Short communication

Effects of aerobic physical exercise on cognition

Efeitos da atividade física aeróbica na cognição

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ABSTRACT

Introduction: The increasing prevalence of cognitive impairment in older adults is a major concern nowadays. Interventions able to change the natural history of the most common cause of cognitive impairment in older adults, Alzheimer's disease (AD), are needed. Physical inactivity is considered one of the most important modifiable risk factors for AD. **Objective:** To review recent evidence on the role of physical exercise (PE) in the older adults cognition. **Method:** The authors reviewed recent papers about PE and cognition in older adults. **Conclusion:** Current data indicate that PE is a promising intervention to decrease the risk of cognitive impairment in cognitively normal older subjects and in those with Mild Cognitive Impairment. Controversy still remains about the effect of PE in demented patients, but more recent data is pointing towards a positive effect.

Keywords: Cognition, physical exercise, rehabilitation.

RESUMO

Introdução: A prevalência crescente de comprometimento cognitivo em adultos mais idosos é uma grande preocupação atual. Intervenções capazes de alterar a história natural da causa mais frequente de comprometimento cognitivo em adultos mais idosos, a doença de Alzheimer (DA), são necessárias. A inatividade física é considerada um dos fatores de risco modificáveis mais importantes na DA. **Objetivo:** Rever evidências recentes no papel do exercício físico (EF) na cognição de adultos mais idosos. **Método:** Os autores fizeram uma revisão dos artigos recentes sobre EF e cognição em adultos mais idosos. **Conclusão:** Dados correntes indicam que o EF é uma intervenção promissora para diminuir o risco de comprometimento cognitivo em indivíduos mais idosos cognitivamente normais e naqueles com Comprometimento Cognitivo Leve. Ainda permanecem controvérsias quanto ao efeito do EF em pacientes demenciados, porém dados mais recentes apontam para um efeito positivo.

Palavras-chave: Cognição, exercício físico, reabilitação.

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As life-expectancy increased in the last half of the last century, a growing concern is the increasing prevalence of cognitive impairment in older adults.¹ Current numbers indicate that approximately 13% of the population over 65 years has some cognitive impairment, the most common cause being Alzheimer's disease (AD).² AD is estimated to affect 1% of the older adult population, and its incidence duplicates every 5 years. The prevalence of cognitive impairment is expected to triplicate by 2050, if no intervention that changes the natural history of AD is developed. These numbers are actually worst for Latin America countries, where due to several factors, the prevalence of dementia may be possible bigger.^{3,4} The financial burden of cognitive impairment in older adults is enormous. The direct costs of dementia are expected to exponentially increase in the future, with the frightening figure of 1% of the gross domestic product by 2050.⁵ Also, the emotional impact of AD and other dementias in the families, and the indirect cost for the caregivers, are both important questions for the future. As developing countries are more susceptible to the economic burden of dementia care, this is an emerging public-health issue. In the view of the epidemic proportions of dementia in the future, there has been an extensive search for interventions that reduce the progression of cognitive decline in older subjects.

Physical inactivity is considered one of the most important modifiable risk factors for AD.¹ In a recent meta-analysis of the population-attributable risk for AD, physical inactivity was one of the greatest modifiable risk factors.⁶ The risk attributed to physical inactivity was 21% (95% CI, 95% CI 5.8-36.6) for the American population. This risk is comparable to the risk attributed to low educational attainment of 19.1% (95% CI 12.3-25.6), a well-known risk factor for AD.¹ In contrast, physical exercise (PE) is associated with a decreased risk of dementia in normal older adults.^{7,8} A meta-analysis has shown the protective effects of PE in cognitively normal older adults.⁹ However, data is not so encouraging when subjects with established dementia are studied. Despite some studies have shown benefits,^{10,11} a meta-analysis demonstrated absence of benefit of PE on cognition, in subjects with dementia.¹² However, more recent data is challenging this statement,¹³ and this question is definitely still open. Current evidence is stronger for a preventive role of PE on cognition. In 2010,

the NIH state-of-the-science conference statement about prevention of AD and cognitive impairment concluded that there was not enough evidence to conclude that PE decreases the risk of cognitive impairment.¹⁴ Despite that, several critics were drawn about the conclusion, which were too conservative.¹⁵ The effects of PE on cognitive functions are still an outstanding question. Several biological mechanisms have been implicated in the protective effects of PE, including improved neurogenesis, angiogenesis, and synaptic plasticity as well as a decrease in vascular risk factors, insulin resistance, and normal aging-related brain atrophy.^{16,17} These protective effects are based in the concept of cognitive reserve.¹⁸ According to this theory, an increased brain resiliency to AD pathology would delay the clinical symptoms, even with the accumulation of brain pathology. Alternatively, PE may also decrease brain deposition of amyloid β (A β) protein, one of the hallmark features of AD pathology. A β protein is currently thought to be the initial event in a cascade of events leading to neurodegeneration.¹⁹ Although data regarding this effect are conflicting, these effects may be implicated in the lower risk of dementia in subjects who were active through their lives.^{20,21}

The potential benefits of PE on cognitive function have been supported by studies showing that physically active subjects during adulthood have a decreased risk of cognitive impairment during later life.²²⁻²⁶ PE has been shown to improve cognition in cognitively normal older adults, to reduce age-related hippocampal atrophy and general brain tissue loss, to improve vascular function, and to interact with genetic risk factor for AD, such as APOE.²⁴⁻²⁷ The current evidence is strongest for beneficial cognitive effects of PE for normal older adults without cognitive impairment. A 2008 Cochrane Database states: "there is evidence that aerobic physical activities, which improve cardiorespiratory fitness, are beneficial for cognitive function in healthy older adults, with effects observed for motor function, cognitive speed, delayed memory functions and auditory and visual attention".⁹

An important question is if PE may still benefit subjects with increased risk of cognitive decline compared with the normal elderly population, such as subjects with mild cognitive impairment (MCI). MCI is a heterogeneous condition characterized by cognitive decline that is not severe enough to cause

functional impairment, and meet the threshold of dementia.²⁸ It is a major risk factor for dementia, with an annual conversion rate to dementia of 5%-15% (as compared to a 1% rate in cognitively normal older adults).²⁹ Recent studies have demonstrated that PE may improve cognition in subjects with MCI. Data from randomized controlled trials with PE have indicated improvements in global cognitive function, memory, and executive function.³⁰⁻³⁶ A recent meta-analysis showed strong evidence of benefits for global cognitive function.³⁷ Furthermore, some studies revealed changes in biomarkers: decreased brain atrophy rate,³⁵ and improved brain efficiency^{38,39} in subjects with MCI who performed PE.

In conclusion, current data indicate that PE is a promising intervention to decrease the risk of cognitive impairment in cognitively normal older subjects and in those with MCI. Controversy still remains for dementia, but more recent data is pointing towards a positive effect. Further studies are necessary to better understand the mechanisms implicated in the effects of PE on brain functions. Despite some gaps in the current knowledge, there is enough evidence to support the PE as an intervention to generally prevent cognitive impairment.

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