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The Effects of Physical Activity on Cognitive Function in Older Adults: Evidence From Randomized Controlled Trials

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The Effects of Physical Activity on Cognitive Function in Older Adults: Evidence From Randomized Controlled Trials

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With the rising prevalence of dementia and lack of pharmacological treatments, there has been a focus in recent years on identifying lifestyle intervention strategies that can improve cognitive outcomes and reduce dementia risk in older adults. One such intervention is exercise, where there has been an accumulation of evidence for the benefits of physical activity for not only the body but the mind as well. However, there are remaining questions about the types of exercise that are the most effective, the populations that they are best suited for, and the cognitive domains that are specifically targeted.

The aim of this Special Issue is to highlight key papers published in the *Journal of Aging and Physical Activity* on the topic of exercise training and cognitive function. We have included 15 previously published papers. Our selection criteria included the following: (a) papers published in the past 10 years to focus on the most recent evidence, and (b) randomized controlled trials and systematic reviews to include the highest level of evidence. Furthermore, our Special Issue includes many studies that include novel forms of exercise, such as dance, Tai Chi, and exergaming. We briefly describe each of our chosen studies below.

As mentioned above, several of the selected studies used dance as an alternative to traditional exercise. Dance has several potential advantages over standard aerobic training in that involves rhythmic movement, cognitive processes (e.g., memory for choreography), and often has a social component. It has been demonstrated that dance can improve cognitive function in a variety of populations. For example, the study by Marquez et al. (2017)¹ demonstrated that 4 months of dance training improved episodic memory and executive function in cognitively healthy older Latinos. Likewise, a 10-week dance intervention was shown to improve cognitive outcomes, including short-term memory, working memory, and cognitive flexibility in older adults living in a residential care setting (Kosmat & Vranic, 2017). Importantly, these benefits were found to persist at the 5-month follow-up assessment. While these two studies used health education control groups where participants remained sedentary, other studies have directly compared dance with traditional forms of exercise and have found benefits for dance above and beyond aerobic and resistance training. The study by Hamacher et al. (2015) examined the effects of a 6-month dancing program compared with an endurance and strength training control group. The authors reported that dancing had positive effects on motor-cognitive dual-task performance during walking—including

reduced gait variability, increased minimum foot clearance variability, and improved cognitive performance during dual-tasking compared the control group. In contrast, a study by Blumen et al. (2022) found that social dancing twice per week for 6 months had limited benefits above and beyond their control group who completed treadmill walking for the same length and frequency in a population of older adults at-risk for dementia; notably, their sample size was limited due to COVID-19 disruptions. Thus, future research with large sample sizes is required to examine the potential added benefits of dance compared with other forms of physical activity.

Another increasingly popular form of exercise in the literature is Tai Chi. This form of exercise emphasizes a mind-body connection while focusing on whole-body low-impact movements. The study by Fogarty et al. (2016) examined the effects of 10 weeks of Tai Chi training on memory performance in older adults with amnesic mild cognitive impairment. The authors reported no evidence of benefits for Tai Chi training on a cognitive battery including verbal learning, working memory, set-shifting, and attention above and beyond a memory intervention program, suggesting that exercises focusing on higher intensities than what Tai Chi offers may be necessary to impart cognitive benefits. In a separate study that compared Tai Chi with Poi—a series of exercises conducted with a weight on the end of a cord—both forms of exercise were found to benefit attention and memory (Riegle van West et al., 2018).

Critically, the required intensity to achieve cognitive benefits may depend on the population. In a study by Dillon and Prapavessis (2021), the authors found that in a population of mildly to moderately cognitively impaired older adults in assisted living, merely reducing sedentary time by doing 10 min of light physical activity, three times per day, was enough to increase global cognitive function, as measured by the Alzheimer's Disease Assessment Scale-Cognitive.

Within the acute exercise (i.e., a single bout) literature, McSween et al. (2021) found that 30 min of moderate-intensity exercise improved word learning compared with high-intensity interval training or stretching control. However, these benefits were observed only among those who had lower baseline learning performance—suggesting that not everyone reaps the same rewards postexercise. In a novel acute exercise study that used stair climbing as the exercise bout, Nasrollahi et al. (2022) found that the moderate- to high-intensity intervention led to improvements in a visuomotor task, although participants also reported feeling more tired from their stair-climbing intervention, suggesting that exercises should be tailored to suit individual preferences to increase enjoyment, and therefore, adherence.

Interestingly, from the articles included in this Special Issue, we can see that not all domains of cognition are impacted equally; indeed, cognition is an umbrella term that encompasses different

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processes, such as memory, attention, language, and executive function. In the study by Prick et al. (2017), a 3-month multicomponent intervention in older adults with dementia was found to specifically improve attention, as measured by the digit span test, but not measures of memory or executive function. In another study by Iuliano et al. (2017), the authors found that exercise significantly improved subjective memory complaints in community-dwelling older adults but did not impact objective memory performance, highlighting the potential role of exercise in promoting self-efficacy and well-being beyond cognition itself.

With the rapid rise of technology, we may begin to see more innovative ways of incorporating exercise into our daily lives. Choi and Lee (2019) used a virtual kayaking intervention in older adults with mild cognitive impairment and found improved postural balance, muscle performance, and global cognitive function after 6 weeks of training. One recent focus in the literature has been on exergaming—video games that incorporate physical activity. In a study by Anderson-Hanley et al. (2017), participants who completed neuro-exergame training that consisted of riding a stationary bike while navigating a virtual world where they had to complete various tasks improved executive function. Similarly, Gouveia et al. (2021) found that 12 weeks of exergaming improved short- and long-term memory compared to an active control group.

Our Special Issue also includes one umbrella review evaluating the systematic reviews and meta-analyses. Andrade et al.'s (2022) review specifically focused on the benefits of exercise in

those with Alzheimer's disease and found the strongest evidence for cognitive effects from multicomponent exercises, rather than strictly aerobic or resistance training. However, while benefits were found, the authors noted that many of the papers included were of low to medium quality and that higher quality evidence is still needed. In addition, the authors called our attention for more rigorous methodological reporting for exercise trials related to key protocol details such as exercise prescription and delivery for us to precisely understand the benefits and the prescription of exercise for cognitive enhancement.

Collectively, these articles demonstrate the importance of exercise to improve cognitive function in older adults using a variety of different styles of physical activity and in different populations, ranging from older adults who are cognitively healthy to those with dementia. Future research in this field will continue to illuminate the underlying mechanisms for these relationships and provide further insight into the types and dose of exercises with a particular interest in exploring the precision of exercise design, prescription, and delivery for the different types of cognitive impairments (i.e., mild cognitive impairment, Alzheimer's disease, and dementia).

Note

1. The *JAPA* papers cited in-text are included in the virtual special issue.