

## Publication

## A network meta-analysis comparing the effects of exercise and cognitive training on executive function in young and middle-aged adults

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In young and middle-aged adults, executive function is associated with success in work-life and mental health. Physical activity with and without cognitive training has the potential to benefit executive function, but its relative effectiveness remains unclear. This network meta-analysis compares the effectiveness of different exercise and cognitive training types and their combination on executive function in young and middle-aged adults. PubMed, Web of Science, MEDLINE, Cochrane, PsycINFO, and SPORTDiscus were searched for experimental studies that compared pre- to posttest changes in inhibitory control and/or working memory between one or more intervention groups and a control group. Interventions were ranked on their relative effectiveness using P-scores. Study quality was rated using the PEDro scale. Forty-six studies were included and yielded 30 and 70 pair-wise effect sizes for the inhibitory control and working memory networks, respectively. With one exception, all studies were of high quality. Combined exercise and working memory training induced the greatest benefits for working memory (standardized mean differences, SMD = 0.59), whereas training a single executive function (SMD = 0.32) was most effective for inhibitory control. The effectiveness of working memory training (SMD  $\geq$  0.27) and coordinative exercise (SMD  $\geq$  0.20-0.29) ranked second and third for both executive function outcomes. In contrast, the effectiveness of endurance exercise was comparable to active controls on both networks. In young and middle-aged adults, exercise with coordinative demands seems to have an effectiveness similar to working memory training. The combination of exercise and cognitive training further increases executive function benefits. Highlights Despite a developmental peak of executive function in young adulthood, this cognitive domain can be trained by exercise and cognitive training Exercise with coordinative demands and working memory training benefit inhibitory control and working memory to a similar extent The combination of exercise and working memory training elicited even greater benefits for working memory Young and middle-aged adults cannot expect executive function benefits following endurance exercise.

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