'Tis a Mystery: People who are More Physically Fit have Better Executive Functions, but Most Physical Activity Interventions have Failed to Produce Benefits to Executive Functions

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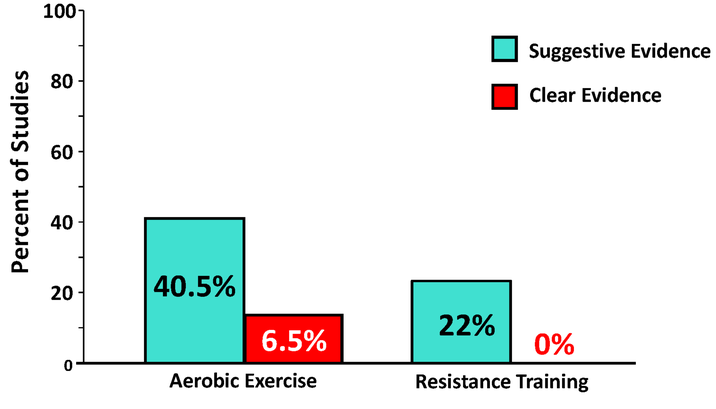
We completed a comprehensive systematic review of studies of all the different approaches (improving executive functions (EFs) across all ages (including 68 physical-activity interventions). EFs include abilities like selective attention, self-control, reasoning, and problem-solving. All studies evaluated had ≥ 1 objective behavioral EF measure besides the trained task, had a control group, and were not correlational.

Success Rates of Aerobic Exercise and Resistance Training for Improving EFs

Percentage of Studies finding Suggestive[A] or Clear[B] Evidence of Physical Activity Benefiting any EFs (including reasoning)



Suggestive Evidence = More EF improvement ***or*** better EF post-test performance than control group on ≥50% of measures.

Clear Evidence = More EF improvement ***and*** better EF post-test performance than control group on ≥67% of measures.

POSSIBLE EXPLANATIONS FOR WHY

Possibility #1

Many aerobic exercise (AE) and resistance-training studies have found brain changes. Brain changes can precede observable cognitive changes by years. Perhaps studies have not followed participants long enough to observe cognitive benefits.

Possibility #2

Perhaps the correlations between better physical fitness and better grades and EFs are not due to exercise producing cognitive benefits. After all, improvements in aerobic capacity are uncorrelated with cognitive improvements.

Causality might go in the opposite direction. Better EFs (e.g., self-discipline) may be needed to maintain a regular exercise regiment.

A third factor, like athletes eating or sleeping better, might be the causal agent.

Possibility #3

Perhaps AE and resistance-training interventions have produced minimal EF benefits because of the content. Emotional investment may be key to whether an activity improves EFs.

Training decontextualized skills, like running on a treadmill or practising dribbling but never playing basketball, is unlikely to engender deep personal commitment.

Possibility #4

Since stress impairs EFs and AE reduces stress, perhaps if AE interventions focused on highly stressed individuals, they might find more EF benefits.

Our systematic review: Diamond, & Ling (in press Oct 2019) Fundamental questions surrounding efforts to improve executive functions (including working memory). In: Bunting et al. (eds.), An Integrative Approach to Cognitive and Working Memory Training: Perspectives from Psychology, Neuroscience, and Human Development. Oxford University Press.