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EXERCISE, EXECUTIVE FUNCTIONS, AND ENGAGING WITH PHYSICAL ACTIVITY FOR BETTER BRAIN HEALTH

When it comes to the relationship between physical activity and improved executive function (EF), it may not be about the activity itself is as much as it is about how the activity is performed. A 2018 paper by Dr. Adele Diamond (https://www.centreforbrainhealth.ca/diamond-adele) and graduate student Daphne S. Ling argued that changing the focus of research into the benefits of physical activity for EFs may produce more meaningful results. Their paper, which discusses research

Tweets by @DMCBrainHealth

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In one of 2018's most exciting papers (HT @Human_Kinetics), @DrAdeleDiamond and @daph_ling argue that physical activity without context is not enough to drive improvement in executive function. ow.ly/yGW530owIyO

1h

Djavad Mowafaghian Cen
@DMCBrainHealth

We're thrilled to host @cryoem_UBC tomorrow afternoon for his first lecture @UBC as the new Gobind Khorana @CERC_CERC . Join us at 3:30 in the Rudy North Lecture Theatre. Refreshments to follow. Learn more

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on the effects of exercise on EFs, has been selected as one of 2018's must-read papers in a list of the year's most exciting research by the journal *Pediatric Exercise Science* (https://journals.humankinetics.com/doi/full/10.1123/pes.2019-0010).

EFs are cognitive control functions that rely on the prefrontal cortex (PFC) and other interrelated brain regions. EF skills include self-control, selective attention, working memory, cognitive flexibility, reasoning, and planning.

As Dr. Diamond points out, on the one hand, people who exercise more and who are more physically fit have better EFs, and that is true for both children and adults. On the other hand, as the review by Dr. Diamond and Daphne Ling shows, most aerobic exercise and resistance training interventions have produced almost no benefit to EFs.

After conducting a comprehensive systematic review of existing research on all approaches to improving EFs, Dr. Diamond and Daphne Ling argue in their paper (published in the journal *Developmental Cognitive Neuroscience* (https://www.sciencedirect.com/science/article/pii/S1878929318300094?via%3Dihub)) that research into how these physical activities affect EFs have not been testing aerobic activities that likely improve EFs in the real world.

"To improve EFs, the activity probably requires a level of individual investment not currently captured in many aerobic exercise or resistance training intervention studies. Hitting a ball with a racquet or dribbling a basketball on its own might benefit individual health, but we hypothesize that engaging in the game of tennis or basketball has many elements we hypothesize are critical for improving EFs that are absent when one or two skills drawn from a sport are practiced out of the context of that sport," said Dr. Diamond.

Diamond and Ling hypothesize that by decontextualizing activities drawn from sports, and asking study participants to perform rote tasks, researchers are not seeing the EF benefits that can come from physical activity.

"Some researchers, noting changes to the brain, have conflated that with improvements to EFs," said Dr. Diamond. "It is a serious fallacy to equate brain changes with cognitive or behavioral changes or to assume that simply because a change in the brain has been observed, even in a brain region relevant to a particular skill or behavior, that there has necessarily been any change in that skill or behavior. It is essential that change in the skill or behavior be empirically observed."

"We know that often activity in a brain region can change in a seemingly task-dependent way while participants are performing a task and yet task performance is unaffected by silencing that brain region," added Daphne Ling. In their 2018 paper (https://www.sciencedirect.com/science/article/pii/S1878929318300094?via%3Dihub), Diamond and Ling provide a number of reasons why brain changes should never be over-interpreted as *ipso facto* indicating cognitive improvements.

"I think it's important to stress that we are in no way 'anti-exercise,'" explains Ling. "We are not saying that exercise has no benefits for EFs or benefits in general. We are saying that exercise intervention studies have generally failed to demonstrate those benefits. We have to go where the data take us."

Dr. Diamond agrees.

"We hypothesize that that is because the interventions that researchers have designed have not captured the characteristics of activities that drive EF benefits," said Dr. Diamond. "We predict that the way an activity is done, whether it brings the participants joy, builds their self-confidence and pride, and challenges their EFs, the human qualities of the mentors or trainers (such as their supportiveness and their unwavering belief in the participants and the program), the emotional investment of participants, and whether the activity builds community and a commitment among participants to be there for one another will likely prove decisive in whether an activity improves EFs."

RELATED LINKS:

Adele Diamond, Daphne S. Ling. Aerobic-Exercise and resistance-training interventions have been among the least effective ways to improve executive functions of any method tried thus far (https://www.sciencedirect.com/science/article/pii/S1878929318300094?via%3Dihub). Developmental Cognitive Neuroscience, 2018. ISSN 1878-9293, doi.org/10.1016/j.dcn.2018.05.001.

Eliakim et al. Expert's Choice: 2018's Most Exciting Research in the Field of Pediatric Exercise Science (https://journals.humankinetics.com/doi/full/10.1123/pes.2019-0010). Pediatric Exercise Science, 2019. doi.org/10.1123/pes.2019-0010.

TAGS: DIAMOND, EXECUTIVE FUNCTION, EXERCISE, COGNITION