

Researchers closer to figuring out what causes exercise to boost your brain

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A study exploring the mechanisms behind why cognitive performance

improves in response to exercise, has revealed forced muscle movement doesn't have the same effect as voluntary.

Electrical muscle stimulation (EMS) is often used in physiotherapy and rehabilitation to help loosen tight muscles so they can recover. Devices trigger nerves that make muscles contract, ultimately relaxing and loosening tight spots.

Many gyms have also introduced EMS Training—which involves a person wearing similar devices during a workout—to help recruit more muscle fibers.

Scientists have now investigated whether electrical muscle stimulation results in improved cognitive function, in the same way voluntary movement does.

As part of the study, experiments were carried out with 24 young, healthy male participants. Individuals were asked to complete cognitive tasks at rest and while cycling. They then had to do the same tasks with and without EMS being applied to the lower limb muscles.

Participants completed the tasks quicker when voluntary moderate-intensity exercise was done. This was not the case though during low-intensity exercise, and when only forced electrical stimulation was used.

Co-author Dr. Joe Costello, from the University's School of Psychology, Sport and Health Sciences, said, "Our results suggest that the relationship between exercise and [brain activity](#) is crucial for faster reaction time. Forcing the muscles to move using an electrical current takes away this connection, and as a result participants didn't experience an increase in [cognitive performance](#) like they did while cycling."

The new study is part of ongoing research exploring what mechanism or

mechanisms cause exercise to improve cognitive function in extreme environments. This discovery could help establish a new therapeutic pathway for cognitive health.

"Not everyone is able to reap the benefits of physical activity—like faster reaction times—because of injury or disability," explained Associate Professor Costello.

"If we figure out exactly what it is that causes cardiovascular exercise to improve cognitive performance then we can potentially replicate this and remove the need to do moderate-intensity exercise."

The latest findings support previous research by the authors which suggests dopamine has a significant role in the relationship between exercise and cognitive function.

The "feel good" neurotransmitter and hormone—which is tied to pleasure, satisfaction and motivation—is known to increase when you work out. It plays a significant role in several conditions including Parkinson's disease, schizophrenia, ADHD, addiction, and depression.

The team have also previously demonstrated that 20 minutes of exercise can boost your brain after a bad night's sleep.

Soichi Ando, Associate Professor in the Health & Sports Science Laboratory at the University of Electro-Communications in Japan, said, "These latest findings suggest that standard central neural activity—which happens during low-intensity and forced movement— isn't enough to cause improved reaction time.

"Instead it may be—at least in part—the result of enhanced sympathetic nervous system activity, which happens during [moderate-intensity exercise](#). Your sympathetic nervous system is best known for its role in

responding to dangerous or [stressful situations](#), where it activates to speed up your [heart rate](#) and deliver more blood to areas of your body to help you get out of danger."

The paper, [published](#) in the *European Journal of Applied Physiology*, says further studies are urgently needed to fully understand how our sympathetic nervous system is linked to cognitive performance following exercise.

The authors also recognize limitations to the sample size being relatively small, and recommend more participants are needed in future experiments, from a range of populations including women and older individuals, over a longer period of time.

The study was a collaboration between The University of Electro-Communications, Meiji Yasuda Life Foundation of Health and Welfare, and Setsunan University in Japan; and the University of Portsmouth in England.

More information: Mizuki Sudo et al, Effects of voluntary exercise and electrical muscle stimulation on reaction time in the Go/No-Go task, *European Journal of Applied Physiology* (2024). [DOI: 10.1007/s00421-024-05562-8](#)

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