

Scientists Discover a Previously Unknown Cognitive Benefit of Aerobic Exercise

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STORY AT-A-GLANCE

- › A single session of moderate aerobic exercise helped preserve the brain's automatic ability to adjust movements when sensory feedback didn't match expectations
- › Exercise supports neuroplasticity through several pathways, including BDNF, a protein involved in strengthening and reorganizing connections between brain cells
- › Aerobic exercise, strength training, combined training, mind-body exercise and other forms of activity increased BDNF, while harder exercise didn't necessarily produce greater increases
- › Consistency matters: BDNF responses increased during the early weeks of regular exercise and peaked at approximately eight to 20 weeks, with favorable responses continuing during longer programs
- › In children, higher aerobic fitness was associated with better inhibitory control, suggesting that physical fitness is linked to the brain's ability to stop an automatic response and resist distractions

Your brain is constantly adjusting your movements without your awareness. Every time you reach for an object or shift your weight, your nervous system compares what it expected to happen with what actually happened, then revises its plan for the next movement. Researchers call this process implicit sensorimotor adaptation, and a 2026 Physiology & Behavior study found that a single session of moderate aerobic exercise helped preserve it in ways that rest did not.¹

That automatic correction system depends on neuroplasticity, your brain's ability to reorganize in response to experience. Brain-derived neurotrophic factor (BDNF), a protein that works like fertilizer for your brain, plays a key role in that process. A separate 2026 analysis in *Frontiers in Physiology* examined dozens of exercise trials in older adults and found that multiple forms of physical activity produced favorable BDNF results, with practical implications for how hard and how long you need to work out.²

A third study, published in *Scientific Reports*, adds another dimension by linking aerobic fitness to inhibitory control in children — the brain's ability to stop an automatic response when it isn't useful.³ Together, these three studies illustrate that exercise supports cognitive processes you rarely think about but rely on constantly.

Exercise May Help Preserve Automatic Motor Corrections

For the *Physiology & Behavior* study, researchers used a specialized reaching task to determine whether **aerobic exercise** affects automatic adaptation independently of deliberate problem-solving.⁴ Participants moved a robotic handle toward a target while a cursor represented their hand position. On selected trials, the researchers secretly shifted that visual feedback 30 degrees clockwise or counterclockwise.

Participants knew these visual distortions would occur and were specifically told not to compensate for them. The researchers then measured the small, involuntary change in hand direction on the next normal trial. Called post-rotation bias, this response shows how your nervous system automatically updates its movement plan after sensory information doesn't match what it expected.

- **Rest weakened this automatic adjustment, while exercise appeared to preserve it** — Before the rest period, the average post-rotation bias measured 2.93 degrees. After rest, it fell to 2.20 degrees, a decline of 0.73 degrees that was statistically significant. Participants became less responsive to the movement errors they had just experienced. The exercise condition followed a different pattern.

Automatic corrections remained nearly stable before and after the workout, with no statistically significant decline. That means physical activity appeared to preserve the nervous system's automatic error-correction response rather than merely sharpening conscious attention.

- **The finding held up regardless of which session participants completed first —** Researchers divided participants into two groups. One group exercised during the first session and rested during the second, while the other group did the reverse. Both showed the same basic pattern: automatic adaptation declined after rest but remained stable after exercise.

The amount of time between sessions also differed considerably. One group averaged 37 days between sessions, compared with just five days for the other. Even with that difference, the overall pattern remained the same, making it less likely that the order or timing of the sessions explained the results.

- **Exercise could sharpen your brain's response to movement errors —** One explanation centers on norepinephrine, a chemical messenger released during heightened arousal. Norepinephrine helps nerve cells separate meaningful signals from background noise, which improves the accuracy of neural communication. The researchers noted that higher norepinephrine levels after exercise have been associated with better motor learning.

This matters because your cerebellum, a brain region heavily involved in movement correction, constantly compares what you intended to do with the sensory feedback that came back. Norepinephrine released from a brain region called the locus coeruleus reaches the cerebellum and helps regulate how strongly the nervous system responds to prediction errors. Exercise could therefore make those error signals harder for your brain to ignore.

- **Exercise also changes the brain circuits that control movement and plasticity —** Prior research discussed in the paper shows that aerobic activity alters communication between the cerebellum and the motor cortex, the part of your brain

that directs voluntary movement. Exercise reduces certain inhibitory signals while increasing others that make nerve cells more receptive to change.

Those shifts support neuroplasticity, meaning the brain's ability to strengthen or reorganize connections through experience. The authors also discussed **BDNF** as another possible contributor because acute aerobic exercise temporarily increases circulating BDNF in previous studies. BDNF supports changes at connections between neurons that underlie learning.

These mechanisms weren't measured directly in this experiment, however, so they explain plausible biological pathways rather than proving exactly why the exercise effect occurred.

- **The findings point toward rehabilitation uses, but the evidence remains early —** Automatic adaptation is especially relevant after neurological injury because rehabilitation often requires the brain to rebuild accurate movement despite altered sensory feedback or impaired conscious processing.

The researchers proposed that moderate aerobic exercise immediately before rehabilitation sessions could help support this adaptive process, particularly for people who struggle with high-intensity workouts.

Still, this experiment involved neurologically healthy young adults rather than **stroke** patients or older adults in rehabilitation. The study also included only 26 participants. The results therefore establish an intriguing physiological effect under controlled laboratory conditions, while larger studies in clinical populations are needed to determine how much that effect improves real-world recovery and movement.

Moderate Exercise Supports BDNF as You Age

The Frontiers in Physiology analysis examined 47 randomized controlled trials from 18 countries to determine how different forms of exercise affected BDNF in older adults.⁵ The trials included 1,815 participants, with average ages that ranged from 55.8 to 92.3 years. Exercise programs lasted from one to 48 weeks, while individual sessions ranged from 10 to 90 minutes.

The researchers compared aerobic, resistance, combined aerobic and resistance, aquatic, mind-body, mixed, coordination and high-intensity interval exercise. Most participants were healthy enough to exercise or had stable chronic conditions, such as high blood pressure, Type 2 diabetes or mild cognitive impairment. Most programs also took place under professional supervision.

- **Several types of exercise increased BDNF, so there isn't one workout you have to follow** — Aerobic exercise, strength training, combined aerobic and strength training, water-based exercise, mind-body exercise and programs that mixed different types of activity all increased BDNF. This means you have flexibility to choose activities that fit your fitness level, abilities and preferences rather than relying on one specific type of workout.

Water-based exercise showed the largest increase, but that finding came from only two studies involving 24 people, so there isn't enough evidence to say it works better than other forms of exercise. High-intensity interval training (HIIT) and coordination exercises, meanwhile, didn't produce clear increases in BDNF in the main analysis.

- **Harder exercise didn't lead to a bigger BDNF boost** — Lower-intensity exercise initially produced a larger predicted increase in BDNF. As exercise intensity increased, the predicted benefit dropped slightly and then leveled off. In other words, pushing harder didn't produce better results.

This means you don't have to make every workout strenuous to support BDNF. A range of exercise amounts and intensities produced favorable results, although the researchers didn't find enough evidence to identify one specific amount or intensity

as best.

- **The strongest BDNF response appeared after weeks of consistent exercise —** Program duration mattered in a more complex way than simply "longer is better." The predicted response increased early and peaked at approximately eight to 20 weeks. After that, it declined very slowly, yet remained above the researchers' statistical benchmark through programs lasting as long as 48 weeks.

An unexpected pattern also appeared after exercise programs ended. The predicted BDNF response didn't immediately disappear. Instead, it peaked about 12 to 16 weeks into follow-up and remained relatively high at 24 weeks. The researchers described these findings as evidence of sustained and delayed biological effects, although they emphasized that changes in circulating BDNF don't prove corresponding improvements in memory or cognitive performance.

- **Different exercises appear to reach BDNF through different biological routes —** Aerobic activity supports blood flow to the brain and overall metabolism, while **resistance exercise** activates communication between your muscles and brain. Contracting muscles release chemical messengers called myokines.

One example discussed by the researchers is irisin, which is believed to cross the blood-brain barrier and promote BDNF expression in the hippocampus, a brain region closely involved in memory.

Mind-body exercises such as **tai chi**, yoga and qigong take another route. They combine physical movement with breath control, focused attention and awareness of body position. The researchers explained that these activities affect autonomic nervous system balance and stress-related pathways, which helps explain their BDNF effects. Mixed programs combine several mechanisms through aerobic activity, resistance work, balance and coordination.

- **Age was linked to how much BDNF increased —** BDNF increases tended to become smaller as the average age of participants rose. By around age 90, the results were too uncertain to show a clear increase. Studies with more women also tended to

find larger increases, although researchers said more evidence is needed to know whether women and men respond differently.

The findings also need to be interpreted with some caution because results differed considerably from one study to another, and the strength of the evidence ranged mostly from moderate to very low. Most importantly, higher BDNF in the blood doesn't necessarily mean that memory, thinking or other brain functions improved. The researchers measured BDNF as a marker associated with the brain's ability to adapt and change, not actual improvements in cognitive performance.

Higher Aerobic Fitness Is Linked to Better Impulse Control in Children

A study published in Scientific Reports examined whether aerobic fitness and body fat were independently related to inhibitory control in 102 preadolescent children, whose average age was about 10.⁶ Inhibitory control is your brain's ability to stop an automatic response or ignore a distraction when it isn't useful.

Researchers measured aerobic fitness with a progressively harder treadmill test and used DEXA scans to distinguish body fat from lean tissue, including muscle. This allowed them to study fitness and body composition separately instead of assuming that a leaner child was automatically more physically fit.

- **The children had to override a response they had practiced repeatedly** — To test inhibitory control, researchers used Go and NoGo tasks while recording the children's electrical brain activity. During the initial task, one image appeared much more frequently than another, encouraging the children to become accustomed to pressing a button in response.

Researchers then changed the instructions. The children had to suppress that increasingly automatic button press under certain conditions, creating a simple test of how effectively the brain could stop a learned response.

- **Fitter children were better at stopping an automatic response** — Children with higher aerobic fitness were more accurate during the NoGo portion of the experiment, indicating better inhibitory control. Importantly, fitness was based on how efficiently the children's fat-free tissue used oxygen during strenuous exercise rather than simply how much oxygen their entire bodies consumed.⁷

This distinction helped researchers focus more closely on aerobic capacity while accounting for differences in body size and fat mass.

- **Aerobic fitness was also associated with differences in brain activity** — Aerobic fitness was related to differences in two electrical brain responses that occur as your brain processes information, evaluates what's happening and controls whether you act. Aerobic fitness was associated not only with better performance but also with differences in how the brain recruited its resources while deciding whether to respond.
- **Body fat showed a different relationship with inhibitory control** — Higher body fat wasn't associated with poorer accuracy on the behavioral task. Instead, children with more body fat showed differences in the timing of a brain response during the NoGo condition, and the researchers described their responses as more impulsive.
- **The findings show an association rather than proof that fitness caused the difference** — Researchers measured the children's existing aerobic fitness, body composition and inhibitory control rather than assigning them to an exercise program and tracking changes over time. That means the results don't establish that increasing aerobic fitness directly improves inhibitory control.

The participants were also preadolescent children, so the findings don't establish that the same relationships occur in adults. Still, the results provide evidence that aerobic fitness is independently associated with both inhibitory-control accuracy and the way children's brains allocate resources during tasks that require them to stop an automatic response.

How to Build a Brain-Supportive Movement Routine

You don't need exhausting workouts to support your brain's ability to adapt. The research points in a much more practical direction: regular movement at a manageable intensity supports the biological processes tied to neuroplasticity, while one moderate aerobic session helps preserve automatic motor adaptation.^{8,9} I recommend making movement part of your daily routine rather than relying on occasional hard workouts.

- 1. Make walking your aerobic foundation** — If you're sedentary now, start with an amount you tolerate comfortably and gradually work toward about 60 minutes of walking each day. You don't have to complete it all at once. Short walks spread throughout your day make this goal easier to reach and help you replace long stretches of inactivity with regular movement. Keep the effort manageable. Your goal isn't to exhaust yourself with [high-intensity workouts](#). It's to create a routine you'll repeat.
- 2. Add strength training twice a week** — Your brain benefits from more than aerobic activity. Use simple resistance movements that train your major muscle groups, and build your strength gradually. If you're older or haven't exercised consistently, focus first on good form and steady progress rather than heavy weights. Each completed workout gives you another opportunity to strengthen your muscles while supporting the muscle-to-brain signals discussed in the research.¹⁰
- 3. Use moderate aerobic exercise before tasks that demand motor learning** — If you're about to practice a physical skill, moderate aerobic activity beforehand is a simple strategy worth considering. The Physiology & Behavior study found that a single moderate cycling session appeared to prevent the decline in automatic adaptation seen after rest.¹¹

This principle also has relevance if you're working to regain a physical skill after a neurological injury, although the researchers emphasized that their experiment involved healthy young adults rather than rehabilitation patients. Treat the finding

as a reason to value well-timed movement, not as proof that one workout guarantees faster rehabilitation.

- 4. Choose exercise you'll sustain for months, not days** — Set a specific consistency target, such as exercising four days a week for eight weeks, and track your progress. You also have flexibility. Aerobic exercise, resistance exercise, combined training, mind-body exercise and mixed programs all increased BDNF levels.¹² If you dislike one form of exercise, choose another that fits your abilities and interests. Consistency matters more than chasing whichever workout sounds most impressive.
- 5. Build movement into your entire day** — Avoid viewing one scheduled workout as permission to remain sedentary for every other hour. Walk, stand and move regularly throughout your day, then use dedicated aerobic and resistance sessions to build on that foundation.

Keep the plan simple enough to follow: walk daily, strength train twice weekly and add other movement you enjoy. If your current fitness level is low, increase your activity gradually rather than jumping immediately into strenuous exercise. Prioritize sustainable movement over maximum effort.

FAQs About Exercise and Your Brain

Q: How does aerobic exercise support the brain's ability to adapt?

A: Moderate aerobic exercise helps preserve the brain's automatic ability to adjust movements when sensory feedback doesn't match expectations. Exercise also supports neuroplasticity, the brain's ability to reorganize and strengthen connections through experience.

Q: Do you need intense exercise to increase BDNF?

A: No. Researchers found favorable BDNF responses across different exercise intensities, and harder exercise didn't produce greater increases. Aerobic exercise, strength training, combined training, mind-body activities and other forms of movement all increased BDNF.

Q: How long does it take for regular exercise to influence BDNF?

A: BDNF responses increased during the early weeks of exercise programs and peaked at approximately eight to 20 weeks. Favorable responses remained during programs lasting as long as 48 weeks, reinforcing the value of consistent activity rather than occasional strenuous workouts.

Q: Is aerobic fitness related to impulse control in children?

A: Yes. In a study of 102 preadolescent children, those with higher aerobic fitness were more accurate when they had to stop an automatic response. Their brain activity also differed during tasks that required them to decide whether to respond, although the study showed an association and didn't prove that greater fitness caused better impulse control.

Q: What type of exercise routine best supports brain health?

A: A sustainable routine combines regular aerobic movement with strength training and frequent activity throughout the day. Walking provides a practical aerobic foundation, while strength training twice a week and choosing activities you enjoy makes it easier to stay consistently active over time.

This article is for informational purposes only and does not constitute medical advice. Consult a qualified healthcare provider before making changes to your health regimen.

Sources and References

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