



Opinion

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The Effects of Exercise on Cognition and Its Potential Utility in Helping to Overcome Drug Addiction



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Abstract

Exercise is known to have beneficial effects on mood and sleep, both of which are likely to be beneficial for individuals trying to overcome addiction but there is less consideration of the likely benefits of exercise on cognition. There is evidence that exercise-based interventions are likely to improve executive cognitive functions, functions that can contribute to/be affected by drug addiction leading to the idea that exercise might be readily employed in many individuals trying to overcome addiction. This is important given its straightforward implementation, the lack of any pharmacological component and how it can potentially supplement any other treatment being considered. Investigation of how this can be achieved and whether there are personality aspects that might indicate its likely effectiveness might form the basis of systematic assessment of its utility.

Keywords: Addiction; Exercise; Fitness; Cognition; Executive control

Opinion

Drug addiction, like all other forms of addiction, is problematic to overcome. Having achieved the difficult stage of abstaining from drug use, maintaining this and avoiding relapse can be hard, with relapse rates being high [1]. Treatments to help addiction also have the problem that there can be several to select from but the limited success rates of each can lead to successive drop-out from treatment before the most effective intervention for an individual is determined. While the reasons for the difficulty in overcoming addiction can relate to a number of factors, including the circumstances and personality of the individual affected, drug use can also result in structural changes in the brain that increase the difficulty with remaining abstinent from drug use. For example, amphetamine use has been associated with changes in the circuitry between the prefrontal cortex and the striatum [2] as well as neurochemical changes [3]. Similarly, cocaine addiction is associated with structural and functional changes in the brain [4], and, like in amphetamines, these affect the prefrontal cortex and

striatum. Such changes are likely to contribute to difficulties with a number of functions that would be expected to be beneficial when trying to overcome addiction, such as inhibitory control, i.e., the ability to overcome impulsive behavior or habitual behavior. This is one of the executive functions performed by the brain, and all of which are functions that relate to goal-directed behavior, including action selection and monitoring. This is consistent with the cognitive impairments that have been reported in drug users, such as cocaine users having affected decision making and abstract reasoning [5,6]. Here it is suggested that the use of exercise (or participation in sport) could be employed as a standard aspect of treatment in individuals trying to overcome addiction, because it is simple to implement and, importantly, because a number of studies have reported beneficial effects on cognition of sport/exercise, and on executive functions in particular. When the other benefits associated with exercise are considered, as well as there being no pharmacological factor in such a 'treatment' it is hard to suggest anything other than that engaging in activity

expected to increase fitness should be encouraged in individuals trying to overcome addiction. When considering in more detail the benefits of exercise/sport to help with addiction and reduce the likelihood of relapse, as was been mentioned above, there are several benefits, some more obvious than others. Health benefits of improved fitness are clear [7,8] but there are also numerous studies showing beneficial effects on factors such as mood and sleep which can be viewed as 'quality of life' benefits. It is well established that aerobic exercise, or exercise likely to improve fitness, improves both sleep quality and sleep quantity [9] and similar benefits have also been reported for resistance exercise [10]. These effects on sleep have also been shown to help with factors linked to poor sleep, such as depression [3]. This may help with the depression often associated with drug addiction with, for example, there being a higher risk of depression in cannabis users [11].

In addition to the aforementioned benefits of exercise which, in themselves, seem to offer enough benefit to suggest that it should be employed more routinely in individuals trying to overcome addiction, there is a substantial body of evidence linking exercise, fitness and/or participating in sport with beneficial effects on cognition. These can be considered in the context of cross-sectional studies, which tend to be in younger individuals who engage in sport (but not exclusively so), and interventional studies, often where sport or exercise participation has been used in older individuals with the aim of helping with cognitive processes.

As mentioned, cross-sectional studies often look at specific cognitive processes in younger individuals who engage in sports. An example is the study by Wang and colleagues [12] in which cognitive processes related to temporal processing were investigated in tennis players, swimmers, and individuals who did not engage in sport/exercise. This study found markedly different performance in a task involving temporal preparation in the tennis players. Similarly, tennis players have been found to show better inhibitory control than swimmers and sedentary controls [13]. While these findings show a sport-specific effect, it is the case that more general benefits that seem to be related to fitness have also been seen in studies in younger individuals. For example, Haapala and colleagues [14] reported a range of beneficial correlations with higher motor fitness in adolescents, such as less depressive symptoms (like above) and lower perceived stress, as well as better global cognition. This is also consistent with a recent study in older adults that looked at the relationship between fitness (specifically, cardiorespiratory fitness) and cognition in older adults [15]. They carried out an assessment in 648 individuals and looked at the relationship between their fitness levels and performance on a range of cognitive tasks, reporting that higher fitness was associated with better performance on a range of tasks, and so for a range of cognitive domains. In fact, a positive relationship was seen for all cognitive domains, extending

previous reports that had used proxy measures for fitness and less wide-ranging cognitive testing [16].

These findings are encouraging, with beneficial associations between fitness and factors that could be beneficially improved in recovering addicts. Similar suggestions can be gained from studies where exercise has been used as an intervention with the aim of improving cognition. In a review of such studies by Colcombe and Kramer [17], it was reported that benefits of fitness training on cognition were seen and these being largest for effects on executive-control processes, exactly the sort of processes that might differ/be affected in addicts. While the main conclusion from all of these studies could, quite reasonably, be that people should exercise and improve their fitness, the patterns seen are also consistent with there being a benefit to using exercise to try to help people overcome addiction. Improved mood, better sleep, and benefits for cognitive processes that might be affected by addiction and would also aid in preventing relapse are all positives. In other words, benefits of exercise on executive functions might help increase success in overcoming addiction. This is also particularly worth mentioning because few relatively studies have been carried out using exercise in addicts to try to help overcome addiction and, specifically, with consideration of beneficial cognitive effects to this end. For example, a recent meta-analysis/review [18] covered 17 investigations of the use of exercise in trying to overcome addiction, but not all of the studies had measures of cognitive function, there was variability in the exercise interventions employed and there was a lack of consistency in the cognitive measures used when there were employed. This led to the somewhat limited conclusion that 'physical activity-based interventions may be effective'.

This lack of clarity may be somewhat in line with a similar lack of clarity about the reasons underlying cognitive benefits from exercise/sport when they are seen. This has been mentioned in a number of studies, including Oberlin and colleagues [15], with some of the suggested mechanisms relating to blood flow, neurotrophic factors, as well as others (or a combination of these) [19]. Despite this, it seems that, as long as the physical condition of an individual allows for it, there are only likely to be beneficial effects of exercise and some of these are likely to relate to cognitive processes shown to often be affected in addict. In summary, while there is a need for clarity about what is causing the benefits associated with fitness and/or sport on cognition, ideally at a neural process level, the reported effects should be helpful when trying to overcome addiction. In other words, are there measurable skill or fitness measures resulting from sport or exercise that are consistently linked with changes in cognition. This should be investigated further, both as a benefit to treatment and to understand the nature of these effects. In particular, this requires more intervention studies in younger individuals and more additional measurements to be collected from participants in such studies. This could be achieved by there being a specific

goal of the exercise/training or inclusion of a metric by which the degree of change in fitness could be accurately measured. Additional measures of personality, such as those likely to link to how much someone is likely to 'try' at whatever the intervention is could be informative. This latter point is also related to drop-out rates from any imposed exercise regime, which might be somewhat like drop-out rates for treatments to recover from addiction (although the latter could be a consequence of treatment ineffectiveness). While this might not help with the treatment of such individuals, it could indicate who would be a good candidate for such an intervention and for whom a different treatment might be better.

References

1. Milkman H, Weiner SE, Sunder Wirth S (1983) Addiction relapse. *Advances in Alcohol & Substance Abuse* 3(1-2): 119-134.
2. Tolliver BK, McRae-Clark AL, Saladin M, Price KL, Simpson AN, et al. (2010) Determinants of cue-elicited craving and physiologic reactivity in methamphetamine-dependent subjects in the laboratory. *The American Journal of Drug and Alcohol Abuse* 36(2): 106-113.
3. Kwon NJ, Han E (2018) A commentary on the effects of methamphetamine and the status of methamphetamine abuse among youths in South Korea, Japan, and China. *Forensic Science International* 286: 81-85.
4. Porrino LJ, Smith HR, Nader MA, Beveridge TJ (2007) The effects of cocaine: a shifting target over the course of addiction. *Prog Neuropsychopharmacol Biol Psychiatry* 31(8): 1593-600.
5. Hoff AL, Riordan H, Morris L, Cestaro V, Wieneke M, et al (1996) Effects of crack cocaine on neurocognitive function. *Psychiatry Res* 60(2-3): 167-176.
6. Rogers RD, Robbins TW (2001) Investigating the neurocognitive deficits associated with chronic drug misuse. *Curr Opin Neurobiol* 11(2): 250-257.
7. Ortega FB, Ruiz JR, Castillo MJ, Sjöström M (2008) Physical fitness in childhood and adolescence: a powerful marker of health. *International Journal of Obesity* (2005) 32(1): 1-11.
8. Caspersen CJ, Powell KE, Christenson GM (1985) Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. *Public Health Reports* (Washington, D.C.: 1974) 100(2): 126-131.
9. King AC, Oman RF, Brassington GS, Bliwise DL, Haskell WL (1997) Moderate-intensity exercise and self-rated quality of sleep in older adults: A randomized controlled trial. *JAMA* 277(1): 32-37.
10. Singh N, Clements K, Fiatarone M (1997) A randomized controlled trial of the effect of exercise on sleep. *Sleep* 20(2): 95-101.
11. Churchill V, Chubb CS, Popova L, Spears CA, Pigott T (2025) The association between cannabis and depression: an updated Systematic Review and Meta-analysis. *Psychological Medicine* 55: e44.
12. Wang CH, Chang CC, Liang YM, Shih CM, Muggleton NG, et al. (2013a) Temporal preparation in athletes: a comparison of tennis players and swimmers with sedentary controls. *Journal of Motor Behavior* 45(1): 55-63.
13. Wang CH, Chang CC, Liang YM, Shih CM, Chiu WS, Tseng P, Hung DL, Tzeng OJ, Muggleton NG, Juan CH (2013b) Open vs. closed skill sports and the modulation of inhibitory control. *PLoS One* 8(2): e55773.
14. Haapala EA, Leppänen MH, Skogh H, Lubans DR, Viitasalo A, et al. (2025) Childhood Physical Fitness as a Predictor of Cognition and Mental Health in Adolescence: The PANIC Study. *Sports Medicine* 55(2): 487-497.
15. Oberlin LE, Wan L, Kang C, Romano A, Aghjayan S, et al. (2025) Cardiorespiratory fitness is associated with cognitive function in late adulthood: baseline findings from the IGNITE study. *British Journal of Sports Medicine* 59(3): 167-176.
16. Edwards MK, Loprinzi PD (2017) Combined associations of sedentary behavior and cardiorespiratory fitness on cognitive function among older adults. *Int J Cardiol* 229: 71-74.
17. Colcombe S, Kramer AF (2003) Fitness effects on the cognitive function of older adults: a meta-analytic study. *Psychological Science*: 14(2): 125-130.
18. Xu C, Zhang Z, Hou D, Wang G, Li C, et al. (2024) Effects of exercise interventions on negative emotions, cognitive performance and drug craving in methamphetamine addiction. *Front Psychiatry* 15: 1402533.
19. Stillman CM, Esteban-Cornejo I, Brown B, Bender CM, Erickson KI (2020) Effects of Exercise on Brain and Cognition Across Age Groups and Health States. *Trends Neurosci* 43(7): 533-543.



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