

Publication

The Influence of an Acute Exercise Bout on Adolescents' Stress Reactivity, Interference Control, and Brain Oxygenation Under Stress

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Background: High psychosocial stress can impair executive function in adolescents, whereas acute exercise has been reported to benefit this cognitive domain. The aim of this study was to investigate whether an acute bout of aerobic exercise improves the inhibitory aspect of executive function and the associated dorsolateral prefrontal cortex (DLPFC) oxygenation when under stress. Methods: Sixty male high school students aged 16–20 years performed a Stroop task (baseline condition) and were randomly assigned to an exercise group (30 min on ergometer at 70% of maximum heart rate) and a control group (30 min of reading). Subsequently, all participants underwent a modified Trier Social Stress Test, which included a Stroop task under enhanced stress. The Stroop tasks in both conditions were combined with functional near-infrared spectroscopy to record changes in DLPFC oxygenation in response to the tasks. Stress reactivity was measured with saliva samples (cortisol, alpha-amylase), heart rate monitoring, and anxiety scores. Results: All stress parameters indicated increases in response to the stressor ($p < 0.001$), with higher alpha-amylase [$t(58) = -3.45, p = 0.001, d = 1.93$] and anxiety [$t(58) = -2.04, p = 0.046, d = 0.53$] reactions in the control compared to the exercise group. Controlling for these two parameters, repeated measures analyses of covariance targeting changes in Stroop interference scores showed no main effect of stress [$F(1, 58) = 3.80, p = 0.056, \eta^2 = 0.063$] and no stress $\times$ group interaction [$F(1, 58) = 0.43, p = 0.517, \eta^2 = 0.008$]. Similarly, there was no main effect of stress [$F(1, 58) = 2.38, p = 0.128, \eta^2 = 0.040$] and no stress $\times$ group interaction [$F(1, 58) = 2.80, p = 0.100, \eta^2 = 0.047$] for DLPFC oxygenation. Conclusion: Our study confirms potentially health-enhancing effects of acute exercise on some of the physiological and psychological stress reactivity indicators. However, our data do not support the notion of an effect on interference control and DLPFC activation under stress.

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