



Null effects of tDCS over the Left Prefrontal Cortex on Self-paced Exercise and EEG

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Purpose: to test the hypothesis that transcranial direct current stimulation (tDCS) over the left dorsolateral prefrontal cortex (DLPFC) influences performance in a 20' self-paced exercise and electroencephalographic (EEG) oscillatory brain activity in a group of trained male cyclists.

Methods: We conducted a pre-registered (<https://osf.io/rf95j/>), randomised, sham-controlled, within-subject design experiment. 36 trained males cyclists, age 27 (6.8) years, VO₂max: 54 (6.13) ml/min/kg, completed a 20' self-paced exercise in three separate sessions, under three stimulation conditions: anodal, cathodal and sham. TDCS was delivered for 20' before each test at a current intensity of 2.0 mA. The anode electrode was placed over the DLPFC and the cathode over the shoulder. We measured the power output, heart rate, RPE and EEG (at baseline and during exercise).

Results: There were no differences in power output ($F = 0.031 = 0.31$, $p > 0.05$) during the self-paced exercise between conditions: Anodal (235 W [95%CI 222 - 249 W]); Cathodal (235 W [95%CI 222 - 248 W]) and Sham (234 W [95%CI 220 - 248 W]). Neither the heart rate, RPE nor EEG activity were affected by the tDCS (all P s > 0.05).

Conclusions: tDCS over the left DLPFC did not affect self-paced exercise performance in trained cyclists. Moreover, tDCS did not elicit any change on EEG activity either at baseline or during exercise. Our data suggest that the significant effects of tDCS on endurance performance (and at rest) reported by recent studies should be taken with caution.

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