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Repetitive Transcranial Magnetic Stimulation Does not Improve Lower Extremity Anaerobic Physical Fatigue in Healthy Participants

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The ability to maintain anaerobic performance is important for physical activities that involve periodic segments of high-intensity actions. Intermittent theta burst stimulation (iTBS), a form of repetitive transcranial magnetic brain stimulation (rTMS), may improve anaerobic power, but its effects on anaerobic performance during fatigue have yet to be determined. In addition, despite growing evidence that stimulation parameters can influence the efficacy of rTMS protocols, little is known about the effects of continuous theta burst stimulation (cTBS). **PURPOSE:** To examine the effects of iTBS and cTBS over the supplementary motor area (SMA) and primary motor cortex (M1) trunk and leg representations on anaerobic performance under fatiguing conditions. **METHODS:** On three separate visits, 19 participants (5W, age: 25.8±5.0yr, weight: 71.8±12.7kg, height: 172.9±9.9cm) performed two consecutive Wingate Anaerobic Tests (WAnT) on a cycle ergometer after receiving TBS over the SMA, M1_{TRUNK}, or M1_{LEG} representations. A subset of the participants received cTBS (n=8), while others (n=11) received iTBS. Participants were provided a 2min warm up followed by a 15s lead-in at 125W and 100RPM. Each participant was familiarized to the protocol and 2min rest was given between trials. Mean and peak power (normalized to body weight) as well as the rate of decline in power (fatigue index) were compared among target locations and between stimulation protocols using a mixed-model ANOVA. **RESULTS:** WAnT performance decreased from trial 1 (T1) to 2 (T2) (T2-T1 Peak power: -0.46±0.08 W/kg, $F_{1,17} = 30.5$, $p < 0.01$, $\eta^2p = 0.64$; Mean power: -1.10±0.12 W/kg, $F_{1,17} = 81.2$, $p < 0.01$, $\eta^2p = 0.83$; Fatigue index: 1.52±.023 W/s, $F_{1,17} = 42.9$, $p < 0.01$, $\eta^2p = 0.71$) but did not differ between cTBS and iTBS ($F = 1.1-2.7$; $p = 0.12-0.30$) or target location ($F = 0.6-1.4$; $p = 0.25-0.56$). **CONCLUSIONS:** Lower extremity Wingate performance decreased from T1 to T2 but did not differ among TBS protocols or SMA, M1_{TRUNK}, or M1_{LEG} stimulation targets. Thus, our preliminary evidence does not suggest that two promising forms of non-invasive brain stimulation mitigate lower extremity anaerobic fatigue when targeted at M1 representations of primary task agonists, axial synergists, or the supplementary motor area.

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