

The Effects of Transcranial Direct Current Stimulation on Brain Oxygenation and Pleasure during Exercise

Authors : Alexandre H. Okano, Pedro M. D. Agrícola, Daniel G. Da S. Machado, Luiz I. Do N. Neto, Luiz F. Farias Junior, Paulo H. D. Nascimento, Rickson C. Mesquita, John F. Araujo, Eduardo B. Fontes, Hassan M. Elsangedy, Shinsuke Shimojo, Li M. Li

Abstract : The prefrontal cortex is involved in the reward system and the insular cortex integrates the afferent inputs arriving from the body's systems and turns into feelings. Therefore, modulating neuronal activity in these regions may change individuals' perception in a given situation such as exercise. We tested whether transcranial direct current stimulation (tDCS) change cerebral oxygenation and pleasure during exercise. Fourteen volunteer healthy adult men were assessed into five different sessions. First, subjects underwent to a maximum incremental test on a cycle ergometer. Then, subjects were randomly assigned to a transcranial direct current stimulation (2mA for 15 min) intervention in a cross over design in four different conditions: anode and cathode electrodes on T3 and Fp2 targeting the insular cortex, and Fpz and F4 targeting prefrontal cortex, respectively; and their respective sham. These sessions were followed by 30 min of moderate intensity exercise. Brain oxygenation was measured in prefrontal cortex with a near infrared spectroscopy. Perceived exertion and pleasure were also measured during exercise. The asymmetry in prefrontal cortex oxygenation before the stimulation decreased only when it was applied over this region which did not occur after insular cortex or sham stimulation. Furthermore, pleasure was maintained during exercise only after prefrontal cortex stimulation ($P > 0.7$), while there was a decrease throughout exercise ($P < 0.03$) during the other conditions. We conclude that tDCS over the prefrontal cortex changes brain oxygenation in ventromedial prefrontal cortex and maintains perceived pleasure during exercise. Therefore, this technique might be used to enhance effective responses related to exercise.

Keywords : affect, brain stimulation, dopamine neuromodulation, pleasure, reward, transcranial direct current stimulation

Conference Title : ICKES 2017 : International Conference on Kinesiology and Exercise Sciences

Conference Location : Paris, France

Conference Dates : October 19-20, 2017