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Mode Matters - Endurance Exercise Modes Influence Changes In EEG Resting State Brain Networks

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INTRODUCTION:
Acute bouts of exercise affect the organization of human brain networks transiently and can either improve or deteriorate neural processes underlying sports performance. Exercise intensity is regarded as a key variable in this interaction, since moderate to high intensities facilitate neural processing, while exhaustive exercise seems to impair these processes. Besides intensity, the sensorimotor demands of different exercise modes may further affect modulations of brain networks due to differences in sports-specific techniques or muscles involved. However, exercise mode is barely considered an additional moderator of acute exercise brain interactions. Therefore, this study aimed to explore the effect of exercise mode on transient changes in electroencephalography (EEG) resting state networks (RSNs) comparing running and cross-country (XC) skiing.
METHODS:
Fifteen male and highly trained XC skiers (20.1+.6 years, 74.4+5.6 kg, 178.9+5.5 cm) participated in the study. All athletes performed an incremental treadmill test to obtain peak oxygen uptake (VO2peak) in running (65.3 ml/min/kg) and XC skiing (63.5 ml/min/kg). Based on the incremental test, each athlete performed another incremental treadmill protocol with continuous stages at 50, 70, and 90% of speed VO2peak in both modes. EEG resting state data was recorded once before and intermittently throughout the protocols after each stage. The reconstruction of brain graphs allowed for the computation of the small world index (SWI, network efficiency), clustering coefficient (CC, network segregation), and path length (PL, network integration) in the theta, alpha-1, and alpha-2 frequency bands. To compare physiological demands between modes, blood lactate concentration, heart rate, and Borg scale were assessed. Repeated measures ANOVA was applied to explore the modulatory effects of exercise intensity (protocol stages) and mode (running vs XC skiing) on RSN outcomes and physiological markers.
RESULTS:
ANOVA revealed main effects of exercise intensity in the theta network which indicated modulations of SWI ($p < .001$), CC ($p < .001$), and PL ($p = .003$) following exercise at 90% of speed VO2peak for both modes. Further, main effects of mode on SWI ($p = .047$), CC ($p < .001$), and PL ($p = .031$) were observed in the alpha-2 network and indicated stronger modulations in network organization following XC skiing. Physiological outcomes were modulated by intensity solely and peaked after exhaustive exercise in both modes ($p < .001$).
CONCLUSION:
The present study demonstrated that both exercise intensity and mode may affect transient modulations of brain networks after exercise. Exercise intensity seems to induce modulations in brain networks associated with attentional control. Additionally, exercise mode seems to induce modulations in brain networks related to task-related information processing. Further research is required to understand the modulatory role of exercise mode in the acute interaction between exercise and brain function.

Topic: Training and Testing

Presentation Oral