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EFFECTS OF TAI CHI TRAINING ON EEG SPECTRUM POWER DURING SLEEP DEPRIVATION
IN A NARROW AND SEALED ENVIRONMENT

Abstract

Objective: Sleep deprivation is the condition of not having enough sleep; it can be either chronic or acute. A chronic sleep-restricted state can cause fatigue, daytime sleepiness, clumsiness and weight loss or weight gain. It adversely affects the brain and cognitive function. Recent study showed that Tai Chi training has positive regulation for the central nervous system, in particular the brain cognition and brain functional state such as attention, working memory, executive function. The present study investigated the influence of Tai Chi training during sleep deprivation in narrow and sealed environment by recoding and analyzing EEG activity.

Methods: The participants were 6 middle-aged Chinese male (28-37 years old), with right handed based on self report and normal or corrected to normal visual acuity and no history of psychiatric or neurological disorders. They were asked to retain sleep deprivation for 72h in narrow and sealed environment and conducted Tai Chi training for 10min at the same time in the former day, the first day, the second day and the third day. The resting EEG signals were recorded for 2 min before and after each training session with sampling rate of 512 Hz. The EEG frequency spectrum was calculated for each frequency band: δ (0.5-3Hz), θ (4-7Hz), α_1 (8-10Hz), α_2 (11-13Hz), β_1 (14-17Hz), β_2 (18-25Hz), γ_1 (30-60Hz), and γ_2 (60-80Hz). The measurements were subjected to a two-way repeated-measured ANOVA with Test time (before and after Tai Chi training) and Deprive time (the former day, the first day, the second day and the third day) as within-subject factors.

Results: Overall, sleep deprivation induced higher δ and θ activity at frontal area. Compared with the data acquired before Tai Chi training, this short-term training significantly decreased spectrum power for δ band ($p < 0.01$), θ band ($p < 0.01$), α_1 band ($p < 0.01$) as well as β_1 band ($p < 0.05$), respectively. There were no significant training effects for other EEG frequency bands ($ps > 0.1$).

Conclusion: Tai Chi training can reduce the low frequency activity of EEG signals under the condition of sleep deprivation in narrow and sealed environment, indicating that this training produce positive influence for attention and relaxation as well as alerting in extreme living environment.