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Relationship between the resting-state EEG brain oscillations and archery shooting performance

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## INTRODUCTION:

Resting state before exercise has been shown to reflect sporting performance in previous studies (1,2,3). However, such evidence was mostly based on data collected from one single resting state session, either with eyes open or closed, correlated with the following sporting performance. To overcome these limitations, the current study recorded the resting-state electroencephalography (EEG) at multiple sessions in both eyes open and closed conditions in a longitudinal design, and investigated the relationship with the following archery shooting performance in one skilled archer.

## METHODS:

We recruited a collegiate archer who has seven years of archery shooting experience and was currently active in competitions. In each experiment, the resting-state EEG activity, with eyes opened and closed for three minutes respectively, was recorded with a 32-channel EEG system (Brain products LiveAmp) with 250 Hz sampling rate. Next, the participant was asked to shoot 12 rounds of 6 arrows at a 122-cm target face at 70 m. 6 experiments were performed. Standard preprocessing and removal of noise identified using independent component analysis (ICA) was performed with eeglab (v2021.0). Then, the mean power density in each frequency band (delta, theta, alpha, beta, and gamma) in frontal (Fz), central (Cz), parietal (Pz), and occipital sites (Oz) was computed. Pearson correlation coefficient was used to examine the relation between the power density in each frequency band in the four sites with the mean (M) and standard deviation (SD) of the shooting scores across the six experiments. The level of significance was set at  $p = .05$ .

## RESULTS:

For eyes-open states, a positive ( $r=.814$ ,  $p<.05$ ) and a negative correlation ( $r=-.814$ ,  $p<.05$ ) was found in the power of the alpha band at Oz with the M and SD of scores, respectively. Whereas the delta power at Pz was negatively correlated with the M of scores ( $r=-.825$ ,  $p<.05$ ). For eyes-closed state, gamma power at the Fz ( $r=.827$ ,  $p<.05$ ) and Oz ( $r=.820$ ,  $p<.05$ ) was positively correlated with the M of scores.

## CONCLUSION:

Generally, our results were in agreement with the notion that pre-performance resting state brain oscillations could reflect the latter sporting performance. However, resting state EEG with eyes open and closed might reveal different brain oscillations from specific bands at specific brain regions correlated with the shooting performance. Whether resting state EEG with eyes open or closed might need to be considered when correlating the performance in different sport types.

## Reference:

- 1) Babiloni et al., *The Journal of physiology*, 2008
- 2) Landers et al., *Medicine & Science in Sports & Exercise*, 1991
- 3) Thompson et al., *Methods (San Diego, Calif.)*, 2008

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