

## **Higher Alpha/Theta Ratio May Indicate Decreased Brain Function in Older Adults during CSPFP10 Compared to Young Adults**

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### **ABSTRACT**

Declined physical ability and brain function observed in elder can affect daily living activities and negatively influence the quality of life (QOL). While the extensive research has explored the changes in cortical activity related to motor control in elder, less is known about how the brain functions during a physical function test.

**PURPOSE:** To examine the electrocortical activation in the older adults' brain during the Continuous Scale Physical Function Performance-10 (CSPFP-10) compared to young adults. **METHODS:** Twenty five older adults (OLD; 75.40±7.32 yrs, 70.33±18.23 kg, 162.87±7.55 cm) and twenty five young (YOUNG; 19.88±1.72 yrs, 66.52±14.22 kg, 167.50±10.22 cm) completed CSPFP10 while frontal (F<sub>3</sub>, F<sub>z</sub>, F<sub>4</sub>), central (C<sub>3</sub>, C<sub>z</sub>, C<sub>4</sub>), temporal (T<sub>7</sub>, T<sub>8</sub>, P<sub>7</sub>, P<sub>8</sub>), parietal (P<sub>3</sub>, P<sub>z</sub>, P<sub>4</sub>), and occipital (O<sub>1</sub>, O<sub>z</sub>, O<sub>2</sub>) regions' electrocortical activation was measured using a mobile electroencephalograph (EEG). Spectral power values ( $\mu V^2/Hz$ ) for theta ( $\theta$ : 4-8 Hz) and alpha ( $\alpha$ : 8-13 Hz) band were averaged across the target electrodes. Then  $\alpha/\theta$  ratio was calculated. Data were analyzed using independent t-test. **RESULTS:** OLD exhibited significantly higher  $\alpha/\theta$  ratio in frontal (M=0.98 vs.0.95,  $p<.02$ ), central (M=0.99 vs.0.96,  $p=.02$ ), temporal (M=1.02 vs. 0.98,  $p=.006$ ) compared to YOUNG. The separated t-test showed YOUNG had higher  $\theta$  and  $\alpha$  in frontal ( $\theta$ : M= 40.93 vs. 37.56,  $p<.001$ ;  $\alpha$ : M=38.98 vs. 36.83,  $p=.03$ ), central ( $\theta$ : M=39.68 vs. 36.43,  $p<.001$ ;  $\alpha$ : M=38.15 vs. 36.09,  $p=.038$ ), and parietal  $\theta$  (M=40.55 vs. 37.98,  $p=.001$ ) compared to OLD. Pearson's correlation analysis did not find any significance between brain function and CSPFP10 scores in both groups. **CONCLUSION**  $\alpha/\theta$  ratio in OLD showed that their  $\alpha$  power was relatively higher than YOUNG. Increased  $\alpha$  power indicates suppression/selective cortical processing. It might indicate that OLD had inhibitory cortical activation process during the CSPFP10 task. Decreased frontal and parietal  $\theta$  in OLD may indicate diminished decision making speed and attention with aging, while lower  $\theta$  power in a central region (motor cortex) implies disrupt motor control. Overall, our result may indicate that brain activation patterns become less active during aging. It's important to enhance both physical and brain function to improve activities of daily living and QOL in elderly population.