

⚡ Key message ⚡

Subjective sleepiness (ESS) is not associated with resting-state aperiodic EEG activity.

Resting-state EEG aperiodic component as a candidate biomarker of daytime sleepiness after mild traumatic brain injury

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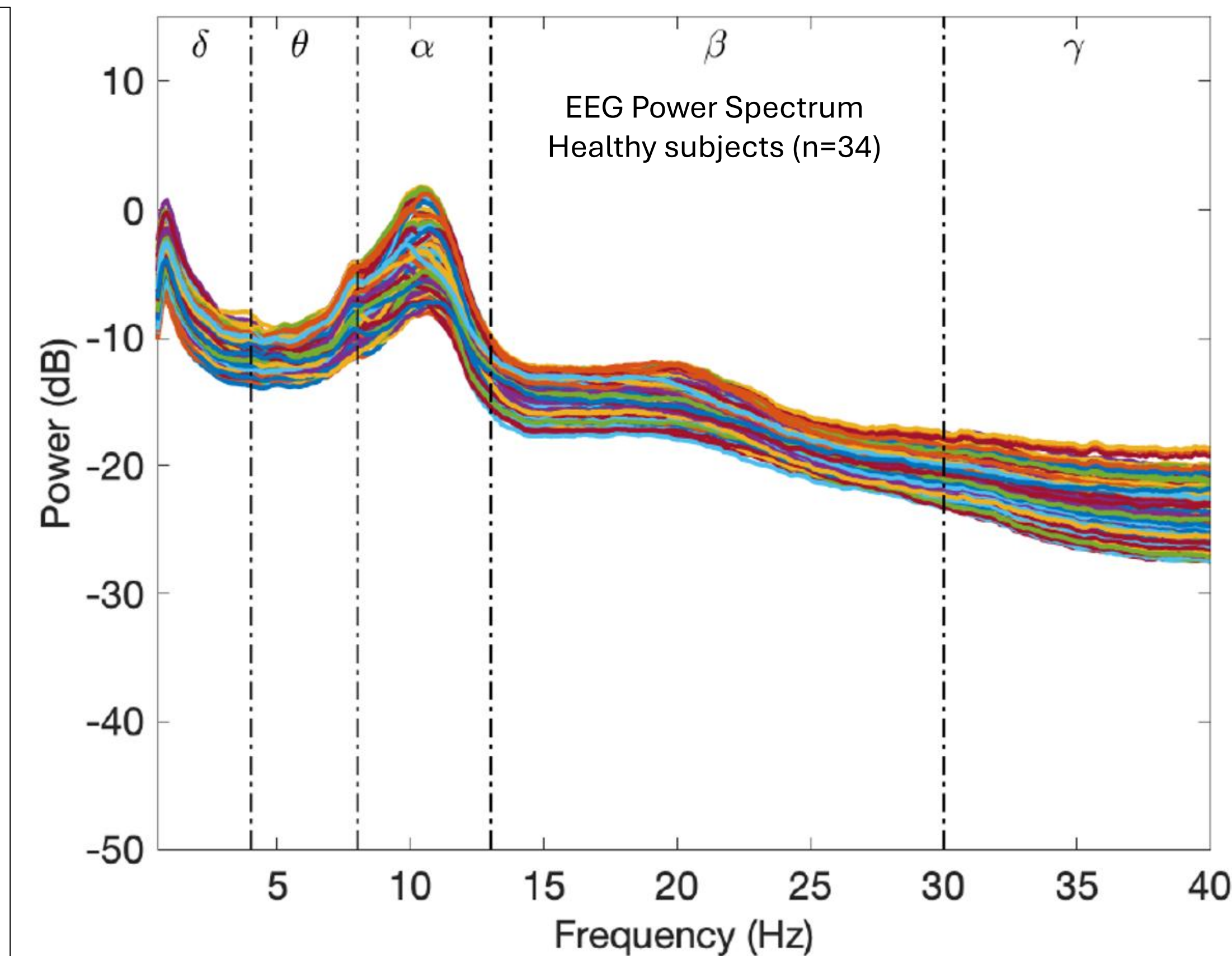
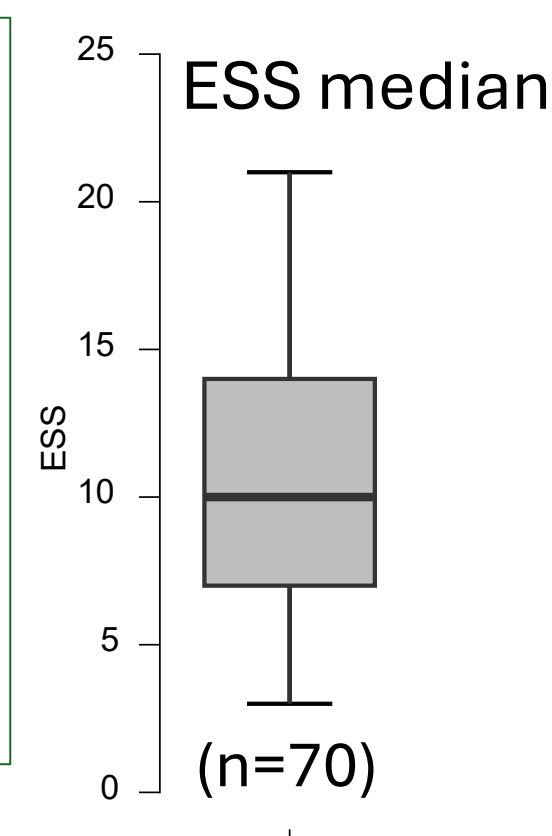
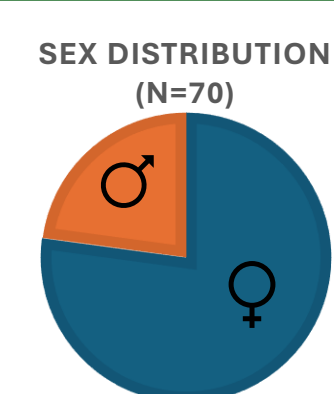
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Introduction

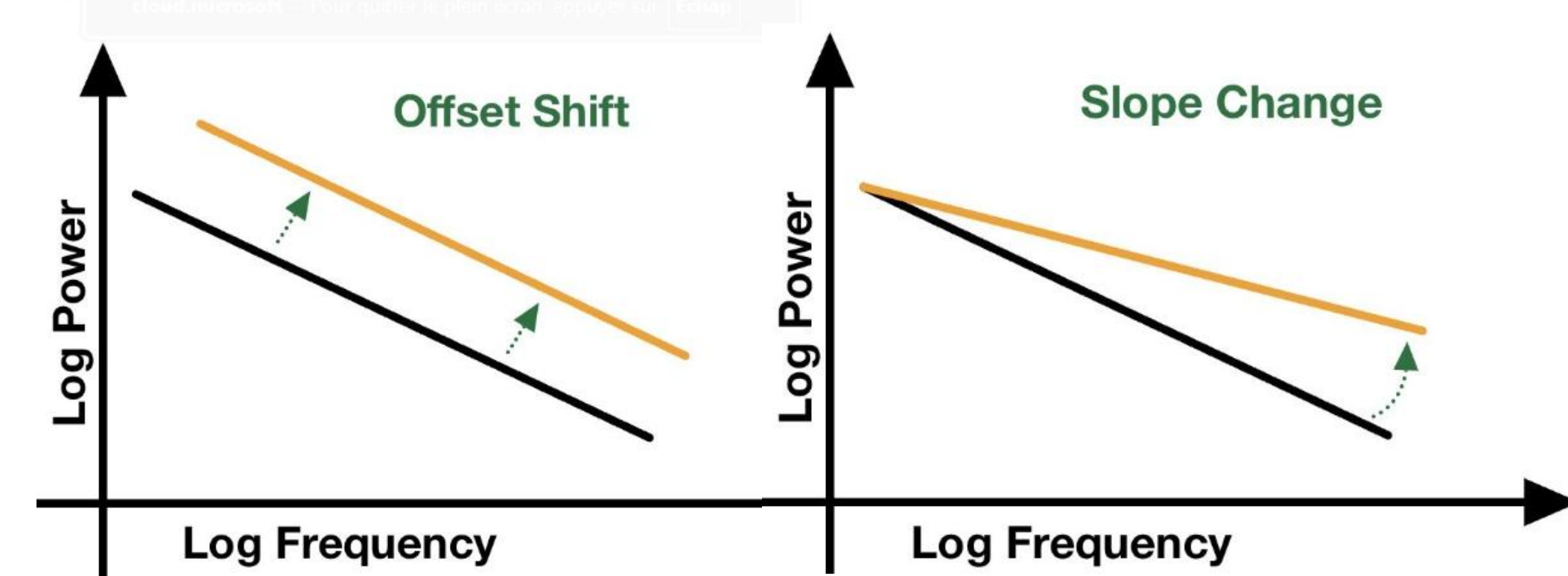
- Mild traumatic brain injury (mTBI) frequently leads to persistent post-concussive symptoms (PPCS) (~30%), including excessive daytime sleepiness.
- The Epworth Sleepiness Scale (ESS) is an 8-item questionnaire (score range: 0-24), with higher scores indicating greater daytime sleepiness.
- Aperiodic EEG parameters (slope and offset) reflect the non-oscillatory 1/f component of the EEG spectrum and reflect the balance between excitation/inhibition and cortical activity.
- Objective: To test whether subjective daytime sleepiness is associated with aperiodic resting-state EEG activity.

Methods

- 70 patients with PPCS : 54 women (77%), 16 men (23%), aged 18-64 years.
- Clinical questionnaires: ESS, PSQI, RPQ, BDI, BAI.
- EEG: High-density resting EEG. Parameterization using FOOOF and extraction of slope and offset.
- Spearman's correlations and multivariate models controlling for age and sex.

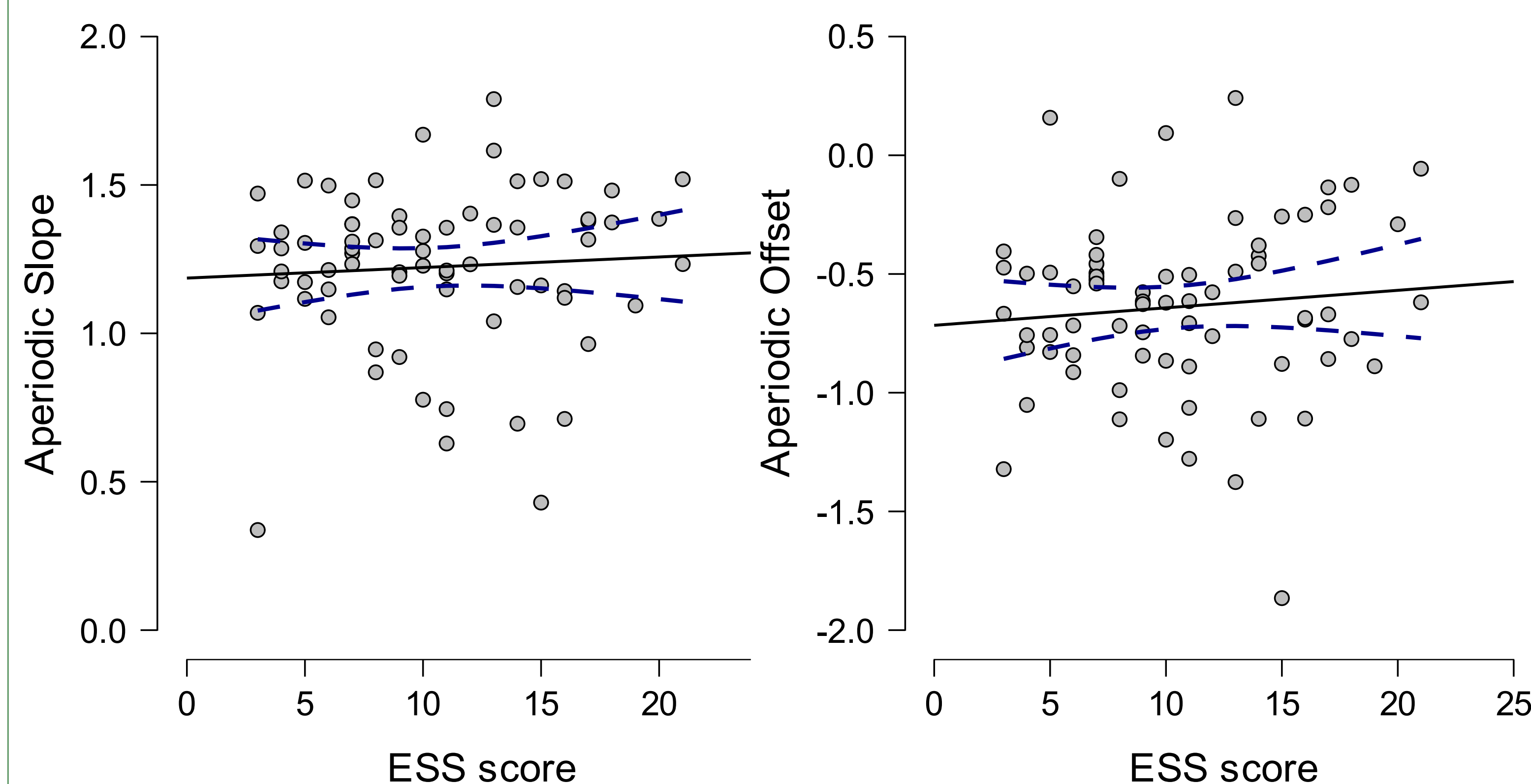


Aperiodic component of the EEG power spectrum (1/f)



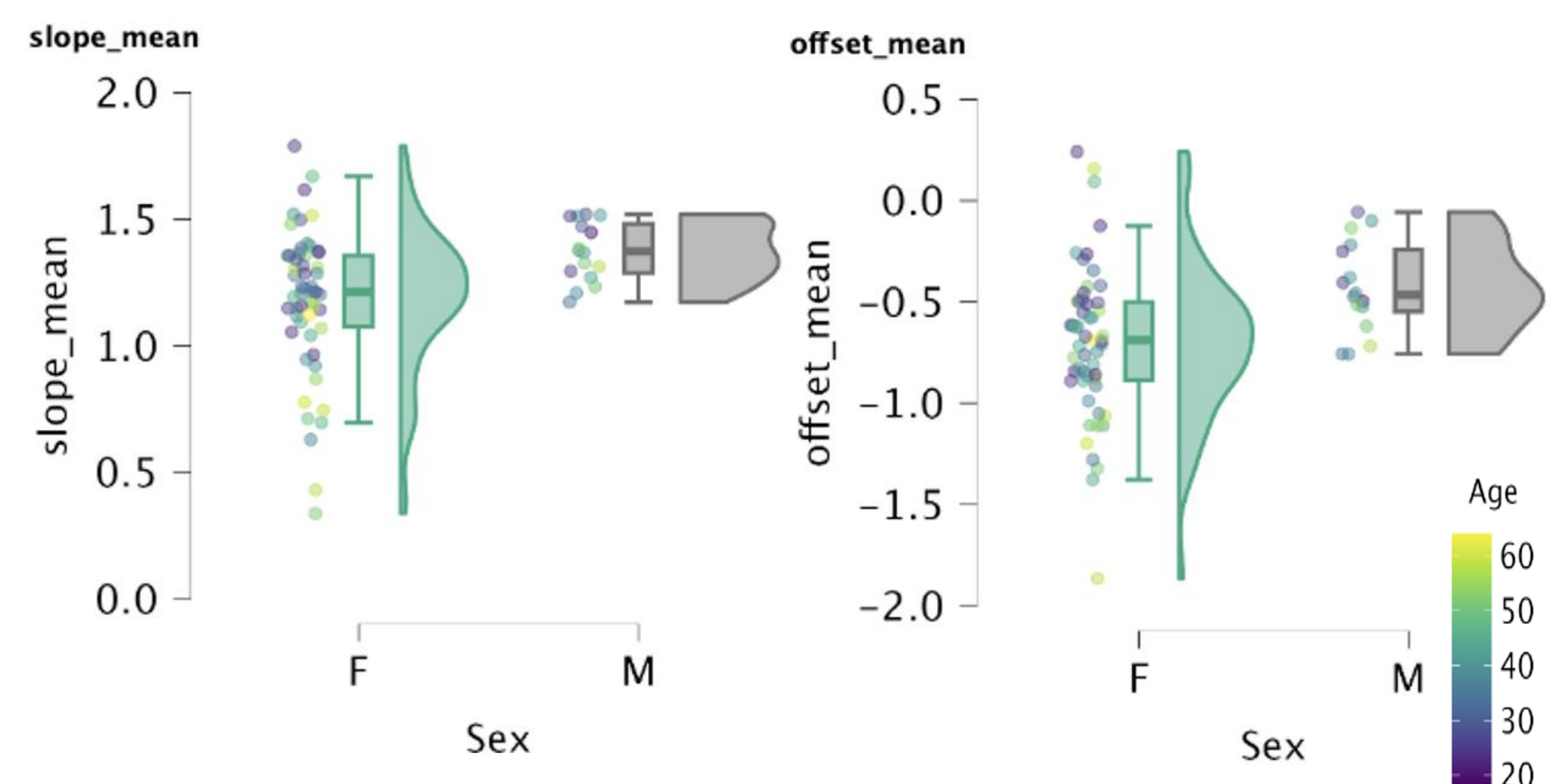
Results (1)

- ✓ No significant correlation was found between ESS and aperiodic parameters (slope: $\rho = 0.093$, $p = 0.444$; offset: $\rho = 0.095$; $p = 0.435$).



Results (2)

- ✓ Age and Sex modify the aperiodic EEG.
 - Slope model : Age + Sex (adjusted $R^2 = 0.170$, $p < 0.001$).
 - Offset model : Age + Sex (adjusted $R^2 = 0.152$, $p = 0.002$).
 - Younger age was associated with higher slope and offset.
 - Men showed higher slope and offset.



Discussion

- ❖ Our results suggest that the excitation/inhibition balance reflected by the aperiodic component is not directly related to subjective sleepiness measured by the ESS, indicating that aperiodic EEG activity may capture neurophysiological processes not reflected by subjective complaints.
- ❖ Investigating aperiodic EEG components during sleep, rather than resting wakefulness, may better reveal neurophysiological alterations underlying sleep complaints in PPCS.
- ❖ Age and sex significantly influence aperiodic EEG parameters and should therefore be considered as important covariates when studying aperiodic activity.

Conclusion

The aperiodic component of resting EEG does not appear to be a reliable biomarker of subjective excessive daytime sleepiness in patients with PPCS but is significantly influenced by age and sex.

References and abbreviations

- Donoghue et al., 2020.
- ESS : Epworth Sleepiness Scale
- mTBI : Mild traumatic brain injury
- PPCS : persistent post-concussive symptoms
- PSQI : Pittsburgh Sleep Quality Index
- RPQ : Rivermead Post-Concussion Symptoms Questionnaire
- BDI : Beck Depression Inventory
- BAI : Beck Anxiety Inventory
- FOOOF : Fitting Oscillations & One-Over-F