

Sleep disruption can vary depending on the respiratory event type and severity in OSA

January 4 2022

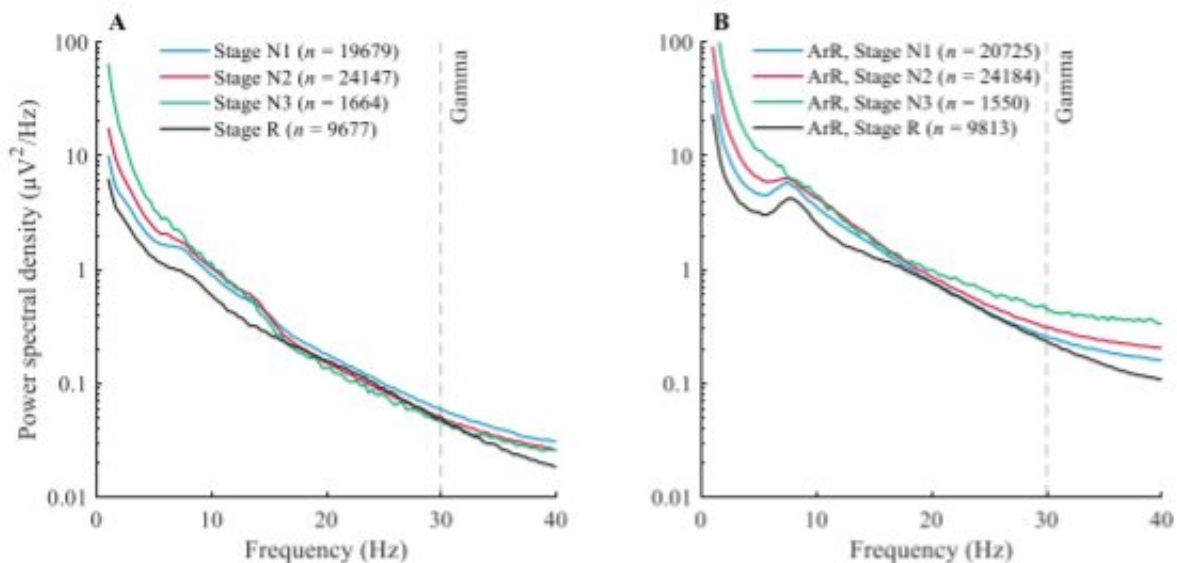


Fig. 1. Median electroencephalography (C4–M1) power spectral densities during 3-second epochs of stable non-rapid eye movement (Stage N1, Stage N2, Stage N3) and rapid eye movement (Stage R) sleep (A) and during respiratory arousals (ArR) in the corresponding stages (B). Credit: DOI:

10.1109/TBME.2021.3118229

Obstructive sleep apnoea (OSA) is a common breathing disorder causing excessive daytime sleepiness and increasing the risk for cardiovascular disease, hypertension, and stroke. OSA is characterized by repetitive complete (apnoea) or partial (hypopnoea) obstructions of the upper airways during sleep, which often lead to blood oxygen desaturations and

arousals from sleep. Arousals constantly interrupt the normal sleep pattern, which then results in inadequate sleep and shortened sleep times.

The quality of sleep, e.g., sleep stages and arousals from sleep, can be assessed based on the electroencephalogram (EEG) signal recorded during a polysomnogram. Even though arousals from sleep are identified from overnight recordings to characterize the degree of sleep interruption, this information is seldom utilized when assessing OSA severity. A recent study conducted in the Sleep Technology and Analytics Research (STAR) group at the University of Eastern Finland investigated differences between arousals caused by varying respiratory events.

In the study, 867 patients with clinical suspicion of OSA were investigated for differences in the high frequency content of EEG signals during respiratory arousals. The differences were studied in the [gamma](#) frequency band (30–40 Hz) between arousals caused by different respiratory events (obstructive apnoeas and hypopnoeas with and without a $\geq 3\%$ blood oxygen desaturation) and as a function of respiratory event duration (10–20 s, 20–30 s, or >30 s). Arousals were also investigated in different sleep stages, comparing them to 3-second epochs of steady sleep during the corresponding stages.

As opposed to steady sleep, where gamma power decreased towards deeper stages, arousal gamma power increased as the sleep deepened. In addition, arousal gamma power was higher related to obstructive apnoeas compared to hypopnoeas and increased related to longer obstructive apnoeas compared to shorter ones. Furthermore, arousal gamma [power](#) was higher in the presence of an oxygen desaturation compared to when a desaturation event was not present.

As elevated EEG gamma activity has previously been associated with wakefulness during night, the results demonstrate that the arousal

intensity and, therefore, the magnitude of sleep disruption and respiratory instability might vary depending on the preceding respiratory event type and severity.

"These findings can bring more insight into respiratory event-related [sleep](#) fragmentation and OSA severity assessment," says lead author, Early Stage Researcher Henna Pitkänen from the University of Eastern Finland.

More information: Henna Pitkanen et al, Gamma Power of Electroencephalogram Arousal is Modulated by Respiratory Event Type and Severity in Obstructive Sleep Apnea, *IEEE Transactions on Biomedical Engineering* (2021). [DOI: 10.1109/TBME.2021.3118229](https://doi.org/10.1109/TBME.2021.3118229)

Provided by University of Eastern Finland

Citation: Sleep disruption can vary depending on the respiratory event type and severity in OSA (2022, January 4) retrieved 11 May 2024 from <https://medicalxpress.com/news/2022-01-disruption-vary-respiratory-event-severity.html>

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