Evaluation of Daytime Sleepiness Levels According to Types of Epilepsy

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Abstract

Aim: This study aimed to investigate the relationship between electroencephalogram (EEG) findings, clinical characteristics, and subjective sleep measures in adult patients with epilepsy.

Methods: In this study, 105 patients previously diagnosed with epilepsy were included. EEG recordings were analyzed for interictal epileptiform discharges. Participants were divided into two groups: generalized and focal epilepsies, patients with focal epilepsy were also divided into subgroups. The Jenkins Sleep Scale (JSS) and Epworth Sleepiness Scale (ESS) were used to assess sleep quality and daytime sleepiness, respectively. Statistical data were obtained by making pairwise comparisons between groups.

Results: This study revealed that there was a significant association between EEG findings and gender, with frontal lobe epilepsy (FLE) more prevalent in females and temporal lobe epilepsy (TLE) more common in males. According to treatment modalities, monotherapy was predominant in patients with FLE and TLE, but statistically there was no difference across the groups. EEG abnormalities varied, with temporal and generalized abnormalities most prevalent. Significant differences were found in ESS and JSS scores across epilepsy groups, with higher scores observed in FLE. A positive correlation was found between ESS and JSS scores.

Conclusion: The impact of epilepsy on various aspects of a person's life, including sleep, is significant. This study underscores the importance of conducting comprehensive sleep assessments in clinical practice for individuals with epilepsy.

Keywords: *Epilepsy; sleep; Epworth; Jenkins*

1. Introduction

Epilepsy is a chronic neurological disorder characterized by recurrent seizures, and it is associated with a wide range of comorbid conditions, including sleep disturbances. Patients with epilepsy often experience both nocturnal and daytime sleep-related issues, which can exacerbate their condition and reduce their overall quality of life. Previous studies have shown that sleep disturbances, such as excessive daytime sleepiness, are common in epilepsy patients, but the mechanisms underlying these disruptions are not fully understood. While focal and generalized epilepsy types have distinct clinical presentations, their impact on sleep may differ [1].

Epilepsy and sleep disorders often coexist with many neurological or psychiatric conditions, which can affect epileptic seizure frequency and sleep quality[2]. Disruptions in sleep patterns can exacerbate the condition in patients with epilepsy[3]. Concurrently, the rise in seizure frequency may disturb patients' sleep structure and contribute to sleep disorders[3].

Some types of epilepsy are more likely to occur during specific stages of sleep, such as nocturnal seizures that occur during non-REM (rapid eye movement) sleep or during transitions between sleep stages[3]. In Frontal lobe epilepsy (FLE) seizures can disrupt the normal progression of sleep stages, leading to fragmented sleep and alterations in sleep architecture. These disruptions may result in excessive daytime sleepiness, fatigue, and impaired daytime functioning[4, 5]. Conversely, some studies suggest that sleep architecture is more disturbed in adults with temporal lobe epilepsy (TLE) compared with other types of epilepsy[1].

This study employed a prospective, observational design in adult patients with epilepsy to investigate the relationship between electroencephalogram (EEG), clinical findings, JSS and ESS scores.

2. Materials and Methods

This study was carried out in the Neurophysiology laboratory of Adana City T&R Hospital between 1 December 2022 and 1 March 2023. Patients aged 18 and over were included in the study and epilepsy was diagnosed according to the ILAE 2017 guideline[6].

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The EEG examinations were evaluated by a neurologist and a neurophysiologist separately for a specific epileptiform abnormality, the interictal spike or sharp wave. For a transient to be considered a specific interictal epileptiform discharge, at least 5 criteria had to be fulfilled according to the International Federation for Clinical Neurophysiology (IFCN) definition of interictal epileptiform discharge: (1) Di- or tri-phasic wave with pointed peak; (2) different wave duration than the ongoing background activity; (3) asymmetry of the waveform; (4) followed by a slow after-wave; (5) the background activity is disrupted by the presence of the IEDs; and (6) voltage map with distribution of the negative and positive potentials suggesting a source in the brain corresponding to a radial, oblique, or tangential orientation of the source[7, 8].

Electroencephalography recordings were performed in a dimly lit room at an outpatient neurophysiology laboratory using the standard 10-20 measuring system and gold disc electrodes affixed with Ten20 conductive paste (Weaver and Company, Norwalk, CA). The participants were relaxed and in a lying position. They were asked to abstain from alcohol for 24 h and coffee for 2 h before recording. To minimize the impact of external factors, eyes closed EEG was recorded. The 19-channel EEG was recorded for 20 min at least. The Cadwell Sierra Summit EEG (Cadwell Laboratories, Kennewick, Washington, USA).) device was used for recordings. The signals from 19 channels Fp1, Fp2, F7, F3, Fz, F4, F8, T3, C3, Cz, C4, T4, T5, P3, Pz, P4, T6, O1, and O2 were recorded using the electrode Cz as reference. The raw EEG signal was recorded at the sampling frequency of 256 Hz, a high-pass filter of 0.53 Hz, a low-pass filter of 70 Hz and impedances of less than 5 kΩ. The primary montage used was the "longitudinal anatomic bipolar montage" with the option for rederivation to a different montage. Patients were reclined comfortably during the recordings, which lasted between 25 and 30 minutes. Reactivity was measured with eye opening and closing while patients were awake and alert. Photic stimulation was performed at rates of 1, 3, 6, 12, 15, 18, 20, and 30 Hz, for 10 seconds each, with 10 seconds in between. Hyperventilation was performed for three minutes unless medically contraindicated. The remaining study time was dedicated to quiet recording to facilitate drowsiness or sleep. EEG reports were analyzed using visual analysis and manual counting by a fellowship-trained neurophysiologist.

The Jenkins Sleep Scale (JSS) is used to assess various aspects of sleep quality and disturbances [9]. The scale was designed to evaluate the sleep onset, sleep maintenance, sleep duration and overall sleep quality. The respondents answer the questions using a six-point Likert-type scale. Total scores range from 0-20, and higher scores indicate a greater number of sleep problems[10].

The Epworth Sleepiness Scale (ESS) is a questionnaire that assess the likelihood of falling asleep in different situations commonly encountered in daily life. Individuals rate items in this questionnaire on a scale from 0 (never) to 3 (high probability), indicating the likelihood of them dozing off or falling asleep while engaged in various activities[11].

Both the Jenkins Sleep Scale and the Epworth Sleepiness Scale are valuable tools for assessing sleep quality and daytime sleepiness, respectively, and are frequently used in combination with objective measures of sleep to provide a comprehensive evaluation of sleep disorders and their impact on individuals' lives. Participants were provided with printed copies of the JSS and the ESS questionnaires along with instructions for completion. Participants completed the questionnaires in a quiet and comfortable environment, without time constraints. Research staff were available to answer any questions and clarify instructions if needed. Once participants completed the questionnaires, they returned them to the research staff for scoring and data entry.

The total score of ESS is calculated by summing the ratings across all items, with scores typically ranging from 0 to 24. Scores above 10 are considered indicative of excessive daytime sleepiness. The cutt-off value for the JSS-TR was determined to be 6.5 for differentiates between poor and good sleepers[12].

We excluded patients with diagnostically inconclusive and patients with nonepileptic paroxysmal events. Additionally, patients with diseases that may occasionally reveal IEDs like dialysis dementia, hypocalcemia, uremic encephalopathy, acute or chronic renal failure, nonketotic hyperglycemia, metabolic encephalopathies, eclampsia, thyrotoxicosis, and Hashimoto's encephalopathy were excluded.

For the expected specificity of 80%, with a significance level of % 10 and a power of 0.8, we needed at least 44 patients[13].

This study has received ethical approval from the Adana City T&R Hospital ethics committee (date: 17.11.2022, no: 116/2250), and all participants agreed to be included in this study by filling out an informed consent form.

2.1.Statistical analyses

Descriptive statistics were used to summarize demographic characteristics and sleep study variables. EEG findings were classified based on established criteria for sleep staging and identification of epileptiform abnormalities. Jenkins Sleep Scale scores were analyzed to assess subjective sleep quality, while Epworth Sleepiness Scale scores were used to quantify daytime sleepiness. Correlation analyses, such as Pearson correlation coefficients or Spearman rank correlations, were conducted to explore associations between EEG findings and subjective sleep measures.

The Independent-Samples Kruskal-Wallis test was conducted to assess whether there were statistically significant differences in epilepsy groups (frontal, generalized, and temporal) among the samples. Pairwise comparisons were then conducted to further examine the differences between specific pairs of groups. The adjusted significance level was set at .050, and the Bonferroni correction was applied to account for multiple comparisons.

3. Results

A total of 105 participants were included in the study. The mean age was 31.02±12.15 in all individuals. The gender distribution was nearly equal, with 52 (49.5%) females and 53 (50.5%) males. The mean duration of epilepsy was 11.18±9.25 years. Types of epilepsy varied among participants, with the most common being focal [temporal 38 patients (36.2%) and frontal 17 patients (16.2%), totally 55 (52.4%)], followed by generalized [50 patients (47.2%)], Most participants (65.7%) had normal MRI findings.

The distribution of patients across frontal, temporal, and generalized EEG findings significantly differed by gender ($p = 0.018$). Frontal lobe epilepsy was more commonly observed in females (62.0%), while temporal lobe epilepsy was more prevalent in males (76.5%).

Regarding treatment modalities, while no statistically significant difference was observed ($p = 0.136$), monotherapy was the predominant treatment approach for patients with frontal (68.0%) and temporal (52.9%) lobe epilepsies, whereas polytherapy was more common in generalized epilepsy (52.6%).

The incidence of head injury was low across all groups, with the temporal lobe epilepsy group showing the highest percentage (35.3%). Abnormal MRI findings were most frequent in patients with temporal lobe epilepsy (70.6%).

Comparative data between the epilepsy groups is presented in **table 1**.

Table 1

Comparative data between the groups

	Generalized epilepsy Mean±SD (Median)IQR	Frontal lobe epilepsy Mean±SD (Median)IQR	Temporal lobe epilepsy Mean±SD (Median)IQR	p
Epilepsy duration (year)	10.8±8.8 (8.5) 13.2	12.5±11.8(8)16.5	10.9±8.6(9)14.25	0.971
JSS score	6.4±4.1(6)7.2	9.2±3.6(11)2.5	5.8±4.5(4.5)8	0.016
ESS score	6.1±3.8(6)6	11±4.8(13)5	5.8±4.3(5)8.2	<0.001
Seizure frequency	5.5±4.9(4)3.7	7.1±8.3(4)7.5	6.2±4.7(5.5)5	0.713
Age	27.1±10.1(24)14.2	31.0±12.7(27)14.5	36.0±12.7(34)17.7	0.002

JSS: jenkins sleep scale, ESS: Epworth sleepiness scale, SD:Standard deviation, IQR: inter quantile range

A significant difference in age across epilepsy groups was found (p = 0.002). Participants with temporal lobe epilepsy were significantly older compared to generalized epilepsy (p = 0.001).

The mean of EDSS in focal and generalized epilepsy patients were 7.47±5.0 and 6.18 ± 3.82 (p=0.201) and JSS were 6.90 ± 4.49 and 6.42± 4.10 (p=0.501) respectively. The Independent-Samples Kruskal-Wallis test revealed a significant difference in ESS scores across epilepsy subgroups (p < 0.001). Post-hoc pairwise comparisons indicated that participants with frontal lobe epilepsy had significantly higher ESS scores compared to those with temporal lobe epilepsy (p = 0.001) and generalized epilepsy (p = 0.001) (**figure 1**).

While analysing the JSS scores, patients with frontal lobe epilepsy had statistically higher scores than patients with temporal lobe epilepsy and generalized epilepsy (p=0.015, p=0.044, respectively) (**figure 2**).

Spearman correlation analysis showed a significant positive correlation between Epworth Sleepiness Scale scores and Jenkins scores (p < 0.001). The mean JSS score was 6.67±4.3 and ESS score was 6.85±4.5.

No significant differences were found in epilepsy duration, seizure frequency, or gender distribution among the groups (p > 0.05).

Figure 2

Jenkins scale scores across the types of epilepsy

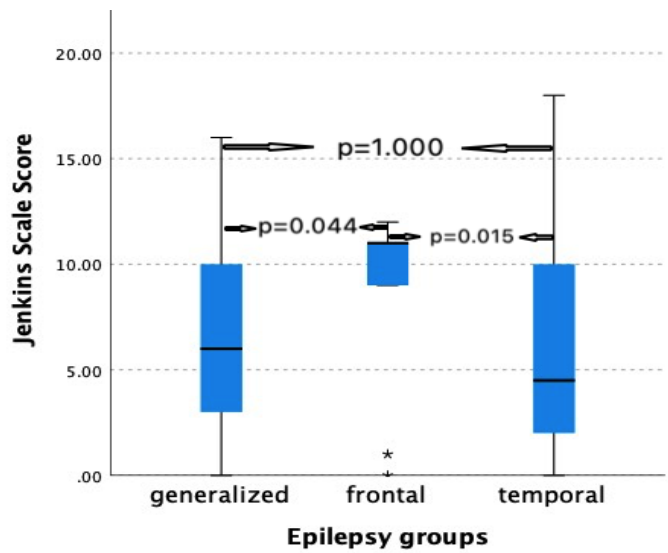
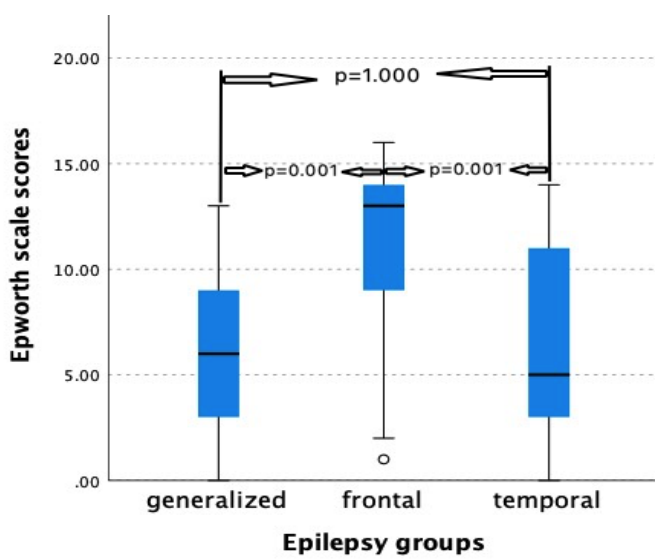


Figure 1

Epworth scale scores across the types of epilepsy



4. Discussion

The findings of this study underscore the importance of sleep-related symptoms in the clinical management of epilepsy. Our findings corroborate existing literature regarding the diverse clinical characteristics of epilepsy.

The wide age range and duration of epilepsy in our study population are consistent with previous reports highlighting the chronic and heterogeneous nature of the condition[14, 15].

Consistent with prior studies[14, 15], our findings indicated that temporal and generalized abnormalities were prevalent EEG patterns among patients with epilepsy. Temporal lobe epilepsy, characterized by seizures originating in the temporal lobes, often exhibits corresponding EEG abnormalities such as focal spikes or sharp waves[14]. Similarly, generalized epilepsy syndromes typically present with diffuse EEG abnormalities involving both hemispheres[15]. Our study's lower prevalence of frontal abnormalities aligns with some previous research[16] although discrepancies across studies suggest potential variability in EEG patterns among different epilepsy populations.

Tailored interventions that consider the multifaceted nature of the condition, including both seizure control and comorbidities such as sleep disturbances and stress, are essential for optimizing patient

outcomes[17]. Integrating EEG monitoring with comprehensive assessments of sleep and psychosocial functioning can inform individualized treatment plans and improve overall quality of life for patients with epilepsy[18].

Regarding sleep disturbances, our findings suggested that patients with epilepsy experienced varying degrees of daytime sleepiness, as evidenced by ESS scores ranging from 0 to 16. While the mean score of 6.86 fell within the mild to moderate range of sleepiness, it was crucial to recognize that excessive daytime sleepiness could have significant implications for quality of life and cognitive function in individuals with epilepsy. Byars et al. found a higher prevalence of sleep disorders in children with epilepsy[19]. Lack of sufficient sleep or poor sleep quality can increase the likelihood of experiencing seizures in individuals with epilepsy. Conversely, seizures themselves can disrupt sleep, leading to a cycle of sleep deprivation and increased seizure susceptibility[1].

In a previous study, it was shown that in patients with chronic epilepsy insomnia symptoms and short sleep duration were more common than recently diagnosed[20]. In another study, sleep architecture can be abnormal in children with primary generalized epilepsy[21]. In another previous study, Herman refers to a comprehensive review of sleep disorders in epilepsy, which would cover topics like excessive daytime sleepiness and the different impacts of epilepsy types on sleep. Some researchers believe that there may be common underlying mechanisms contributing to both epilepsy and certain sleep disorders, such as alterations in neurotransmitter systems or abnormalities in brain structures involved in regulating sleep-wake cycles. Moreover, our study revealed a wide range of Jenkins scores, indicative of varying levels of perceived stress among participants. Stress is known to be a common comorbidity in epilepsy, with potential implications for seizure control and overall well-being. Our findings underscore the importance of assessing and addressing stress in the management of epilepsy.

Seizures originating from the frontal lobe can have a significant impact on sleep architecture and contribute to sleep disturbances in affected individuals5, 22. Additionally, there is evidence to suggest that sleep disorders may also influence the occurrence and severity of seizures in individuals with FLE[2, 3]. Crespel and colleagues found that sleep architecture was more disturbed in 15 patients with mesial TLE compared with 15 with FLE. The patients with TLE had reduced sleep efficiency, increased Wakefulness after sleep onset (WASO), and more arousals[23]. Specifically, patients with frontal abnormalities tended to report higher scores on the ESS and JSS compared to those with temporal or generalized abnormalities in this study. The frontal lobe, particularly the prefrontal cortex, is involved in regulating the sleep-wake cycle. It receives input from other brain regions involved in circadian rhythm regulation and plays a role in promoting wakefulness during the day and initiating sleep at night. Frontal lobe seizures often occur during sleep, particularly during non-REM (rapid eye movement) sleep stages. These nocturnal seizures can disrupt sleep continuity and lead to awakenings during the night, further exacerbating sleep disturbances[3]. Seizures originating in the frontal lobes can disrupt the normal progression of sleep stages, leading to fragmented sleep and alterations in sleep architecture. These disruptions may result in excessive daytime sleepiness, fatigue, and impaired daytime functioning[24]. Sleep disorders such as insomnia, obstructive sleep apnea, or restless legs syndrome may lead to sleep deprivation or fragmentation, increasing the likelihood of seizures in individuals with FLE. Sleep deprivation can lower the seizure threshold and trigger epileptic activity in the frontal lobes.

While previous research has identified associations between specific EEG patterns and sleep disorders such as sleep apnea[25], our findings suggest broader relationships with daytime sleepiness and perceived stress. These associations underscore the complex interactions between epilepsy, sleep regulation, and stress response systems[24], highlighting the importance of comprehensive care approaches that address both clinical and psychosocial aspects of the condition.

Limitations of this study included its observational design, which precluded establishment of causality, and the relatively small sample size. Additionally, the study population consisted of patients presenting with sleep-related complaints, which may limit generalizability to other populations.

5. Conclusion

In conclusion, this study highlights the critical role of sleep disturbances, particularly excessive daytime sleepiness, in the clinical management of epilepsy These results suggest that patients with epilepsy, particularly frontal lobe epilepsy, may be affected by sleepiness. By demonstrating significant differences in ESS and JSS scores across epilepsy subtypes, our findings align with and extend existing literature, suggesting that sleep disturbances may serve as both a consequence and a contributing factor to seizure activity. This underscores the need for tailored interventions addressing sleep comorbidities to improve patient outcomes

Conflict of Interest

The authors declare that they have no conflict of interest.

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Ethics Approval

All methods were carried out in accordance with relevant guidelines and regulations. This study was performed in line with the principles of the Declaration of Helsinki. Ethics approval was obtained by the Adana City T&R Hospital ethics committee (date: 17.11.2022, no: 116/2250).

Consent to Participate

Consent to participate was obtained from all patients for being included in this study.

Consent for Publication

Not applicable.

Informed Consent

Informed consent was obtained from all individual participants included in the study. Patients signed informed consent regarding publishing their data and photographs.

Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Author Contributions

All the authors contributed to the study's conception and design. Material preparation, data collection, and quality assessment were performed by MB. & HF. Statistical analysis and literature review

were performed by MB. The first draft of the manuscript was written by MB. & HF. and all the authors commented on previous versions of the manuscript. All the authors read and approved the final manuscript.

Artificial Intelligence statement

No artificial intelligence was used for the writing of the submitted work.

References

1.Grigg-Damberger MM, Foldvary-Schaefer N. Primary sleep disorders in people with epilepsy: clinical questions and answers. Child Adolesc Psychiatr Clin N Am. 2015;24(1):145-76.
https://doi.org/10.1016/j.chc.2014.09.001

2.Malow BA. Sleep disorders, epilepsy, and autism. Ment Retard Dev Disabil Res Rev. 2004;10(2):122-5.
https://doi.org/10.1002/mrdd.20023

3.Bazil CW, Walczak TS. Effects of sleep and sleep stage on epileptic and nonepileptic seizures. Epilepsia. 1997;38(1):56-62.
https://doi.org/10.1111/j.1528-1157.1997.tb01077.x

4.Touchon J, Baldy-Moulinier M, Billiard M, Besset A, Cadilhac J. Sleep organization and epilepsy. Epilepsy Res Suppl. 1991;2:73-81.

5.Foldvary-Schaefer N, Grigg-Damberger M. Sleep and epilepsy: what we know, don't know, and need to know. J Clin Neurophysiol. 2006;23(1):4-20.
https://doi.org/10.1097/01.wnp.0000206877.90232.cb

6.Fisher RS, Cross JH, French JA, Higurashi N, Hirsch E, Jansen FE, et al. Operational classification of seizure types by the International League Against Epilepsy: Position Paper of the ILAE Commission for Classification and Terminology. Epilepsia. 2017;58(4):522-30.
https://doi.org/10.1111/epi.13670

7.Kane N, Acharya J, Benickzy S, Caboclo L, Finnigan S, Kaplan PW, et al. A revised glossary of terms most commonly used by clinical electroencephalographers and updated proposal for the report format of the EEG findings. Revision 2017. Clin Neurophysiol Pract. 2017;2:170-85.
https://doi.org/10.1016/j.cnp.2017.07.002

8.Kural MA, Duez L, Sejer Hansen V, Larsson PG, Rampp S, Schulz R, et al. Criteria for defining interictal epileptiform discharges in EEG: A clinical validation study. Neurology. 2020;94(20):e2139-e47.
https://doi.org/10.1212/WNL.0000000000009439

9.Jenkins CD, Stanton BA, Niemcryk SJ, Rose RM. A scale for the estimation of sleep problems in clinical research. J Clin Epidemiol. 1988;41(4):313-21.
https://doi.org/10.1016/0895-4356(88)90138-2

10.Schubert CR, Cruickshanks KJ, Dalton DS, Klein BE, Klein R, Nondahl DM. Prevalence of sleep problems and quality of life in an older population. Sleep. 2002;25(8):889-93.

11.Johns MW. A new method for measuring daytime sleepiness: the Epworth sleepiness scale. Sleep. 1991;14(6):540-5.
https://doi.org/10.1093/sleep/14.6.540

12.Duruöz MT, Ünal Ç, Ulutatar F, Sanal Toprak C, Gündüz OH. The Validity and Reliability of Turkish Version of the Jenkins Sleep Evaluation Scale in Rheumatoid Arthritis. Arch Rheumatol. 2018;33(2):160-7.
https://doi.org/10.5606/ArchRheumatol.2018.6376

13.Foldvary-Schaefer N, Neme-Mercante S, Andrews N, Bruton M, Wang L, Morrison S, et al. Wake up to sleep: The effects of lacosamide on daytime sleepiness in adults with epilepsy. Epilepsy Behav. 2017;75:176-82.
https://doi.org/10.1016/j.yebeh.2017.08.002

14.Fisher RS, Acevedo C, Arzimanoglou A, Bogacz A, Cross JH, Elger CE, et al. ILAE official report: a practical clinical definition of epilepsy. Epilepsia. 2014;55(4):475-82.
https://doi.org/10.1111/epi.12550

15.Kobau R, Gilliam F, Thurman DJ. Prevalence of self-reported epilepsy or seizure disorder and its associations with self-reported depression and anxiety: results from the 2004 HealthStyles Survey. Epilepsia. 2006;47(11):1915-21.
https://doi.org/10.1111/j.1528-1167.2006.00612.x

16.Vignatelli L, Bisulli F, Giovannini G, Licchetta L, Naldi I, Mostacci B, et al. Prevalence of nocturnal frontal lobe epilepsy in the adult population of Bologna and Modena, Emilia-Romagna region, Italy. Sleep. 2015;38(3):479-85.
https://doi.org/10.5665/sleep.4514

17.Motamedi M, Yordkhani F, Shirali A, Gheini M. Comparison of the baseline, waking and sleep EEGs after sleep deprivation in patients with sleep seizure. Tehran University Medical Journal. 2011;69(8).

18.Kothare SV, Kaleyias J. Sleep and epilepsy in children and adolescents. Sleep Med. 2010;11(7):674-85.
https://doi.org/10.1016/j.sleep.2010.01.012

19.Byars AW, Byars KC, Johnson CS, DeGrauw TJ, Fastenau PS, Perkins S, et al. The relationship between sleep problems and neuropsychological functioning in children with first recognized seizures. Epilepsy Behav. 2008;13(4):607-13.
https://doi.org/10.1016/j.yebeh.2008.07.009

20.Xu Y, Hackett ML, Nikpour A, Somerville E, Bleasel A, Ireland C, et al. Course and impact of sleep disturbance in newly diagnosed epilepsy: A prospective registry study. Clin Neurol Neurosurg. 2020;195:105963.
https://doi.org/10.1016/j.clineuro.2020.105963

21.Maganti R, Sheth RD, Hermann BP, Weber S, Gidal BE, Fine J. Sleep architecture in children with idiopathic generalized epilepsy. Epilepsia. 2005;46(1):104-9.
https://doi.org/10.1111/j.0013-9580.2005.06804.x

22.Parrino L, De Paolis F, Milioli G, Gioi G, Grassi A, Riccardi S, et al. Distinctive polysomnographic traits in nocturnal frontal lobe epilepsy. Epilepsia. 2012;53(7):1178-84.
https://doi.org/10.1111/j.1528-1167.2012.03502.x

23.Crespel A, Coubes P, Baldy-Moulinier M. Sleep influence on seizures and epilepsy effects on sleep in partial frontal and temporal lobe epilepsies. Clin Neurophysiol. 2000;111 Suppl 2:S54-9.
https://doi.org/10.1016/S1388-2457(00)00402-8

24.Vignatelli L, Bisulli F, Naldi I, Ferioli S, Pittau F, Provini F, et al. Excessive daytime sleepiness and subjective sleep quality in patients with nocturnal frontal lobe epilepsy: a case-control study. Epilepsia. 2006;47 Suppl 5:73-7.
https://doi.org/10.1111/j.1528-1167.2006.00882.x

25.Malow BA, Levy K, Maturen K, Bowes R. Obstructive sleep apnea is common in medically refractory epilepsy patients. Neurology. 2000;55(7):1002-7.
https://doi.org/10.1212/WNL.55.7.1002