RESEARCH PAPER

Association Between Sleep Habits and Quality of Life in Children with Epilepsy: A Cross-Sectional Study

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ABSTRACT

Introduction: Pediatric epilepsy affects not only seizure control but also emotional, cognitive, physical, and social aspects of a child's overall well-being. Sleep disturbances are highly prevalent in children with epilepsy (CWE) and may further worsen their quality of life (QoL). Understanding this relationship is essential for holistic epilepsy care.

Methods: This cross-sectional study was conducted at Jaipur National University Institute for Medical Sciences and Research Centre among 71 children with epilepsy aged 4–17 years. Data were collected using a demographic proforma, Quality of Life in Childhood Epilepsy Questionnaire (QOLCE-16), and Children's Sleep Habits Questionnaire (CSHQ). Statistical analysis was performed using SPSS version 27. Descriptive statistics and multivariate analysis of variance (MANOVA) were applied, with $p < 0.05$ considered statistically significant.

Results: The mean QoL score was 58.57 ± 15.64, indicating moderate impairment, with cognitive and physical domains being the most affected. The mean CSHQ score was 65.11 ± 11.50, reflecting a high prevalence of sleep disturbances. A significant negative correlation was observed between sleep disturbances and QoL ($p < 0.001$). Age was significantly associated with both sleep quality and QoL, with older children demonstrating better outcomes. No significant gender differences were found. However, seizure type showed significant associations with emotional, social, and overall QoL scores, with children having generalized seizures reporting better outcomes than those with partial seizures.

Conclusion: Sleep disturbances are significantly associated with reduced QoL in children with epilepsy. Routine sleep assessment and targeted interventions may improve overall well-being and functional outcomes.

Keywords: Pediatric, Epilepsy, Sleep , Cross-Sectional studies, Quality of Life

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INTRODUCTION

Epilepsy is one of the most prevalent chronic neurological disorders of childhood, characterized by recurrent unprovoked seizures resulting from abnormal and excessive neuronal discharges. These seizures manifest with varied presentations ranging from brief lapses of awareness to major convulsions, and often disrupt cognitive, emotional, and behavioral functioning during critical developmental periods. According to the International League Against Epilepsy (ILAE), epilepsy is diagnosed after two or more unprovoked seizures occurring >24 hours apart, a single seizure with high risk of recurrence, or the presence of an epilepsy syndrome. [1] Childhood epilepsy represents a unique clinical challenge because ongoing seizures, antiepileptic drug (AED) exposure, and neurobiological vulnerabilities can significantly influence daily functioning and long-term developmental outcomes.[2]

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Globally, nearly 50 million individuals live with epilepsy, and approximately 10 million are children under 15 years of age. Low- and middle-income countries (LMICs) bear more than 80% of this burden due to infection rates, perinatal complications, limited diagnostic facilities, and treatment gaps that may reach 50-70%.[3] In India, community-based studies report a pediatric epilepsy prevalence of 2.5-5.4 per 1,000 children, with rural regions showing higher incidence and greater unmet treatment needs. Social stigma, restricted access to neurological care, delayed diagnosis, and inconsistent drug availability further compound the burden for Indian families. [4-6]

Beyond seizure control, the broader impact of epilepsy on children's daily lives is increasingly recognized. Health-related quality of life (HRQoL) encompasses physical functioning, emotional well-being, cognitive ability, and social interactions. Children with epilepsy consistently demonstrate lower HRQoL compared to healthy peers and even those with other chronic illnesses. [7-9,10-13] Contributing factors include seizure severity, AED adverse effects, learning difficulties, behavioral comorbidities, and parental stress. However, HRQoL is not solely determined by seizures or medications; emerging evidence highlights sleep disturbances as a major yet under-recognized determinant of well-being in this population.[11,14]

Sleep disturbances affect an estimated 50-70% of children with epilepsy, significantly higher than the rates observed in the general pediatric population. [14]These disturbances include bedtime resistance, delayed sleep onset, frequent night awakenings, parasomnias, daytime sleepiness, and sleep-disordered breathing.[15] Nocturnal seizures can alter sleep architecture, reducing restorative slow-wave and REM sleep, while certain AEDs may either sedate or fragment sleep. Poor sleep can lower the seizure threshold, impair behavior and attention, reduce academic performance, and contribute to emotional dysregulation, thereby creating a bidirectional and self-perpetuating cycle.[16]

Although global research emphasizes the relationship between sleep and HRQoL in epilepsy, the Indian evidence base is limited, with most studies addressing seizure characteristics, comorbidities, or treatment outcomes. Very few Indian studies have simultaneously evaluated sleep habits and QoL using standardized and validated instruments such as the QOLCE-16 and CSHQ. Furthermore, existing studies rarely analyze domain-specific QoL impacts (cognitive, emotional, social, physical) or explore age-related variations in sleep behavior among children with epilepsy.[17,18] Data from Rajasthan are particularly scarce despite regional challenges, including limited access to specialized pediatric neurology services, variable health literacy, and substantial treatment disparities.[17]

This knowledge gap is clinically significant because sleep problems are often overlooked in routine epilepsy management within Indian healthcare settings. [20]Caregivers commonly report concerns such as irritability, poor concentration, daytime fatigue, or academic decline, yet sleep screening is seldom integrated into pediatric neurology practice. Understanding how sleep disturbances influence QoL in the local context can guide clinicians toward early identification, targeted sleep hygiene interventions, and improved overall management strategies.[19,17,18]

Therefore, the present study aims to investigate the relationship between sleep habits and quality of life among pediatric epilepsy patients attending a tertiary care hospital in Rajasthan, using validated assessment tools. Findings from this study may support evidence-based modifications in clinical practice by emphasizing the importance of routine sleep evaluation in all children diagnosed with epilepsy.

MATERIALS AND METHODS

Study Design and Setting

A descriptive cross-sectional study was conducted to assess the relationship between sleep habits and quality of life (QoL) among pediatric epilepsy patients. The study was carried out in the Pediatric Neurology Outpatient Department (OPD) of Jaipur National University Institute of Medical Sciences and Research Centre (JNUIMSRC), Jaipur, Rajasthan. Data collection was conducted over a six-month period, from December 2024 to May 2025.

Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee of JNUIMSRC (Approval No. JNUIMSRC/IEC/2025/09). Written informed consent was obtained from parents or legal guardians before data collection. Participation was voluntary, and confidentiality, anonymity, and data protection were strictly maintained in accordance with institutional and national ethical guidelines.

Study Participants and Sampling Technique

Pediatric patients aged 4-17 years with a confirmed diagnosis of epilepsy attending the Pediatric Neurology OPD constituted the study population. The sample size was calculated using the Raosoft online sample size calculator. Assuming a finite population of 86 eligible patients, a 99% confidence level, a 5% margin of error, and a 50% response distribution (which provides maximum variability), the required sample size was estimated to be 71. This calculation is based on the formula:$n = N z^2 p (1 - p) / e^2 (N - 1) + z^2 p (1 - p)$

where N is population size, z is the z-score (2.576 for 99% CI), p is the response distribution (0.5), and e is the margin of error (0.05). The final enrolled sample matched this requirement. Convenience sampling was employed due to feasibility constraints and the limited pool of eligible participants. Children were included if they were between 4 and 17 years of age, diagnosed with epilepsy, on follow-up at the Pediatric Neurology OPD, and accompanied by caregivers capable of providing informed consent and reliable information. Exclusion criteria encompassed severe cognitive impairment that hindered reliable assessment, significant language or communication barriers,

incomplete questionnaire responses, and unwillingness of caregivers to participate.

For the purpose of this study, epilepsy was defined as a clinical diagnosis confirmed by a pediatric neurologist in accordance with the International League Against Epilepsy (ILAE) diagnostic criteria. Quality of life (QoL) referred to the total and domain-specific scores obtained from the QOLCE-16 questionnaire, with higher scores indicating better functional status. Sleep disturbance was defined using the total and subscale scores of the Children's Sleep Habits Questionnaire (CSHQ), where higher scores reflect poorer sleep habits and greater sleep-related difficulties. Seizure type, classified as generalized or partial, followed the ILAE operational classification of seizure types.

Study Variables

The primary dependent variable in this study was the quality of life of children with epilepsy, assessed using the total and domain scores of the QOLCE-16 questionnaire. The main independent variable was sleep habits, evaluated through the total and subscale scores of the Children's Sleep Habits Questionnaire (CSHQ). Demographic and clinical covariates included age, gender, seizure type. These variables were included to examine potential influences on both QoL and sleep outcomes and to control for possible confounding factors in subsequent analyses.

Data Collection Tools and Procedure

Data were collected through interviewer-administered questionnaires. A validated Hindi version of the questionnaires was used for caregivers who were more comfortable with Hindi, ensuring better comprehension and minimizing language-related selection bias.

1. Quality of Life Assessment (QOLCE-16)

Quality of life was assessed using the QOLCE-16, a validated instrument comprising cognitive, emotional, social, and physical domains, with scores ranging from 0 to 100 (higher scores indicating better QoL).

Responses were recorded on a 5-point Likert scale (1–5). "Not applicable" and missing responses were treated as missing values, and selected items in the emotional (item d) and physical domains (items a–c) were reverse-coded.

Scores were linearly transformed to a 0–100 scale (1 = 0, 2 = 25, 3 = 50, 4 = 75, 5 = 100). Domain scores were calculated as the mean of items within each domain, excluding subscales with more than two missing items. The total QoL score was computed as the mean of all domain scores.

2. Sleep Assessment (CSHQ)

Sleep habits were assessed using the Children's Sleep Habits Questionnaire (CSHQ), a validated 33-item parent-reported instrument that evaluates eight domains of sleep behavior: bedtime resistance (difficulty going to bed), sleep onset delay (difficulty falling asleep), sleep duration, sleep anxiety, night wakings, parasomnias, sleep-disordered breathing, and daytime sleepiness. Higher scores indicate greater sleep disturbances. The CSHQ was selected because it is a widely validated and extensively used tool for assessing sleep habits in children and has demonstrated good reliability in pediatric clinical and research settings.

Responses were recorded on a 3-point Likert scale: 1 (usually), 2 (sometimes), and 3 (rarely). Selected items were reverse-coded as per standard guidelines to ensure uniform scoring. Subscale scores were calculated by summing the respective items, and the total sleep score was obtained by summing all items, with higher scores reflecting poorer sleep quality. Missing responses were excluded, and scoring was performed according to standard recommendations.

3. Socio-demographic and Clinical Data

A structured information sheet was used to record relevant background variables, including age, gender, seizure type, duration of epilepsy, family history, and details of antiepileptic medications when available. This ensured standardized data collection and facilitated subgroup analysis.

Data Analysis

Data coding and statistical analysis were performed using IBM SPSS Version 27. Descriptive statistics, including frequencies and percentages for categorical variables and mean ± standard deviation for continuous variables, were used to summarize demographic characteristics, QOLCE-16 scores, and CSHQ scores. Normality of continuous variables was assessed using the Shapiro–Wilk test.

For inferential analysis, independent t-tests and one-way analysis of variance (ANOVA) were used to examine differences in QoL and sleep parameters across demographic groups. Multivariate Analysis of Variance (MANOVA) was applied to determine the combined influence of age, gender, and seizure type on QoL and sleep domains. Pearson's correlation coefficient was used to assess the relationship between total QoL scores and total sleep scores. A p-value of <0.05 was considered statistically significant.

RESULTS

Demographic and Clinical Characteristics

A total of 71 pediatric patients with epilepsy were included in the study. The mean age of participants was 9.68 ± 4.06 years, with the majority (60.6%) belonging to the 4–10-year age group. Slightly more than half of the children were male (53.5%). Generalized seizures were predominant (94.4%), while only 5.6% had partial seizure.

Quality of Life Scores (QOLCE-16)

The overall mean QoL score was indicating a moderate level of functioning among the children. Among the QOLCE-16 domains, the emotional domain showed the highest mean score, suggesting relatively better emotional functioning. Cognitive, social, and physical domains were comparatively more affected as demonstrated in Table I.

TABLE I. Mean and Standard Deviation of QOLCE-16 Domain Scores (N = 71)

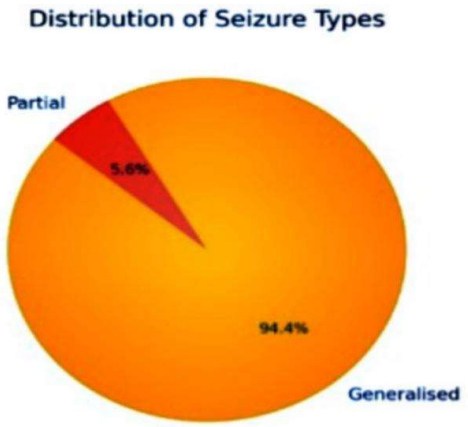
QOL Domain	Mean ± SD
Cognitive	59.02 ± 22.45
Emotional	60.85 ± 18.37
Social	58.21 ± 25.07
Physical	58.57 ± 22.41
Total QoL Score	58.57 ± 15.74

Sleep Habit Scores (CSHQ)

The total mean sleep score indicating the presence of sleep disturbances in the study population. Parasomnias and Bedtime Resistance were the most affected domains. Other domain scores included Sleep Anxiety, daytime sleepiness, sleep-disordered breathing , night waking , sleep duration, and sleep onset delay as shown in Table II and Fig. 1.

TABLE II. Mean and Standard Deviation of Sleep Habit Scores (CSHQ) (N=71)

Sleep Habit Domain	Mean ± SD
Bedtime resistance	12.48 ± 3.42
Sleep onset delay	2.06 ± 0.65
Sleep duration	5.49 ± 1.39
Sleep anxiety	8.08 ± 2.61
Night waking	5.11 ± 1.07
Parasomnias	15.92 ± 2.90
Sleep-disordered breathing	6.11 ± 1.57
Daytime sleepiness	9.86 ± 2.71
Total CSHQ Score	**65.11 ± 11.50**



Association between Demographic Variables and Quality of Life

Fig.1: DISTRIBUTION OF SEIZURE TYPES: Highlights that generalized seizures were the predominant seizure type (94.4%)among the study population.

Age was significantly associated with several QoL domains. Children aged 11–17 years demonstrated significantly higher cognitive ($p<0.001$) and physical functioning scores ($p < 0.001$) compared to younger children. In contrast, emotional functioning was significantly higher in the 4–10-year age group ($p = 0.002$). Seizure type showed a significant association with emotional ($p = 0.023$), social ($p = 0.029$), and total QoL scores ($p = 0.032$), with children having generalized seizures reporting better outcomes than those with partial seizures. No significant differences were observed in QoL domains between males and females as shown in Table III.

TABLE III. Comparison of QOLCE-16 Scores with Demographic Variables

Domain	Age group (4-10 yrs)	Age group (11-17 yrs)	p-value*	Seizure type (partial)	Seizure type (generalised)	p-value*	Gender (male)	Gender (Female)	p-value *

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Cognitive	49.18± 20.86	74.1± 15.45	<0.001**	45.31± 34.38	59.84± 21.65	0.225	60.41± 23.80	57.42± 21.04	0.607
Emotional	66.74± 18.86	51.8± 13.47	0.002*	45.31± 20.01	61.78± 18.00	0.023*	57.11± 18.47	65.16± 17.54	0.099
Social	59.47± 27.93	56.2± 20.22	0.667	34.50± 30.88	59.62± 24.23	0.029*	56.14± 26.02	60.59± 24.09	0.426
Physical	48.89± 23.29	68.3±1 4.83	<0.001**	40.56± 36.34	57.53± 21.36	0.189	60.56± 22.21	51.98± 22.08	0.348

Significant at p < 0.05; p < 0.001(MANOVA)*

Association between Demographic Variables and Sleep Habits

Age-related variations in sleep habits were statistically significant.As shown in Table IV, younger children (4–10 years) had higher scores for bedtime resistance (p < 0.001), sleep anxiety (p < 0.001), parasomnias (p < 0.001), sleep-disordered breathing (p < 0.001), and daytime sleepiness (p = 0.006). Gender differences were observed only in sleep onset delay, with females demonstrating shorter sleep onset delay (p = 0.011). No significant differences in sleep parameters were found between generalized and partial seizure types. Furthermore, Figure 2 illustrates the distribution of mean sleep habit domain scores, showing that parasomnias, bedtime resistance, and daytime sleepiness were the most affected sleep domains among children with epilepsy.

TABLE IV. Associations between Sleep Habit Variables and Demographic Factors

Sleep variable	Age(4-10 yrs)	Age(11-17 yrs)	p-value*	Male (Mean ± SD)	Female (Mean ± SD	p-value*	Generalized Seizure (Mean ± SD)	)Partial Seizure (Mean ± SD)	p-value*
Bedtime Resistance	14.37 ± 2.628	9.57 ± 2.268	0.000**	12.39 ± 3.621	12.58 ± 3.231	0.826	12.43 ± 3.340	13.25 ± 5.188	0.646
Sleep Onset Delay	2.24 ± 0.634	1.85 ± 0.619	0.011**	2.24 ± 0.634	1.85 ± 0.619	0.011**	2.04 ± 0.661	2.25 ± 0.500	0.545
Sleep Duration	5.55 ± 1.370	5.42 ± 1.437	0.701	5.55 ± 1.370	5.42 ± 1.437	0.701	5.48 ± 1.407	5.75 ± 1.258	0.707
Sleep Anxiety	9.40 ± 2.238	6.07 ± 1.720	0.000**	8.11 ± 2.679	8.06 ± 2.573	0.943	8.01 ± 2.591	9.25 ± 3.096	0.362
Night Wakings	5.28± 1.182	4.94 ± 1.029	0.208	5.26 ± 1.107	4.94 ± 1.029	0.208	5.07 ± 1.034	5.75 ± 1.708	0.225
Parasomnias	16.26± 3.094	15.39 ± 2.529	0.000**	16.37 ± 2.804	15.39 ± 2.957	0.159	15.81 ± 2.893	17.75 ± 2.630	0.194
Sleep-Disordered Breathing	6.88 ± 1.384	4.93 ± 1.016	0.000**	6.03 ± 1.619	6.21 ± 1.536	0.623	6.06 ± 1.556	7.00 ± 1.826	0.248
Daytime Sleepiness	10.56 ± 2.823	8.79 ± 2.166	0.006**	9.76 ± 2.498	9.97 ± 2.974	0.751	9.73 ± 2.722	12.00± 1.414	0.104

Significant at p < 0.05; p < 0.001 (MANOVA)*

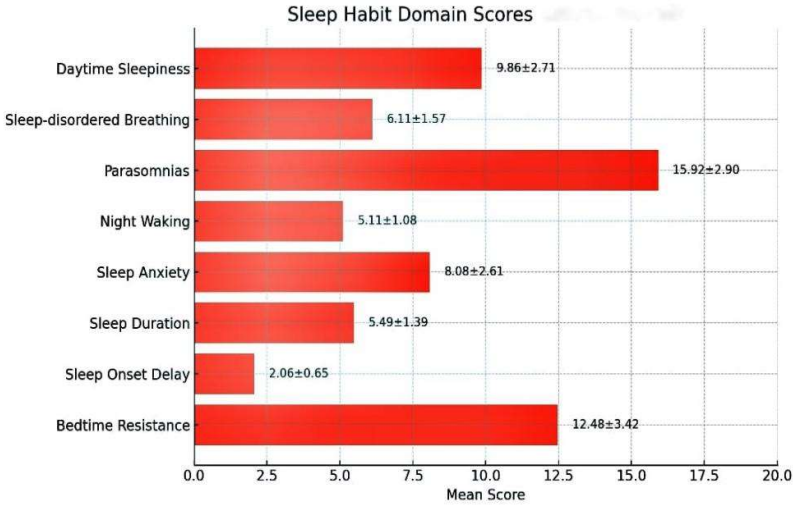

Fig. 2: Mean Scores of Sleep Habit Domains

Figure 2 highlights parasomnias, bedtime resistance, and daytime sleepiness as the most affected sleep habit domains among children with epilepsy.

Correlation between Sleep Habits and Quality of Life

A moderate, significant negative correlation was found between total CSHQ sleep scores and total QoL scores. This indicates that higher levels of sleep disturbance were associated with poorer overall quality of life as shown in Table V. The scatterplot (Fig.3) demonstrates a downward trend, highlighting the inverse relationship between sleep difficulties and QoL.

TABLE V. Correlation between Total QoL and Total Sleep Score

Variables	Correlation Coefficient (r)	p-value
Total Sleep Score vs. Total QoL Score	-0.544**	<0.001

Significant at p < 0.001 (2-tailed test)

(Pearson's correlation)

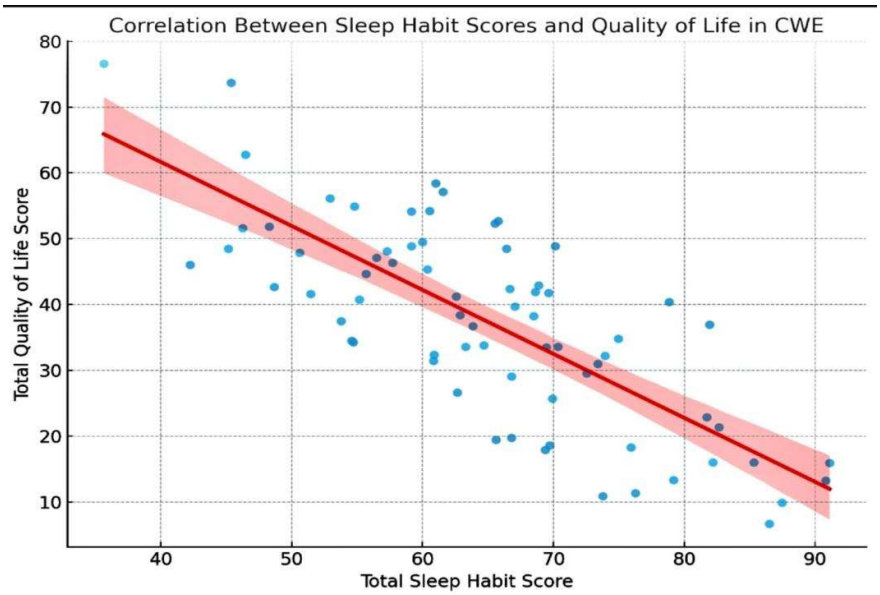

Fig.3: Scatterplot showing correlation between sleep habit scores and QOL

DISCUSSION

This study explored the relationship between sleep habits and quality of life (QoL) among children with epilepsy attending a tertiary care center in Rajasthan. The findings demonstrate that sleep disturbances are common in this population and are significantly associated with poorer QoL outcomes. The study population was predominantly composed of younger children and children with generalized seizures, reflecting patterns commonly reported in pediatric epilepsy literature.

The overall QoL score indicated moderate impairment, with cognitive and physical domains being the most affected. These findings may be explained by the combined effects of recurrent seizures, neurodevelopmental challenges, and adverse effects of antiepileptic medications, which can influence attention, memory, learning, and physical functioning. In contrast, emotional functioning showed comparatively higher scores, possibly reflecting the protective role of family support and caregiver involvement. Similar observations have been reported by Choong et al. [27], Ronen et al. [28], Malhi et al. [23], and Aggarwal et al. [29].

Sleep disturbances were highly prevalent among the participants, particularly parasomnias, bedtime resistance, and daytime sleepiness. Younger children experienced greater sleep difficulties, which may be attributable to developmental immaturity, bedtime dependence, and increased anxiety related to sleep. These findings are consistent with reports by Hansen et al. [31], Larson et al. [32], and Bashiri et al. [33]. The bidirectional relationship between sleep and epilepsy may further contribute to these disturbances, as poor sleep can lower seizure thresholds, while seizures and their treatment may adversely affect sleep architecture [34,35].

Age emerged as an important factor influencing both QoL and sleep outcomes. Older children demonstrated better cognitive and physical functioning and fewer sleep disturbances, possibly due to neurological maturation, improved coping abilities, and adaptation to chronic illness over time. Conversely, younger children exhibited greater vulnerability to sleep-related problems and functional impairment, supporting previous findings by Ekinci et al. [21], Love et al. [22], and Winsor et al. [26]. Children with partial seizures also tended to have poorer QoL and greater sleep-related difficulties than those with generalized seizures,

which may reflect the greater neurobehavioral burden often associated with focal epilepsies [24,25,36,37].

A key finding of the study was the moderate negative correlation between sleep disturbances and QoL. Children experiencing greater sleep problems reported poorer overall functioning, supporting evidence from Joseph et al. [38], Yazaki et al. [39], and Ekinci et al. [21]. Sleep deprivation can adversely affect attention, memory, emotional regulation, and behavior, thereby reducing overall well-being. Although Borusiak et al. [40] suggested that seizure control may lessen the impact of sleep disturbances on QoL, the present findings reinforce the importance of sleep as a potentially modifiable factor in pediatric epilepsy care.

A major strength of this study is the use of validated instruments (QOLCE-16 and CSHQ), allowing standardized assessment of both quality of life and sleep habits.

Furthermore, evidence examining the relationship between sleep and QoL among Indian children with epilepsy remains limited. The present study contributes valuable data from an Indian setting and highlights the clinical importance of incorporating routine sleep assessment, sleep hygiene education, and behavioral interventions into epilepsy management. Early identification and management of sleep disturbances may improve cognitive functioning, emotional well-being, academic performance, and overall quality of life.

Nevertheless, several limitations should be considered. The cross-sectional design precludes causal inference, and convenience sampling from a single tertiary care center may limit generalizability. The use of caregiver-reported questionnaires may have introduced reporting bias, particularly for subjective sleep-related symptoms. In addition, detailed clinical and psychosocial variables, including antiepileptic drug use, seizure control status, seizure duration, neuroimaging findings, sleep hygiene practices, parental characteristics, and coexisting neurodevelopmental disorders, were not systematically assessed. Seizure classification was based on information available in medical records, and detailed categorization according to the latest ILAE classification was not consistently documented. Future multicenter longitudinal studies incorporating objective sleep measures and broader clinical variables are warranted to further clarify the relationship between sleep and quality of life in children with epilepsy.

CONCLUSION

Sleep disturbances are common in children with epilepsy and are significantly associated with poorer quality of life, particularly affecting cognitive and physical domains. The negative correlation between sleep problems and QoL highlights sleep as a key modifiable factor. Younger children were more vulnerable to both sleep disturbances and reduced QoL. These findings emphasize the need to integrate routine sleep assessment and targeted interventions into pediatric epilepsy management to improve overall well-being.

AUTHOR CONTRIBUTIONS: All authors contributed substantially to the conception and design of the study, data collection, analysis and interpretation of data, and manuscript preparation. Diksha Chandwani and Ashwani Kumar conceptualized and designed the study. Data collection was carried out by Diksha Chandwani, Yoshita Gupta, Niley Kumar, and Ashwani Kumar. Data analysis and interpretation were performed by Hari Shankar, Diksha Chandwani, Jopaul Wilson, and Dharavath Hanuma Nayak. The manuscript was drafted by Diksha Chandwani and Hari Shankar. Critical revision of the manuscript for important intellectual content was undertaken by Diksha Chandwani, Dharavath Hanuma Nayak, Sagnika Bhattacharjee, Ashwani Kumar, Yoshita Gupta, and Niley Kumar. All authors reviewed, approved the final manuscript, and agreed to be accountable for all aspects of the work.

ETHICAL APPROVAL: Ethical approval for this study was obtained from the Institutional Ethics Committee of Jaipur National University Institute for Medical Sciences and Research Centre (JNUIMSRC), Jaipur, Rajasthan, India (Approval No. JNUIMSRC/IEC/2025/09). The study was conducted in accordance with institutional ethical standards.

CONSENT TO PARTICIPATE: Written informed consent was obtained from the parents or legal guardians of all participating children prior to enrolment in the study. Assent was obtained from children whenever age-appropriate.

CONSENT FOR PUBLICATION: Not applicable. The manuscript does not contain any individual patient identifiers, clinical photographs, or identifiable personal data.

DATA AVAILABILITY STATEMENT: All data generated or analyzed during this study are included in this published article.

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CONFLICT OF INTEREST: There are no conflict of interest

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