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Sleep quality and depression in mothers of children with epilepsy and its relation to their children's sleep

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ABSTRACT

Objective: This study aimed to evaluate the relationship between sleep disturbances in children with epilepsy (CWE) and maternal sleep quality and depression severity.
Methods: A Cross-sectional study was conducted in pediatric sleep disturbances using questionnaires on mother-reported sleep of CWE [Children's Sleep Habits Questionnaire (CSHQ)], maternal sleep quality [Pittsburgh Sleep Quality Index (PSQI)], and maternal depression status [Self-Rating Depression Scale (SDS)]. 114 dyads consisting of CWE and their mothers were included in this study.
Results: Over three-quarters (78.9 %) of mothers reported poor sleep quality (total PSQI score ≥ 5), and nearly a third (29.8 %) met clinical criteria for moderate or severe depression levels. The mothers' total PSQI scores were between 5.93 ± 2.44 (range: 2–16 points). The most affected PSQI subcomponents were sleep latency (AUC = 0.826p < 0.001) and daytime dysfunction (AUC = 0.800p < 0.001). The majority of children (88.6 %) were stated by their mothers to have sleep-related problems. The total CSHQ scores of the children were between 49.06 ± 9.20 (range: 33–86 points). The most affected CSHQ subcomponents were detected sleep anxiety (AUC = 0.856, p < 0.001), bedtime resistance (AUC = 0.818, p < 0.001) and daytime sleepiness (AUC = 0.807, p < 0.001). There was a statistically significant positive correlation between maternal sleep quality and depression severity (rho = 0.842; p < 0.001). A statistically significant positive moderate correlation was detected between sleep problems in CWE and maternal sleep quality and depression severity (rho = 0.406; p < 0.001, rho = 0.399; p < 0.001, respectively). As a result of multiple stepwise logistic regression analysis, the presence of seizures during sleep and generalized epileptiform discharges on electroencephalography were associated risk factors with poor maternal sleep quality (OR:6.6, p = 0.014; OR:11.5, p = 0.018, respectively). A borderline insignificant relationship was observed between a less than 50 % decrease in seizure frequency and the poor maternal sleep quality (OR:20.59p = 0.059). Seizures during sleep was associated risk factor with children's sleep disturbances (OR:7.2, p = 0.02).
Conclusions: Sleep problems in CWE may lead to negative consequences such as sleep quality and/or depression in mothers. Interventions planned to correct sleep disturbances in mothers suggest that children's sleep problems should be optimally managed.

1. Introduction

Epilepsy is a chronic neurological disease most common in the pediatric population, characterized by recurrent and unprovoked seizures [1]. The prevalence of epilepsy in children was reported to be 3.2–5.5/1000 in developed countries, 3.6–44/1000 in underdeveloped countries [2], and 8/1000 in a cross-sectional study covering the whole of Turkey [3]. Evidence shows that a diagnosis of epilepsy in childhood can often have negative effects on children, their parents, and the family, and this impact has been reported to affect a family's entire life, including sleep, interaction with healthcare, social activities, and education [4–9]. CWE and their families report increased levels of stress, anxiety, and depression [10–13], lower quality of life [14], and higher levels of stigma [15]. CWE have a high risk of developing behavioral problems. In

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this context, disease-related variables such as seizure frequency, seizure control, epilepsy type, age of onset, duration of the disease and antiepileptic drugs, as well as psychosocial variables such as stressors and family harmony, have been shown to be effective [16]. Although the treatment of seizures in childhood epilepsy is important, studies show that management should be holistic, taking into account the difficulties of living with epilepsy [17].

The relationship between sleep disturbances and seizures is a particularly vicious circle. Nocturnal seizures can disrupt sleep; Many causes can worsen seizures, including antiepileptics and sleep disturbances that cause sleep disruption. Ultimately, it leads to daytime sleepiness and worse behavior, cognitive functions and quality of life [18–20]. It has been reported that sleep disturbances are ten times more common in CWE than in controls, and excessive daytime sleepiness is a common sleep problem [21]. Sleep disturbances are a common problem for both CWE and their mothers [9,22,23,24]. It was found that mothers of children aged five and under with epilepsy slept an average of four hours a night and woke up at least three times to check on their children, and this had a negative impact on the mothers' sleep duration and continuity [9]. It has been shown that the risk of sleep disturbances in mothers with epileptic children increases sevenfold compared to healthy controls, while the risk of sleep disturbances in fathers is no different from the control group [23]. It has been reported that the rate of room sharing and co-sleeping is high in CWE and their parents, and that co-sleeping causes negative effects on family functionality and increases sleep disturbance [24]. Reasons such as fear of missing a nocturnal seizure, concern for the safety of their children, and fear of sudden unexplained death in epilepsy (SUDEP) cause mothers to sleep with their children [24]. Sleep disturbances and nocturnal seizure monitoring in pediatric epilepsies are significantly associated with maternal fatigue and poor sleep quality [25]. In addition to the care needs of CWE, poor sleep quality in mothers may also contribute to or result from depression problems [25]. Parents' night waking has been shown to be inversely related to their own sleep quality, maternal health, and family functioning [9]. The higher the level of family resilience, the better sleep quality and less depression mothers experience [26].

Previous studies have extensively investigated sleep disturbances in CWE [18–20], sleep disturbances in parents, depression, quality of life and family functions [22,26–28], and the effect of pediatric epilepsy on sleep patterns and behaviors in children and parents [9,23,24]. However, sleep problems in CWE and their effects on mothers' sleep quality and depression status have not been adequately investigated. Therefore, we conducted this study to examine risk factors for maternal sleep disturbance, depression, and sleep-related impairment, focusing on CWE. We hypothesized a priori that nocturnal seizure burden and seizure anxiety would negatively impact maternal sleep. In this study, we investigated the relationship between pediatric sleep disturbances and the mother's sleep quality and depression status. We also examined potential risk factors leading to poor maternal sleep quality.

2. Materials and methods

It is a cross-sectional study in which 114 dyads consisting of CWE and their mothers participated in a tertiary university hospital in Turkey between January and May 2023. Based on epilepsy prevalence statistics obtained from latest studies, according to the results of the theoretical power analysis, at the 5 % significance level, when the power of the test is 80 % the effect size is 0.543 and the alternative hypothesis (H_1) is two-sided the sample size that needs to be reached in order to find a statistically significant difference between the groups using the one sample proportion test should be at least 27 in total. The power calculations were made by WSSPAS: Web-Based Sample Size & Power Analysis Software [29]. The study was approved by the Inönü University Health Sciences Non-invasive Clinical Research Ethics Committee (ethics approval no.: 2023/4217). Written informed consent was obtained from all participants.

2.1. Study population

2.1.1. Study inclusion and exclusion criteria

Patients with focal and/or generalized seizures between the ages of 4 to 12 years, who were diagnosed with epilepsy according to the International League Against Epilepsy criteria and followed up for at least one year in our pediatric neurology clinic, and their mothers were included in this study [30]. Mothers who worked other jobs outside the home were excluded from the study. Patients with identified metabolic, structural and genetic symptomatic etiologies were not included in the study. Children and their mothers with physical and/or cognitive disabilities other than epilepsy, global development delay or autistic spectrum disorders, and a history of concomitant chronic diseases were excluded from the study.

2.2. Evaluation tools

2.2.1. Data Collection form

The Data Collection Form, which included questions regarding the general information of the participants, was prepared by the researchers for the purpose of this study. The form included family information such as the mother's age, place of residence, education level, and economic income, as well as the age, gender, duration of epilepsy, medication used, and seizure status of her/his children. All medical data about the patient, including clinical information about the disease, seizure type, epilepsy classification, electroencephalography (EEG) results, drug resistance, treatment, and clinical follow-up, were noted by the pediatric neurologist.

2.2.2. Questionnaires

Pediatric sleep disturbances were conducted using questionnaires regarding the sleep of their children with epilepsy (Children's Sleep Habits Questionnaire), maternal sleep quality (Pittsburgh Sleep Quality Index) and depression status (Self-Rating Depression Scale), as reported by the mothers.

2.2.2.1. Children's sleep habits questionnaire (CSHQ). Although the CSHQ is not used to make a definitive sleep disturbance diagnosis, both the total cutoff score and the individual subscale score are a psychometric assessment that can be used to identify children and adolescents aged 4 to 12 years with sleep disturbance and to highlight areas of sleep that require further clinical evaluation [31]. A 45-question test is completed by the parent, who is asked to rate the frequency with which his or her child has displayed the qualities of the described sleep behaviors in the previous week. Eight subscales are listed for the CSHQ, covering bedtime resistance, sleep onset latency, sleep duration, sleep anxiety, night wakings, parasomnias, sleep-disordered breathing; and daytime sleepiness. In the field of parasomnia, behaviors such as wetting the bed at night, talking during sleep, restless and excessive movement, sleep walking, grinding teeth during sleep, waking up by screaming or sweating, and panicking by having scary dreams are included. A total CSHQ score of $\geq$ 41 indicates that individuals experience serious sleep problems [31,32]. In this study, the sleep habits and sleep-related problems of CWE were investigated using the eight subgroups and total scores of the CSHQ.

2.2.2.2. Pittsburgh sleep quality Index (PSQI). PSQI is a 19-item self-report scale that assesses sleep quality and disturbance over the past month. PSQI; It consists of seven subscales and a total score covering subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, sleeping pill use, and daytime dysfunction. A total PSQI score $\geq$ 5 indicates poor sleep quality [33]. In this study, maternal sleep quality was evaluated using the total PSQI seven subgroups and total scores.

2.2.2.3. Self-rating depression scale (SDS). SDS; It is a 20-item scale that evaluates the presence and degree of depression in adults in the last week. Each of the 20 items is given an importance rating from 1 (never or a little) to 4 (most or all of the time), but 10 items must be reverse scored. As the score increases, the severity of depression increases. Results; Below 50 within normal range, 50–59 minimal to mild depression, 60–69 moderate to marked depression, 70 and higher severe to extreme depression. [34,35]. In this study, depression status was evaluated in mothers of CWE using SDS.

2.3. Statistical analysis

The variables used in the study were summarized with mean, standard deviation, median, largest and smallest values, frequency and percentage according to measurement levels. The assumption of normal distribution for numerical variables was examined using the Shapiro-Wilk test. For qualitative variables, Yates' chi-square with continuity correction and Fisher's exact tests were used where appropriate. The correlation analysis among the relevant variables were indicated by Spearman's rho correlation coefficient. Additionally, scatter plots were presented to demonstrate the strength of correlation between variables. The multiple logistic regression analysis was conducted for modelling the relation between dependent and independent variables. The classification performances of binary dependent variables in terms of numerical variables were examined with the value of the area under the ROC curve (AUC). $p \leq 0.05$ was accepted as statistical significance level. IBM SPSS Statistics 27 program was used in the analysis.

3. Results

3.1. Demographic and clinical information of CWE and their mothers

3.1.1. Sociodemographic information of mothers

The average age of 114 mothers with CWE was 39.32 ± 6.41 years (range: 24–58 years). 64 % of the mothers were primary school graduates. Neither mother worked outside the home. 76.3 % of the families lived in urban areas and 23.7 % lived in rural areas. 52.6 % of the families earned between 8 and 10 thousand 〃 (the minimum wage) and 41.2 % wanted financial assistance (Table 1).

3.1.2. Mothers' questionnaire information about the disease

The satisfaction rate with the doctor's explanation about the disease and treatment was 84.4 %, but 53.6 % thought that their access to education about the disease was not sufficient. The proportion of mothers who saw epilepsy as a terrible disease was 63.2 %, but 10.5 % were comfortable with issues such as the child's future, controlling the disease and living a normal life (Table 1).

3.1.3. Sleep patterns in CWE and their mothers

The proportion of mothers who were worried about nocturnal seizures was 67.5 % (77/114) and 43 % (49/114) shared the same bed with their children during night sleep. Of the mothers who reported co-sleeping, 63.3 % (31/49) reported that their children did not co-sleep before their seizures began. The proportion of mothers who reported that sleep quality and/or duration decreased with co-sleeping was 61.2 % (30/49). Does your child's sleep seizures affect your sleep? The proportion of mothers who answered the question "always, often" and "usually" was 57.0 % (65/114), and those who answered "rarely" or "never" was 43 % (49/114) (Table 2).

3.1.4. Demographic and disease information of CWE

The average age of 114 diagnosed CWE was 9.36 ± 2.66 years (range: 4–12 years) and 50.9 % (58) were female. The age at diagnosis of epilepsy was 5.66 ± 3.47 years, and the average disease duration was 3.73 ± 2.73 years. There was consanguinity in the family in 30.7 % (35) and a history of epilepsy in 33.3 % (38). As antiepileptic treatment

Table 1
The descriptive statistics of sociodemographic and disease-related variables of CWE and their mothers (n:114).

Variables	Categories	n (%)
Gender		
	Girl	58 (50.9)
	Boy	56 (49.1)
Relationship		
	Yes	35 (30.7)
	No	79 (69.3)
Family history of epilepsy		
	Yes	38 (33.3)
	No	76 (66.7)
Family features		
Family living space	Urban	87 (76.3)
	Rural	27 (23.7)
Mother education status		
	Primary education	74 (64.9)
	High school	32 (28.1)
	University	8 (7.0)
Father's profession		
	Not working	11 (9.6)
	Self-employment	40 (35.1)
	Officer	11 (9.6)
	Employee	43 (37.7)
	Other	9 (7.9)
Economic situation(TL)		
	3000–7000	32 (28.0)
	8000–15000	60 (52.6)
	> 15000	22(19.3)
Medical expense		
	Family budget	42 (36.8)
	Need help	53 (46.5)
	Getting help	19 (16.7)
Help needed		
	Economic	47 (41.2)
	Transport	3 (2.6)
	Information for epilepsy	27(23.7)
	All	37 (32.5)
Epilepsy features		
Seizure frequency		
	Every day	12 (10.5)
	Per week	12 (10.5)
	Peer month	22 (19.3)
	Peer year	26 (22.8)
	Not seizure	42 (36.8)
Seizure duration		
	< 1 min	49 (43.0)
	1–3 min	44 (38.6)
	3–5 min	20 (17.6)
	> 5 min	1 (0.9)
Seizure type		
	Generalized	87 (76.3)
	Focal	27 (23.7)
Seizure during sleep		
	No	52 (45.6)
	Yes	62 (54.4)
Number of antiepileptic drugs		
	1 drug	87 (76.3)
	2 drug	22 (19.3)
	3 drug	5 (4.4)
Antiepileptic drugs		
	Valproate	40 (35.1)
	Levetiracetam	36 (31.6)
	Topiramate	12(10.5)
	Clobazame	11 (9.6)
	Carbamazepine	10 (8.8)
	Phenobarbital	3 (2.6)
	Lamictal	2 (1.8)
Ketogenic diet		11(9.6)
Clinical follow-up/ seizure frequency		
	Not seizure	74 (64.9)
	90 % reduction	5 (4.4)
	50–90 % reduction	28 (24.6)
	Less than 50 % reduction	6 (5.3)
	Increase seizure	1(0.9)
EEG result		

(*continued on next page*)

Table 1 (*continued*)

Variables	Categories	n (%)
	Normal	52 (45.6)
	Generalized ED	30 (26.3)
	Focal ED	32 (28.1)

CWE = Children with epilepsy, EEG = Electroencephalography, EA = epileptiform discharges.

Table 2
The descriptive statistics of sleep disturbance, depression and sleep patterns of CWE and their mothers (n:114).

Variables	Categories	n (%)
CSHQ / Sleep disturbance		
	No	13 (11.4)
	Yes	101 (88.6)
PSQI /Sleep quality		
	Strong	24 (21.1)
	Poor	90 (78.9)
SDS / Depression		
	Normal / Minimal depression	32 (28.1)
	Mild depression	48 (42.1)
	Modarate depression	29 (25.4)
	Severe depression	5 (4.4)
Sleep patterns		
Co-sleeping		
	< 1 per week	11 (9.6)
	1–2 per week	8 (7.0)
	3–6 per week	12 (10.5)
	All night	18 (15.8)
Reasons for co-sleeping		
	Child's sleep difficulties	22 (44.9)
	Nocturnal seizures	14 (28.6)
	Diseases	13 (26.5)
Co-sleeping reduces your sleep quality or sleep time		
	Yes	30 (61.2)
	No	19 (38.8)
Worried about the nocturnal seizures		
	Yes	77 (67.5)
	No	37 (32.5)
Does your child's nocturnal seizures your sleep?		
	Always	25 (21.9)
	Often	10 (8.8)
	Mostly	30 (26.3)
	Rarely	34 (29.8)
	Never	15 (13.2)

CSHQ = Children's Sleep Habits Questionnaire, PSQI = Pittsburgh Sleep Quality Index, SDS = Self-Rating Depression Scale.

(AED), received 35.1 % valproate, 31.6 % levetiracetam, 10.5 % topiramate, 9.6 % clobazam, 8.8 % carbamazepine, 2.6 % phenobarbital and 1.8 % lamictal. The rate of patients using three antiepileptics was 4.4 %. The rate of patients applying a ketogenic diet in addition to drug treatment was 9.6 % (Table 1).

Presence of seizures during sleep was reported in 54.4 % of the patients. Despite full compliance with treatment, 10.5 % of patients reported having seizures every day. Seizure duration was reported to be less than one minute in 43 %, 1–3 min in 38.6 %, 3–5 min in 16.7 %, and over 5 min in 0.9 % of the patients. At the last outpatient visit, mothers reported that 64.9 % of their children were seizure-free and 5.3 % had less than a 50 % decrease in seizure frequency. Of the EEGs taken simultaneously with the sleep disturbances questionnaires, 45.6 % were normal, 26.3 % were generalized, and 28.1 % were focal epileptiform discharges. (Table 1).

3.2. The relationship between sleep quality and depression in mothers and children's sleep

3.2.1. Sleep in CWE and sleep quality in mothers

Over three-quarters (78.9 %) of mothers reported poor sleep quality (total PSQI score $\geq$ 5), and nearly a third (29.8 %) met clinical criteria for moderate or severe depression levels. The mothers' total PSQI scores (Mean $\pm$ SD) were between 5.93 $\pm$ 2.44 (range: 2–16 points) (Table 3). Among PSQI subcomponents, sleep latency (AUC = 0.826p < 0.001) and daytime dysfunction (AUC = 0.800p < 0.001), sleep disturbance (AUC = 0.676, p < 0.001) and subjective sleep quality (AUC = 0.669, p < 0.001) were statistically significant. Receiver operating characteristic (ROC) Curve Analysis results of CSHQ and PSQI subcomponents are shown in the Fig. 1. ROC Curve Analysis results of PSQI and CSHQ subcomponents, respectively (Tables 8 and 9).

The majority of children (88.6 %) were stated by their mothers to have sleep problems. (total CSHQ score $\geq$ 41). The children's total CSHQ scores (Mean $\pm$ SD) were between 49.06 $\pm$ 9.20 (range: 33–86 points) (Table 3). All CSHQ subcomponents, including sleep anxiety (AUC = 0.856, p < 0.001), bedtime resistance (AUC = 0.818, p < 0.001), daytime sleepiness (AUC = 0.807, p < 0.001), night wakings (AUC = 0.797, p < 0.001), parasomnias (AUC = 0.768, p < 0.001), sleep-disordered breathing (AUC = 0.687, p < 0.001), sleep duration (AUC = 0.685, p < 0.001) and sleep onset delay (AUC = 0.681, p < 0.001), were found to be statistically significant. The most affected CSHQ subcomponents were detected sleep anxiety, bedtime resistance, and daytime sleepiness (Fig. 1).

3.2.2. Correlations between children's CSHQ and mothers' PSQI and SDS

There was a statistically significant positive correlation between maternal sleep quality and depression (rho = 0.842; p < 0.001). A statistically significant, positive moderate relationship was detected between sleep problems in CWE and maternal sleep quality and depression severity (rho = 0.406; p < 0.001, rho = 0.399; p < 0.001, respectively) (Table 4). Scatter graphs of variables related to correlation statistics are given in Fig. 2.

Table 3
The descriptive statistics of demographic information, PSQI and CSHQ for CWE and their mothers (n:114).

Variables	Mean $\pm$ Standard Deviation	Median	Minimum - Maximum
Maternal age (years)	39.32 $\pm$ 6.41	40.00	24.00–58
Child age (years)	9.36 $\pm$ 2.66	10.00	4.00–12
Epilepsy diagnosis age	5.66 $\pm$ 3.47	6.00	1.00–11
Epilepsy duration (years)	3.73 $\pm$ 2.73	3.00	1.00–8
CSHQ			
Bedtime resistance	9.57 $\pm$ 2.84	9.00	6.00–18.00
Sleep onset delay	1.54 $\pm$ 0.74	1.00	1.00–3.00
Sleep duration	4.19 $\pm$ 1.45	4.00	3.00–9.00
Sleep anxiety	6.90 $\pm$ 2.47	7.00	4.00–12.00
Night wakings,	4.58 $\pm$ 1.36	4.00	3.00–8.00
Parasomnias	9.41 $\pm$ 2.57	9.00	3.00–21.00
Sleep disordered breathing	3.88 $\pm$ 1.32	3.00	3.00–9.00
Daytime sleepiness	12.46 $\pm$ 3.11	12.00	8.00–24.00
Global CSHQ score	49.06 $\pm$ 9.20	48.00	33.00–86.00
PSQI			
Subjective sleep quality	1.11 $\pm$ 0.54	1.00	0.00—3.00
Sleep latency	1.56 $\pm$ 1.10	1.00	0.00–6.00
Sleep duration	0.59 $\pm$ 0.64	1.00	0.00–2.00
Sleep efficiency	0.18 $\pm$ 0.43	0.00	0.00–2.00
Sleep disturbance	1.38 $\pm$ 0.67	1.00	0.00–4.00
Use of sleep medication	0.10 $\pm$ 0.46	0.00	0.00–3.00
Daytime dysfunction	1.02 $\pm$ 0.74	1.00	0.00–3.00
Global PSQI score	5.93 $\pm$ 2.44	5.00	2.00–16.00

Descriptive statistics for quantitative variables CWE = Children with epilepsy, CSHQ = Children's Sleep Habits Questionnaire, PSQI = Pittsburgh Sleep Quality Index.

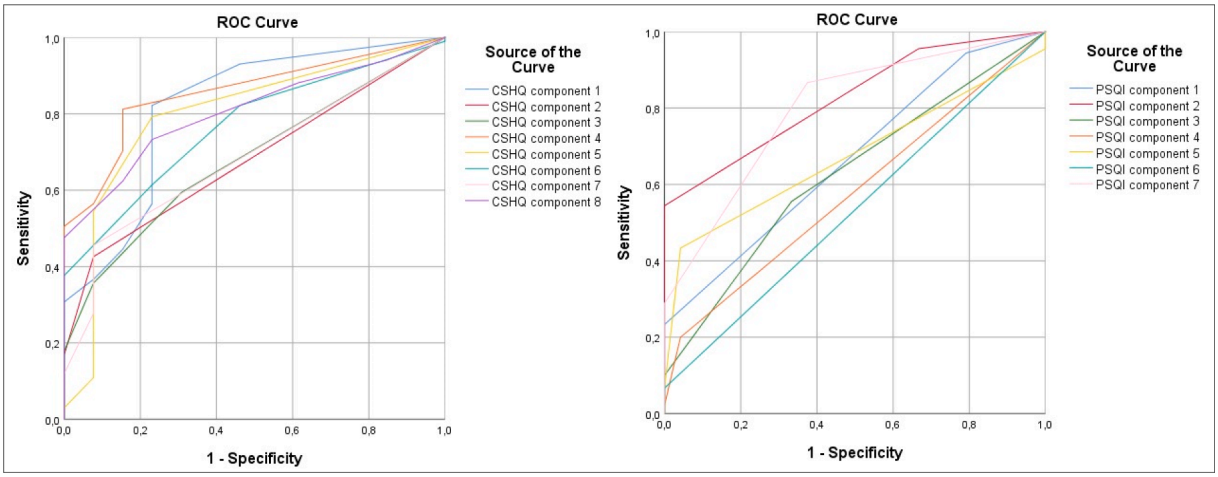

Fig. 1. Receiver Operating Characteristic (ROC) curves of CSHQ and PSQI subcomponents, respectively.

Table 8
ROC Curve Analysis results of PSQI subcomponents.

Variables	AUC (95 % CI)	*p*
PSOI Component 1	0.669 (0.574 – 0.754)	**< 0.001**
PSQI Component 2	0.826 (0.744 – 0.891)	**< 0.001**
PSQI Component 3	0.628 (0.532 – 0.716)	**0.015**
PSQI Component 4	0.580 (0.484 – 0.671)	**0.007**
PSQI Component 5	0.676 (0.582 – 0.761)	**< 0.001**
PSQI Component 6	0.533 (0.438 – 0.627)	**0.0117**
PSQI Component 7	0.800 (0.715 – 0.869)	**< 0.001**

AUC: Area under curve, CI: Confidence interval.

Table 9
ROC Curve Analysis results of CSHQ subcomponents.

Variables	AUC (95 % CI)	*p*
CSHQ Component 1	0.818 (0.735 – 0.884)	**< 0.001**
CSHQ Component 2	0.681 (0.587 – 0.765)	**< 0.001**
CSHQ Component 3	0.685 (0.591 – 0.769)	**< 0.001**
CSHQ Component 4	0.856 (0.778 – 0.915)	**< 0.001**
CSHQ Component 5	0.797 (0712–0,0.867)	**< 0.001**
CSHQ Component 6	0.768 (0.679 – 0.842)	**< 0.001**
CSHQ Component 7	0.687 (0.593 – 0.771)	**< 0.001**
CSHQ Component 8	0.807 (0.722 – 0.875)	**< 0.001**

AUC: Area under curve, CI: Confidence interval.

Table 4
The correlation analysis statistics between sleep disturbance of CWE and their mothers' sleep quality and depression (CSHQ, PSQI and SDS correlations).

Variables	N	Correlation Coefficient*	*p*
CSHQ - PSQI	114	0.406	**< 0.001**
CSHQ - SDS	114	0.399	**< 0.001**
PSQI- SDS	114	0.842	**< 0.001**

*: Spearman's rho.

3.2.3. Risk factors between epilepsy variables and sleep disturbances in CWE and their mothers

As a result of multiple stepwise logistic regression analysis, the presence of seizures during sleep and generalized epileptiform discharges on EEG were associated risk factors with poor maternal sleep quality (OR:6.6, p = 0.014; OR:11.5, p = 0.018, respectively). (Table 5). During clinical follow-up, a borderline insignificant relationship was observed between less than 50 % reduction in seizure frequency and poor sleep quality of the mother (OR: 20.59p = 0.059) (Table 5). Since the drug resistance variable was not included in the final model in the Stepwise LR model, a single analysis was performed with the chi-square test. There is a borderline insignificant relationship between the presence of resistant epilepsy and the decrease maternal sleep quality (Pearson's Continuity Correction, p = 0.085) (Table 6). Seizures during sleep were found to be a risk factor associated with sleep disturbances in CWE (OR: 7.2p = 0.02) (Table 7).

4. Discussion

This study showed that sleep problems in CWE may lead to negative consequences such as sleep quality and/or depression in mothers. It also found that poor maternal sleep quality was associated with increased depression severity.

Our study findings showed that over three-quarters (78.9 %) of mothers reported poor sleep quality (total PSQI score ≥ 5), and nearly a third (29.8 %) met clinical criteria for moderate or severe depression levels. It was determined that the PSQI subcomponents most affected in mothers were sleep latency and daytime dysfunction. A study investigating the sleep of CWE who wore an actigraphy monitor for seven days showed that higher sleep disturbance outcomes in children had negative effects on maternal sleep quality and depression status, even if maternal demographic characteristics were different [22]. It has been shown that one in four mothers of CWE sleeps less than six hours, and one-third of mothers have sleep efficiency below 85 %, meaning that mothers spend less than 85 % of their time in bed actually sleeping [22]. It has also been reported that mothers' self-reports of sleep duration overestimate the amount of time they sleep when compared to objective sleep measures [22]. Previous studies have shown increased sleep disturbance in parents of CWE compared to healthy controls [9,23,24]. It revealed the presence of severe sleep disturbances in mothers of CWE, including short sleep duration and poor sleep quality, regardless of the severity of epilepsy and the time since the last epileptic seizure [23]. Contrary to this study, it showed that parents of CWE had increased sleep disturbance and were more tired, but the degree of sleep disturbance of the parents was related to the child's seizure severity [24]. Daytime dysfunction and habitual sleep efficiency were PSQI subgroups more affected in mothers of CWE than in controls [24]. Parents' sleep quality has been shown to be related not only to the child's seizure frequency but also to quality of life factors such as the parent's level of depression, physical health, pain experience, emotional well-being, and partner relationship satisfaction [9].

Our study found that sleep disturbances in CWE were associated with poor maternal sleep quality and increased depression severity. Studies have suggested that parents of CWE are more likely to experience anxiety and depression [36,37]. Parental anxiety and depression have been associated with significant detrimental effects on parent sleep quality

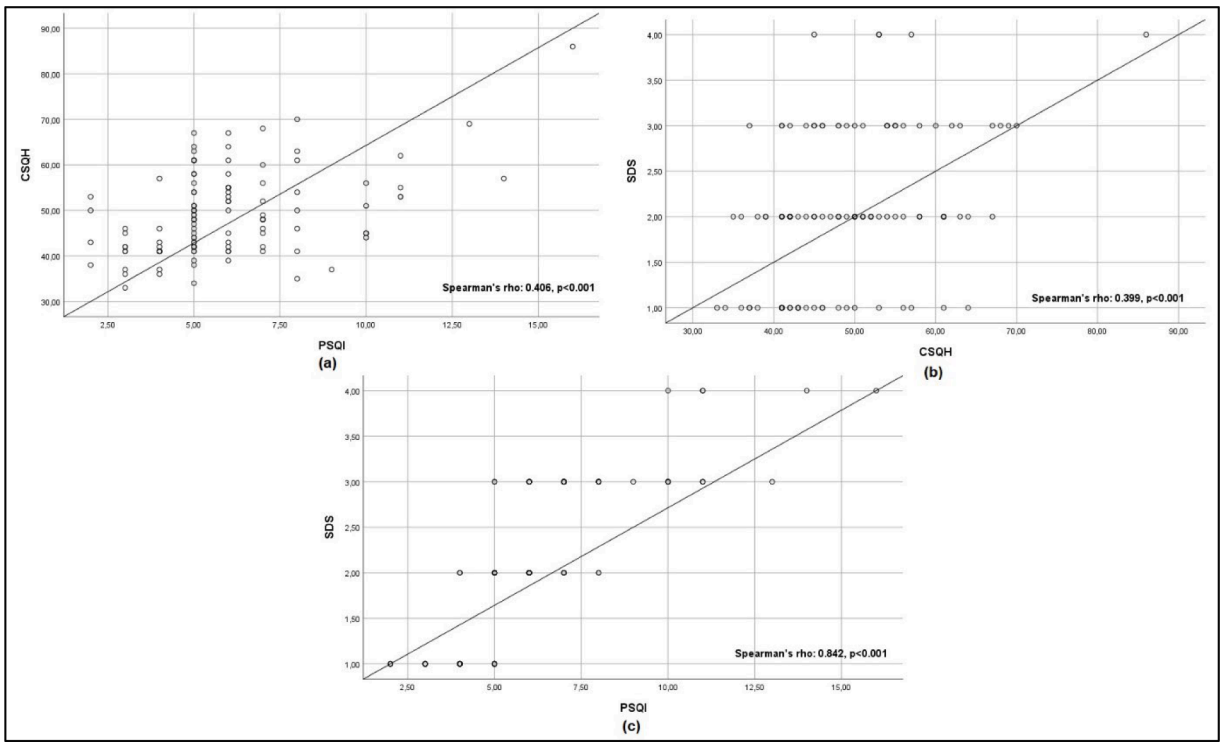

Fig. 2. The scatter plots of relavant variables with correlation statistics (a: CSHQ-PSQI, b: SDS-CSHQ, c: SDS-PSQI).

Table 5
The multiple stepwise logistic regression analysis results between epilepsy variables and maternal sleep disturbance.

Variables	Coefficients	Standard error	Wald statistics	df	*p*	OR	95 % CI for OR	
							Lower	Upper
Constant	4.112	8038.597	0	1	1	61.044		
Seizure Frequency			0.708	4	0.95			
Every day	−19.819	9177.268	0	1	0.998	0	0	.
Per week	−56.073	13503.282	0	1	0.997	0	0	.
Per month	−75.737	17435.454	0	1	0.997	0	0	.
Per year	−75.066	17435.454	0	1	0.997	0	0	.
Seizure during sleep	1.888	0.765	6.09	1	**0.014**	6.609	1.475	29.618
Generalized epilepsy	−20.33	7004.153	0	1	0.998	0	0	.
EEG			6.739	2	**0.034**			
Normal	2.099	115	3.329	1	0.068	8.157	0.856	77.763
Generalized	2.449	1.037	5.574	1	**0.018**	11.573	1.516	88.357
Clinical follow-up/seizure frequency			3.57	4	0.467			
90 % reduction	−16.805	11029.793	0	1	0.999	0	0	.
50–90 % reduction	−55.613	14824.733	0	1	0.997	0	0	.
Less than 50 % reduction	3.025	1.601	3.57	1	0.059	20.592	0.893	474.753
Not seizure	−54.431	43811.77	0	1	0.999	0	0	.

df: Degree of freedom, OR: Odds ratio, CI: Confidence interval.

Table 6
The relationship between Pittsburgh Sleep Quality Index (PSQI) and drug resistance.

		PSQI result			*p**
		Good	Bad	Total	
Drug resistance	**Yes**	2 (7.40 %)	25 (92.60 %)	**27 (100.00 %)**	0.085
	No	22 (25.30 %)	65 (74.70 %)	**87 (100.00 %)**	
	Total	**24 (21.10 %)**	**90 (78.90 %)**	**114 (100.00 %)**	

*: Pearson's Continuity Correction.

and fatigue; On the contrary, friendship and good cognitive status have been shown to be strong protectors for sleep quality and fatigue [25]. Current evidence suggests that there may also be a theoretical bidirectional relationship between maternal depression and sleep quality [13,25,37].

Sleep disturbances are a common problem for both CWE and their mothers [9,22,23,24]. In our study, the majority of children (88.6 %) were stated by their mothers to have sleep-related problems. Although all subcomponents of the CSHQ were statistically affected in CWE, the most affected CSHQ subcomponents were sleep anxiety, bedtime resistance, and daytime sleepiness. A previous study reported that six of eight CSHQ subcomponents were affected in CWE, while parasomnias and night wakings being subcomponents more affected in CWE than in controls [24]. Studies suggest that CWE are susceptible to sleep disturbances, which can exacerbate seizures [38–40]. Sleep disturbances are

Table 7
The multiple stepwise logistic regression analysis results between epilepsy variables and sleep disturbance in CWE.

Variables	Coefficients	Standard error	Wald statistics	df	*p*	OR	95 % CI for OR	
							Lower	Upper
Constant	9.615	2757.883	0	1	0.997	14982.728		
Seizure frequency			2.352	4	0.671			
Every day	19.374	11008.038	0	1	0.999	2.60E + 08	0	.
Per week	19.214	8304.88	0	1	0.998	2.21E + 08	0	.
Per month	−0.905	1.218	0.551	1	0.458	0.405	0.037	4.409
Per year	0.314	1.24	0.064	1	0.8	1.369	0.12	15.542
Seizure during sleep	1.982	0.854	5.378	1	**0.02**	7.255	1359	38.72

df: Degree of freedom, OR: Odds ratio, CI: Confidence interval.

more common in CWE [21,41]. It has been suggested that affected children's difficulty falling asleep, frequent awakenings during the night, and very restless sleep contribute to both the parent's sleep disturbance and the sleep-related impairment in the child [25]. It makes sense that pediatric sleep disturbances affect maternal sleep quality because mothers often engage in co-sleeping and bed-sharing, closely monitoring their children during their sleep to catch signs of difficulty falling asleep, frequent awakenings during the night, or nocturnal seizures [24,25].

In our study, it was shown that seizures during sleep were associated with increased sleep problems in mother and child. The presence of seizures during sleep and generalized epileptiform discharges on EEG were associated risk factors with poor maternal sleep quality. A borderline insignificant relationship was found between the poor maternal sleep quality and seizure severity (less than 50 % reduction in seizure frequency and drug resistance), we think that these variables can also be taken into account. A positive relationship was reported between the severity of epilepsy, the degree of the child's sleep disturbance, parental sleep disturbance, and parental fatigue. It was also stated that multiple antiepileptic drug therapy was a harbinger of more sleep disturbances in the child [24]. The majority of parents reported strong concerns about the risk of children having nocturnal seizures, and many attributed their own poor sleep quality to this concern [24]. While nocturnal seizures are associated with parents' sleep problems, room sharing and co-sleeping behavior have been shown to be associated with children's sleep problems [24]. Previous study found that nocturnal seizures were associated with an increase in parental sleep disturbance, they did not pose a similar risk of sleep disturbance in the child. However, evidence has shown that nocturnal seizures disrupt sleep, causing sleep disturbances, and sleep disturbances worsen seizures [18–20].

4.1. Limitations

Some mothers may have reported effects during periods when seizures were very frequent, and others may have reported effects during periods when seizures were less frequent. Therefore, it may be useful to make objective sleep measurements of children and their mothers in future studies.

5. Conclusion

Our study shows that although the treatment of seizures in pediatric epilepsy is important, the sleep disturbances and depression status of the child and the mother should be evaluated and managed as a whole. Future studies should examine whether a family-based intervention program would be effective in improving sleep in the mother–child dyad and supporting the entire family for better health functioning.

6. Contributors and acknowledgements

All authors contributed to the following items: (1) the conception and design of the study, or acquisition of data, or analysis and interpretation of data, (2) drafting the article or revising it critically for important intellectual content, (3) final approval of the version to be submitted. The authors thank the families who participated in this study.

7. Ethical considerations

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee. The approval of the Ethical Committee of Inönü University was obtained (No: 2023/4217).

Written informed consent was obtained from all participants.

Declaration of 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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