



Assessment and Predictive Factors of Sleep Disturbances among Mothers of Children with Cerebral Palsy

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ABSTRACT

Mothers caring for children with cerebral Palsy (CP) are challenged in their daily activity but also in their sleep. The quality of sleep (QOS) is often associated with quality of life and impaired mental health. We aim to study the QOS in mothers of children with CP and to determine the factors associated with impaired sleep quality in them. This is a cross-sectional study conducted between September 1, 2019 and May 30, 2020 among mothers of children with CP and followed at outpatient and inpatient clinics of physical medicine and rehabilitation. QOS was assessed using a validated self-administered questionnaire. Depressive and anxiety disorder and quality of life were also assessed using specific scales. The study included 54 mothers with a mean age of 38.6 years. CP children had a mean age of 6.9 years. Sleep quality was impaired in 81.5% of mothers. A percentage of 70.4% had anxiety disorder and 63% had depressive. Mental and physical maternal quality of life was altered respectively in 81.5% and 66.7% of the mothers. Among the factors influencing the QOS, we retained the maternal age greater than 35 years, the presence of anxious symptomatology, a deteriorated maternal mental quality of life and the extensive topographic impairment of children with CP. Mothers of children with CP have a disturbed QOS, a troubled mental health and an altered quality of life. Physicians dealing with them must detect these problems early by using adapted questionnaires in order to intervene in a more efficient way.

Keywords: Cerebral palsy; Caregiver; Mental health; Sleep disorders; Child; Quality of life

INTRODUCTION

Cerebral Palsy (CP) was defined in the International Congress of Bethesda as permanent disorders in the development of movement and posture caused by non-progressive damage to the developing brain tissue of the fetus, new born or more rarely infant [1]. The motor disorders of cerebral palsy are often accompanied by sensory, perceptual, cognitive, communication and behavioural disorders, by epilepsy and/or by secondary musculoskeletal problems [1]. CP affects 17 million people worldwide with an incidence of 2.11 per 1000 live births in developed countries [2]. However, these numbers are difficult to establish the incidence of cerebral palsy in the majority of developing countries like Tunisia because CP is not captured in the population census or any other survey in these countries [3]. CP can be an obstacle for daily life activities such as eating, dressing and sleeping. Consequently, taking care of a child with CP constitutes a weary situation for the parents [4-

9]. It could result in physical, psychological, economic and social difficulties and subsequently induces an alteration of aspects of daily life such as intimacy, leisure time, professional activity and sleep [10]. Children with severe disabilities, who often require additional care during the day time, also require the same care at night. Therefore, sleep disorders in parents of children with CP and especially mothers are often described in the literature [11]. According to a study done in the United States of America in 2013, 44% of mothers with a child with CP suffer from sleep disturbances [12]. Identified factors influencing maternal QOS include the extent of motor deficit, presence of epilepsy, severe visual impairment, and environmental factors such as parental unemployment and shared sleep [13].

Sleep problems are associated with impaired mental and physical health of the mother [13,14]. Indeed, maternal mental health, social and emotional functioning of mothers of children with CP

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were significantly lower than mothers of a healthy child [13]. On the other hand, several authors have underlined the importance of the family environment and the psychological balance of the parents in the medical management of children with CP [10-12]. Indeed, mothers poor sleep quality may negatively affect the effectiveness of the treatment program for children with CP [15]. In conducting this study, a lack of studies describing the impact of cerebral palsy on maternal sleep quality was noted. The majority of studies focused on maternal quality of life in general and sleep quality is often overlooked. Hence the importance of this study in gathering local data concerning the QOS of mothers of children with CP. The objectives of this study were to assess QOS in mothers of children with CP and determine its associated factors.

MATERIALS AND METHODS

Type of study

This is a cross-sectional population based study conducted between September 1, 2019 and May 30, 2020.

Study population

All the mothers of the children followed for CP at the outpatient physical medicine and rehabilitation clinics during the study period.

Inclusion criteria:

- Being a mother of a child with CP aged between 3 and 18.
- Giving free and informed consent.

Non-inclusion criteria:

- Mothers who have a medical condition that may interfere with sleep quality
- Conditions that may interfere with passing the scales such as deafness
- Children with pathologies other than cerebral palsy
- Having another family member with a disabling condition determined by the question: 'Do you or anyone else in your family have a chronic illness or disability?'
- Absence of consent.

Course of the study

Data was gathered from the mothers by a pre-trained doctor using a pre-established questionnaire comprising 3 parts during the consultations of their children with CP. For mothers who did not show up with their children on the day of consultation, data was collected by telephone interview. Medical records were used to collect medical data concerning their children followed for PC.

Collected data and data collection instruments

A three-part questionnaire was designed for the purpose of this work. The first part was devoted to the characteristics of the mothers. The second one was devoted the characteristics of the children. The level of motor impairment was assessed using the Gross Motor Function Classification System (GMFCS) [16-18]. The third part was devoted to the standardized evaluation of sleep quality, screening for anxiety and depression, and mental and physical quality of life. Maternal sleep quality was assessed

using the validated Arabic version of Pittsburgh Sleep Quality Index (PSQI) which assesses sleep quality, sleep latency, sleep duration, usual sleep efficiency, sleep disorders, use of sleeping drug and daytime dysfunction. All of these seven components generate an overall score ranging from 0 to 21. A score above 5 reflects disturbed sleep. This threshold of PSQI>5 showed a sensitivity of 89.6% and a specificity of 86.5% to detect a sleep disorder [18]. We used the version translated and validated in Arabic by Suleiman in 2009 after obtaining their consent [19]. Quality of life of mothers was assessed using the SF-12 scale which includes 12 items [20]. We used the validated Tunisian version of the SF-12 [21-28]. The rating of the scores was carried out according to the specific algorithms described in the literature [23,29]. These algorithms give mental and physical health scores that are equal to 50 in the general population. If the respective scores are above the average for the general population, i.e. above 50, the person is considered to be in good mental and physical health. In our work, we used an online tool (<https://orthotoolkit.com/sf-12>) Screening for Anxiety and Depression was conducted through Hospital Anxiety and Depression scale (HAD). This scale contains 14 items: Seven questions relate to anxiety (total A) and seven others to the depressive dimension (total D), thus making it possible to obtain two scores (maximum score for each score=21). The interpretation of the score according to Zigmond et al. [24] is as follows: From 0 to 7: absence of symptoms; From 8 to 10: doubtful symptomatology; From 11 to 21: definite symptomatology. The validated Arabic version was used in our study [25].

Data analysis

The data collected was entered and analysed using the "Statistical Package for Social Sciences" software SPSS version 21. Qualitative variables were described by counts and percentages. Quantitative variables were described by means and standard deviations. The Chi 2 test was used to compare the percentages. When its application conditions were not fulfilled for the comparison of 2%, Fisher's exact test was used. When its conditions of application were not met for the comparison of several percentages, a grouping of the categories of variables was carried out. The strength of association between the different variables tested was estimated using the calculation of the Odds Ratio (OR) and its 95% Confidence Interval (95% CI). Multivariate analysis was performed using binary logistic regression following the top-down stepwise strategy. The dependent variable was, "impaired quality of sleep". All the relevant variables that were associated with this dependent variable during the univariate analysis with a degree of significance <0.25 were included in the initial analysis model. All the statistical tests carried out were two-sided with a risk of error set at 5%.

Ethical considerations

This study did not involve any risk for the participants. This study was conducted with respect for the rights and integrity of individuals. The mothers of children with CP were informed about the purpose of the study and the confidentiality of the data that has been collected. They were free to choose whether or not to participate in the study. Written consent from each participant was obtained.

RESULTS

Among 90 mothers of children with CP, 23 did not meet the inclusion criteria. Among those eligible for the study, 13 candidates did not show up for the outpatient consultations and did not answer the telephone call. In total, our study involved 54 mothers.

Descriptive study

Mean age of the participants was 38.6 ± 7.6 years. Mean age of children with CP was 6.9 ± 3.5 years (Table 1). A PSQI score greater than 5 was objectified in 44 (81.5%) of the mothers. The average of this score was 9.7 ± 3.9 (Table 2). HAD score greater than 11 was present in 38 (70.4%) participants for anxiety and in 34 (63%) participants for depression. Concerning maternal Quality of life, mean physical and mental health scores were 42.6 ± 9.9 and 39.3 ± 12.0 respectively. An alteration in the mental quality of life was objectified in 81.5% of the mothers. While the alteration of the physical quality of life was 66.7% (Table 3).

Table 1: Demographic characteristics of mothers and children with CP (n=54)

Characteristics		Number (n=54)	Percentage (%)
Age	>35 years old	35	64.80%
School level	Illiterate	8	14.80%
	Primary	22	40.80%
	Secondary	13	24.10%
	University	11	20.40%
Habitat	Urban	28	51.90%
	Rural	26	48.10%
Marital status	Married	52	96.70%
	Widow	2	0.30%
Number of children:	≥ 3 children	30	55.60%
	<3 children	24	44.40%
Occupation	Housewife	40	74.10%
	Employed	14	25.90%
	Full time	8	57.10%
	Part time	6	42.90%
Monthly income	<800 DT/month	32	59.30%
	Between 800DT and 1200DT/month	20	37.00%
	>1200 DT/month	2	3.70%
Heath Insurance	CNAM	47	87.00%
	Social help	6	11.10%
	None	1	1.90%
Children Demographic Characteristics			
Sex	Male	32	59.3
	Female	22	40.7
Schooling	Yes	17	31.50%
	No	37	68.50%
motor impairment (GMFCS scale)	I	0	0
	II	26	48.1
	III	24	44.4
	IV	4	7.4
	V	0	0

topographical form	Monoplegia	5	9.3
	diplegia	23	42.6
	Hemiplegia	5	9.3
	triplegia	2	3.7
Neurological forms	Quadriplegia	19	35.2
	spastic	45	83.3
	dystonic	3	5.6
	Ataxic	2	3.7
Cognitive disorders	Mixed	4	7.4
	Yes	39	72.2
Language disorder	No	15	27.8
	Yes	38	70.4
Memory impairment	No	16	29.6
	Yes	5	9.3
Gnostic disorder	No	49	90.7
	Yes	1	1.9
Hearing disorder	No	53	92.1
	Yes	8	14.8
Vision disorder	No	46	85.2
	Yes	10	18.5
Behavior disorder	No	44	81.5
	Yes	9	16.7
Gastroduodenal reflux	No	45	83.3
	Yes	14	25.9
Bladder-sphincter disorders	No	40	74.1
	Yes	4	7.4
Recurrent pneumonia	No	50	92.6
	Yes	12	22.2
swallowing disorder	No	42	77.8
	Yes	22	40.7
Therapeutic management	No	32	59.3
	Botulinum toxin	54	100
	Motor rehabilitation	51	94.4
	Orthopedic Treatment	43	79.6
	Antiepileptic	19	35.2
	Speech therapy	16	29.6

Note: GMFCS: Gross Motor Function Classification System; CNAM: Caisse Nationale Assurance Maladie

Table 2: Results of the scores of the components of the Pittsburgh sleep quality index in the mothers of children with CP (n=54)

Components	Number (%)
Sleep quality	
Very good	4 (7.4)
Pretty good	19 (35.2)
pretty bad	18 (33.3)
Very bad	12 (22.2)
Sleep latency	
<15 mins	19
Between 16 and 30 minutes	26 (48.1)
Between 31 and 60 minutes	10 (18.5)
More than one hour	4(7.4)
Sleep duration	
>7 hours	14 (25.9)
	19
	18 (33.3)

Between 6 and 7 hours	7 (13)
Between 5 and 6 hours	18 (33.3)
<5 hours	11 (20.4)
Usual sleep efficiency	
>85%	14 (25.9)
75-84%	9 (16.7)
65-74%	16 (29.6)
<65%	15 (27.8)
Sleep disturbance	
Waking up in the middle of the night or early in the morning	51 (94.4)
Get up at night to go to the toilet	33 (61.1)
Breathing difficulties	21 (38.9)
Coughing or snoring at night	13 (24.1)
Feeling of coldness	16 (29.6)
Feeling of heat	13 (24.1)
Nightmares	24 (44.4)
The presence of diffuse nocturnal pain	26 (48.1)
Other causes	0
Use of sleeping pills	4 (7.4%)
Day time dysfunction	
No difficulty	5(9.3)
A small difficulty	25 (46.3)
some difficulty	15(27.8)
A great difficulty	5(16.7)

Table 3: Results of the HAD and SF-12 scale sub-scores in the mothers of children with CP (n=54)

HAD	Medium ± standard Deviation
Overall score	25.6 ± 9.5
HAD-anxiety	14 ± 5
HAD-depression	11.6 ± 5.3
Number (%)	
ADH Anxiety	
Score<7	7 (13)
Score between 8 and 10	9 (16.6)
Score ≥ 11	38(70.4)
ADHD Depression	
Score < 7	15 (27.8)
Score between 8 and 10	5 (9.2)
Score ≥ 11	34 (63)
SF-12	
Global Physical Health Score (PCS)	42.6 ± 9.9
Global Mental Health Score (MCS)	39.3 ±12.0
Impaired physical health	36 (66.7)
Impaired mental health	44 (81.5)

Note: HAD: Hospital Anxiety and Depression Scale

Analytical study

Study of the quality of sleep according to maternal data: Among sociodemographic characteristics of the mothers, only age over 35 years was significantly associated with impaired sleep in mothers of children with CP (p=0.023) As for the clinical

and demographic characteristics of the children, extensive involvement including hemiplegia, triplegia or quadriplegia was significantly more frequent in mothers with impaired sleep with an OR of 11.8 [1.4; 101.7]. An impaired QOS was significantly associated with anxiety but not with depression (p=0.049 vs p= 0,147). An altered mental quality of life was significantly higher in mothers with impaired QOS (p=0.001) (Table 4).

Table 4: Results of multivariate analysis of factors associated with impaired sleep quality in mothers of children with CP (n=54)

	Impaired sleep quality		P	GOLD [95% CI]
	Yes (n= 44)	No (n=10)		
Age n (%)				
≤ 35 Years	12(27.3)	7 (70.0)	0.023	6.2 [1.4; 28.1]
> 35 years old	32 (72.7)	2 (30.0)		
Marital status n(%)				
Maried	42 (95.5)	10 (100.0)	N/A	-
Widowed	2(4.5)			
School level n(%)				
Illiterate/ Primary	23 (52.3)	7 (70.0)	0.483	2.1 [0.5; 9.3]
Secondary / University	21 (47.7)	3 (30.0)		
Socio-economic level n(%)				
≤800 TND	25 (56.8)	7 (70.0)	0.501	0.6 [0.1; 2.5]
>800 TND	19 (43.2)	3 (30.0)		
Occupation n(%)				
Housewife	35 (79.5)	5 (50.0)	0.103	0.3 [0.1; 1.1]
Employee	9 (20.5)	5(50.0)		
Habitat n(%)				
Rural	24 (54.5)	4 (40.0)	0.494	0.6 [0.1; 2.2]
Urban	20 (45.5)	6 (60.0)		
Number of children n(%)				
3 children	33 (75)	9 (90.0)	0.426	3.0 [0.3; 26.4]
>3 children	11 (25)	1 (10.0)		
Children's age n(%)				
6 years	4 (7.4%)	4 (7.4%)	4 (7.4%)	4 (7.4%)
>6 years	24 (54.5)	7 (70.0)	0.489	1.9 [0.4; 8.5]
Sex n(%)	20 (45.5)	3 (30.0)		
Male	4 (7.4%)	4 (7.4%)	4 (7.4%)	4 (7.4%)
Feminine	25 (56.8)	7 (70.0)	0.501	1.8 [0.4;7.8]
Stages of motor deficit according to the GMFCS score n(%)	19 (43.2)	3 (30.0)		
I and II	20 (45.5)	6 (60.0)	0.494	1.8 [0.4; 7.7]
III and IV	24 (54.5)	4 (40.0)		
Extent of topographical damage not (%)				
Monoplegia and diplegia	19 (43.2)	9 (90.0)	0.012	11.8 [1.4; 101.7]
Quadriplegia triplegia and hemiplegia	25 (56.8)	1 (10.0)		
Predominant neurological symptomatology n(%)				
spastic	36 (81.1)	9(90%)	0.531	2.1 [0.1; 10.2]
Dystonic, ataxic, mixed	8(18.9)	1(10%)		

Intellectual disability n(%)				
Yes	17 (38.6)	2 (20.0)	0.465	2.5 [0.5; 13.3]
No	27 (61.4)	8 (80.0)		
Cognitive disorders (%)				
Yes	32 (72.7)	7 (70.0)	1	1.1 [0.2; 5.1]
No	12 (27.3)	3 (30.0)		
Behavioral problems n(%)				
Yes	9 (20.5)	54 (100.0)	0.183	0.8 [0.67; 0.9]
No	35 (79.5)			
Epilepsy n(%)				
Yes	16 (36.4)	2 (20.0)	0.466	2.3 [0.43; 12.1]
No	28 (63.6)	8(80.0)		
Visceral involvement n(%)				
Yes	28 (63.6)	5 (50.0)	0.486	1.7 [0.4; 7]
No	16 (36.4)	5 (50.0)		
Equipment n(%)				
Yes	37 (84.1)	6 (60.0)	0.185	3.5 [0.8; 15.8]
No	7 (15.9)	4(40.0)		
Motor rehabilitation n(%)				
Yes	42 (95.5)	9 (90.0)	N / A	
No	2 (4.5)	1 (10.0)		
Speech Therapy n(%)				
Yes	12 (27.3)	4 (40.0)	0.459	0.6 [0.1; 2.3]
No	32 (72.7)	6 (60.0)		
Depression n (%)				
No depressive syndrome	14 (31.8)	6(60)	0.147	3.2 [0.8; 13.2]
Depressive syndrome	30 (68.2)	4 (40)		
Anxiety n(%)				
No anxiety syndrome	10 (22.7)	6 (60)	0.049	5.1 [1.2; 21.7]
Anxiety syndrome	34 (77.3)	4 (40)		
Mental quality of life n(%)				
Not altered	4(9.1)	6 (60.0)	0.001	15.0 [2.9; 76.6]
Altered	40(90.9)	4 (40.0)		
Physical quality of life n(%)				
Not altered	13(29.5)	5 (50.0)	0.273	2.4 [0.6; 9.6]
Altered	31(70.5)	5 (50.0)		

Note: GMFCS: The Gross Motor Function Classification System; N/A: Not applicable

Multivariate analysis

Multivariate analysis revealed that the factors most influencing sleep impairment in participants were: Impaired mental quality of life, topographic damage extending beyond the hemibody and maternal age greater than 35 years (Table 5).

Table 5: Results of multivariate analysis of factors associated with impaired sleep quality in mothers of children with CP (n=54)

Features	OR [95% CI]	p	ORa [95% CI]	p
Maternal age				
>35 years old	6.2 [1.4-28.1]	0.023	12.6 [1.0-156.1]	0.048
≤35 years old		0.012	1	0.042

Topographic infringement				
Hemiplegia, triplegia or quadriplegia	11.8 [1.4-101.7]	-	25.6 [1.1-587.3]	
Monoplegia or diplegia		0.001	1	0.005
mental quality of life				
Altered	15 [2.9-76.5]	-	68.4 [3.5-1312.1]	
Not altered		-	1	

Note : ORa: Adjusted odds ratio, OR: Odd Ratio

DISCUSSION

Caring for children with CP is a laborious task. A good state of mental and physical health of the parents, especially the mothers, is essential in order to ensure good support and good care for these children. Sleep is one of the most important determinants of mental health and maternal quality of life [12]. In accordance with data from the literature, the average age of the participants in our study was 38.6 ± 7.6 years. This age varied between 30 and 50 years $\pm 26-28$, but a maternal age over 35 years is considered an established risk factor for cerebral palsy in infants because they are more likely to have gestational diabetes, a history of miscarriages and cesarean deliveries [29,30]. The majority of mothers were housewives (74.1%) this was also found in the literature with a rate that varied from 80% to 90% [15,26,27,31]. The high rate of maternal unemployment could be explained by the dependence of children with CP on their mothers on the one hand, and the limitation of work opportunities compared to the general population on the other hand. This created an impact on their Socio-economic level and financial difficulties [32-34]. Moreover, in our study, more than half of the mothers (59.3%) had a monthly income of less than 800 DT/month. This study found a significant deterioration in the QOS of mothers with a child with CP (81.5%). Few studies have focused on this subject in the literature and this rate varied between 40% and 50% [12,35-37]. The average PSQI score in our population was 9.7 but in the literature this average was 5.5 [38]. This could be explained by the methodological differences applied in these studies. Indeed, the sociodemographic characteristics of the mothers in the study by Adiga et al. were different from our study population where we find a younger maternal age which varied between 20 and 30 years, and according to Wayte et al. the majority (62.5%) of mothers worked full time while the majority of mothers in our study (70.4%) were housewives [35,38].

According to the univariate analysis in our study, 4 factors influenced the quality of maternal sleep: maternal age greater than 35 years, the presence of maternal anxiety, the alteration of the participants' quality of life and the topography exceeding the hemibody of the child with CP. The first factor was maternal age (over 35) with an OR at 6.2 [1.4;28.1]. Indeed, in our study 72.7% of mothers with impaired sleep were over 35 years old, but this relationship has not been demonstrated in the literature ($p=0.167$) [15]. One hypothesis could explain this relationship by the alteration of the physiological functions of any individual with age [39]. Consequently, mothers aged over 35 would be more vulnerable to physical and mental exhaustion than mothers

aged less than 35, which could subsequently alter the quality of maternal sleep [40]. A study in adults aged 31 to 44 found that sleep quality deteriorated with age [41]. One might assume that the deterioration in the QOS in mothers aged over 35 was related to the large number of dependent children or the fact of having young children who require a lot of attention. Indeed, Mindell et al. demonstrated an impact on sleep quality of preschool children and mothers, however these factors were not correlated in our study with the quality of maternal sleep and this could be due to the size of our sample [42].

The second factor related to impaired maternal sleep quality was anxiety (OR 5.1 [1.2; 21.7]). Indeed, 77.3% of participants with impaired sleep had an anxiety syndrome and the average HAD-A score was 14. This score was higher than that found in the literature, which varied between 8 and 10 (62.63) which confirms the high prevalence of anxiety among our participants and the importance of screening for it. Indeed, Gugala et al. observed that mothers of children with CP had a higher HAD score than fathers by 1.11 points [43,44]. This was explained according to Byrne et al. by the fact that mothers of children with CP spent more time caring for their children and that mothers felt a higher burden [37]. In the literature, anxiety was a factor influencing maternal QOS quality through maternal stress [45]. This relationship was confirmed by a study carried out on a sample of 338 Japanese adults, in whom the presence of anxiety disorders altered the quality of their sleep (65.66). According to Gugala et al. factors that increased maternal anxiety were low educational level and impaired physical health of mothers. Regarding the factors that diminished it, we cite the perception of family support and financial stability [43]. These factors could explain the rate of anxiety in the mothers of the children with CP in our study because half (55.6%) of the mothers were either illiterate or at the primary level and the physical quality of life was impaired in 66.7% of the participants.

The 3rd factor intervening on the quality of maternal sleep in our study was the altered maternal quality of life (OR 68.4 [3.5-1312.1]). Indeed, among the mothers with impaired sleep, it was found that 90.9% of the participants had an impaired quality of life. This has been confirmed in the literature where there is a significant relationship between maternal quality of life and sleep quality ($p=0.05$) [15]. The quality of life of mothers of children with CP was widely reported in the literature [15,26,28,31,46-50]. It was significantly more impaired than that of mothers of healthy children and this was explained by the fact that mothers of children with cerebral palsy are more exposed to psychological constraints, and are often worried about the future of their children plus most of their time is spent on daily child needs such as food, transportation and medical appointments [50]. Mental quality of life includes an individual's mental health, such as depression. Indeed, sleep allows tissue repair and cell multiplication. Consequently, a sleep deficit can have an impact at the cognitive level and subsequently generates mood disorders such as anxiety [45]. The risk of emotional instability is more frequent in case of sleep disorders as well as depression [45].

This was demonstrated in our work with the presence of a depressive syndrome in two thirds of the participants (68.2%) ($n=30$) with impaired sleep. However, the relationship between

impaired sleep and depressive syndrome was not significant ($p=0.147$). In opposition with our results, Richdale et al. reported that maternal QOS was significantly correlated with maternal depression ($p<0.01$), anxiety ($p<0.01$), stress intensity ($p<0.01$) and frequency of sleep stress ($p<0.01$) [50]. This could be explained by the methodological differences between our study and that of Richdale et al. whose children's ages varied between 2 and 12 years and the questionnaire used to measure maternal anxiety also included the measurement of maternal stress [50]. Yilmaz et al. for example showed a statistically significant relationship between depression and anxiety scores in mothers of children with CP and those with a child with normal development ($p<0.001$) [51]. The last factor intervening in the alteration of the quality of sleep in our study was the extent of the topographic involvement of the child with CP (OR 25.6 [1.1-587.3]). Studies on this matter were controversial. Some studies have found a link between the topographic impairment of children with CP and maternal sleep quality and others have not found a relationship with gross motor classification according to the GMFCS scale.

Regarding the topographic involvement of children with CP, among the mothers with sleep disorders in our study, 56.8% had a quadriplegic, hemiplegic or quadriplegic child and 81.8% had a child with a spastic form. This could be explained by the presence of significant muscle pain and frequent nocturnal involuntary movements with extensive topographic involvement and with the presence of spasticity, moreover, this explanation has been highlighted in several studies [36,52,53].

The relationship between the Gross Motor Function Classification System (GMFCS) and maternal sleep quality was not significant ($p=0.494$). This was also demonstrated in the literature (16.51). The absence of the GMFCS V stage in our sample could explain the absence of this relationship because according to Horwood et al. sleep-wake alternation disorders and sleep-disordered breathing were more common in children with GMFCS stage VCP than those with stages I, II, and III [54]. Four factors having a statistically significant relationship with impaired maternal sleep quality were identified. However, other factors influenced maternal sleep quality without having a statistically significant relationship. Housewives had more impaired sleep than working women, but the relationship between mothers' working status and sleep quality was not statistically significant ($p=0.103$). A hypothesis was proposed by Manuel et al. indicating that working mothers are less likely to be socially isolated [55]. Therefore, mothers depressed due to social isolation may find it difficult to manage their sleep problems. Low socioeconomic status was responsible for 40% of impaired maternal well-being [56]. In our study, a monthly income of less than 800 DT/month was reported by 59.4% of the participants. This could be explained by the lack of work of the participants with a rate of 74.1% housewives either for lack of time or because of their educational level.

The QOS was not influenced by the behavioral disorders of children with CP ($p=0.183$), which opposes data from the literature which classified these disorders as a risk factor. Impaired sleep quality in children with CP and therefore impaired maternal sleep quality [54,55]. Indeed, the presence of behavioral disorders in children with CP induces problems of resistance to bedtime by

having tantrums or requiring rituals before bedtime [56-60]. The majority of children affected by CP (79.6%) were fitted with an orthopedic brace at night, but in our study there was no statistically significant relationship between the fitting of the children and the quality of maternal sleep altered ($p=0.185$). The absence of this correlation has been reported in the literature (85.88) and it was explained according to Mol et al. by abandoning the use of orthoses during the night when this caused sleep disorders in children [61]. The absence of studies in our country dealing with maternal sleep disorders indicates that the mental health of mothers of children with CP is often overlooked. However, a preserved maternal mental health guarantees better care for the child with CP. It is therefore essential to give importance to this health problem in order to promote early intervention and form educational programs for mothers.

The study carried out an evaluation using validated scales. In order to minimize data collection bias, the interviewer received training prior to passing the various assessment scales. Explanations regarding the nature and purpose of the work have been advanced to minimize social desirability bias. We performed a multivariate analysis to control for confounding variables and highlight the determining factors independently influencing maternal sleep quality. However, our study has some limitations that should be noted. The cross-sectional nature of the present study did not allow us to report causal links. A prospective longitudinal study with long-term follow-up would make it possible to better study the prognosis of CP in children and its impact on the health of their mothers as well as on other people around them. Since CP is a rare disease, the size of our sample was not large. The strength of association between impaired sleep and the various explanatory variables was estimated using odds ratios, which could be the cause of an overestimation of this strength. Furthermore, the estimated confidence intervals were wide due to the small sample size. Given that CP is a rare disease, an analytical case-control study with a sufficient number of controls would make it possible to better study these risk factors.

In view of the heavy psychological impact of CP on the mental health of the mother, the first recommendation that emerges, and to make doctors treating children with CP aware of the importance of psychological care for the patient's family members such as the mothers who are often present during the consultation. They must be attentive to their needs by providing continuous support for the different stages of care for children with CP. They must also facilitate the verbalization of their emotions and the difficulties encountered by these mothers. Appropriate strategies to help parents of children with CP need to be developed. Moreover, health personnel can use the questionnaires used in our study, such as the HAD scale, to detect symptoms of psychological distress such as depression and anxiety at an early stage. If a depressive or anxiety disorder is detected, multidisciplinary care involving psychologists, social workers and careers should often be established. Consequently, it is necessary to encourage decision-makers to generalize these items in the various hospitals in order to provide psychological, social and financial assistance to parents and thus facilitate the management of expenses related to equipment and appliances that are often not covered or partially covered by social funds [33,62-64]. Especially since the majority of participants in our

study had a modest monthly income (59.3%) Studies have shown the benefit of a financial support policy provided to parents of children with CP in the sense of reducing stress parental (89,90). Non-governmental organizations and associations could greatly contribute in this direction and provide both financial and psychological assistance.

The creation of discussion groups for families with a disabled child would make it possible to share their suffering, to seek collective solutions and even to do leisure activities together, which would considerably reduce mental health problems in their homes. However, parents of children with disabilities often do not have enough time for leisure activities, which increases their feelings of stress [64]. Dedicated child care facilities for children with disabilities can provide free time for their parents and solve this problem. This would allow better management of stress caused by daily constraints and improve their psychological well-being. Thus, a decrease in maternal psychological distress could create a more favorable environment and guarantee better care for the child.

For certain cases that are difficult to manage or for which the parents cannot provide daily care on their own, home care workers or even specialized accommodation structures are necessary. It is also necessary to emphasize the importance of specialized structures in the care of children with CP such as therapeutic and educational institutes which welcome children with significant behavioral disorders, and which guarantee the integration of these children into educational establishments. Collective information and education sessions for parents of children with CP would facilitate the understanding and management of their children's disabilities. Thus their feeling of competence would reduce the stress at home [65]. Other prospective studies and on larger samples on a national scale are necessary in order to better understand the factors involved in the deterioration of the quality of maternal sleep in order to prevent them. The study of QOS in children with CP is necessary because of the relationship between the alteration of their sleep quality and that of their mothers. Finally, fathers of children with CP should be included in future research since previous studies have suggested that fathers of children with developmental disabilities also experience impaired sleep quality [66].

CONCLUSION

In recent years, several studies have focused on the quality of life of mothers with a child with CP. Still, the study of maternal QOS and its impact on quality of life and maternal mental health is a subject that has attracted less attention but which undoubtedly has the same objective. Therefore, this work aimed to assess sleep quality in mothers of children with CP and to determine the factors associated with impaired sleep quality in them. Maternal QOS was impaired in 81.5% of the cases. The main factors influencing maternal sleep quality in this study were maternal age greater than 35 years, the presence of maternal anxiety, impaired quality of life in the participants and topographic damage extending beyond the hemibody in children with CP. The majority of participants had depressive (70.4%) and or anxious (63%) symptoms with an impaired mental and physical quality of life respectively in 66.7%. and 81.5% of our sample. This work, despite its limitations, sheds light for

health professionals on the various possible solutions aimed at improving maternal quality of life by emphasizing the importance of good support from the attending physician by ensuring good listening in order to help mothers to verbalize their emotions and the difficulties encountered on the one hand and the granting of particular attention to maternal mental health by using an adapted questionnaire during the consultation in order to detect early psychological distress in these mothers of 'somewhere else'. In the event of a disorder detected by the attending physician, care should be multidisciplinary, involving a psychologist and social workers. More research is still needed to detect other factors associated with impaired sleep quality in them and this for the purpose of contributing to better care for children with CP.

REFERENCES

- Rosenbaum P, Paneth N, Leviton A, Goldstein M, Bax M, Damiano D, et al. A report: the definition and classification of cerebral palsy April 2006. *Dev Med Child Neurol Suppl.* 2007;109:8-14.
- Oskoui M, Coutinho F, Dykeman J, Jetté N, Pringsheim T. An update on the prevalence of cerebral palsy: a systematic review and meta-analysis. *Dev Med Child Neurol.* 2013;55(6):509-519.
- Cans C. Surveillance of cerebral palsy in Europe: A collaboration of cerebral palsy surveys and registers. *Dev Med Child Neurol.* 2000;42(12):816-824.
- Trute B, Hiebert-Murphy D. Family Adjustment to Childhood Developmental Disability: A Measure of Parent Appraisal of Family Impacts. *J Pediatr Psychol.* 2002;27:271-280.
- Dyson LL. Families of young children with handicaps: parental stress and family functioning. *Am J Ment Retard.* 1991;95(6):623-629.
- Harris S, Roxborough L. Efficacy and Effectiveness of Physical Therapy in Enhancing Postural Control in Children With Cerebral Palsy. *Neural Plast.* 2005;12:229-243.
- Jessop DJ, Riessman CK, Stein RE. Chronic childhood illness and maternal mental health. *J Dev Behav Pediatr JDBP.* 1988;9(3):147-156.
- White-Koning M, Arnaud C, Dickinson HO, Thyen U, Beckung E, Fauconnier J, et al. Determinants of child-parent agreement in quality-of-life reports: a European study of children with cerebral palsy. *Pediatrics.* 2007;120(4):e804-814.
- Pless IB, Satterwhite B. A measure of family functioning and its application. *Soc Sci Med* 1967. 1973;7(8):613-621.
- Ben Salah Frih Z, Boudokhane S, Jellad A, Salah S, Rejeb N. Quality of life of parents of children with cerebral palsy. *J Med Rehab: Pract Training Phys Med Rehab.* 2010;30.
- Horwood L, Li P, Mok E, Shevell M, Constantin E. A systematic review and meta-analysis of the prevalence of sleep problems in children with cerebral palsy: How do children with cerebral palsy differ from each other and from typically developing children? *Sleep Health.* 2019;5(6):555-571.
- Lee J. Maternal stress, well-being, and impaired sleep in mothers of children with developmental disabilities: A literature review. *Res Dev Disabil.* 2013;34(11):4255-4273.
- Bourke-Taylor H, Pallant JF, Law M, Howie L. Relationships between sleep disruptions, health and care responsibilities among mothers of school-aged children with disabilities. *J Paediatr Child Health.* 2013;49(9):775-782.
- Bourke-Taylor H, Law M, Howie L, Pallant JF. Development of the Child's Challenging Behaviour Scale (CCBS) for mothers of school-aged children with disabilities. *Child Care Health Dev.* 2010;36(4):491-498.
- Albayrak I, Biber A, Çalılıkan A, Levendoglu F. Assessment of pain, care burden, depression level, sleep quality, fatigue and quality of life in the mothers of children with cerebral palsy. *J Child Health Care Prof Work Child Hosp Community.* 2019;23(3):483-494.
- Palisano RJ, Rosenbaum P, Bartlett D, Livingston MH. Content validity of the expanded and revised Gross Motor Function Classification System. *Dev Med Child Neurol.* 2008;50(10):744-750.
- Palisano RJ, Hanna SE, Rosenbaum PL, Russell DJ, Walter SD, Wood EP, et al. Validation of a model of gross motor function for children with cerebral palsy. *Phys Ther.* 2000;80(10):974-985.
- Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res.* 1989;28(2):193-213.
- Suleiman KH, Yates BC, Berger AM, Pozehl B, Meza J. Translating the Pittsburgh Sleep Quality Index into Arabic. *West J Nurs Res.* 2010;32(2):250-268.
- Ware J, Kosinski M, Keller SD. A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity. *Med Care.* 1996;34(3):220-233.
- Younsi M, Chakroun M. Measuring health-related quality of life: psychometric evaluation of the Tunisian version of the SF-12 health survey. *Qual Life Res.* sept 2014;23(7):2047-2054.
- Younsi M. Health-Related Quality-of-Life Measures: Evidence from Tunisian Population Using the SF-12 Health Survey. *Value Health Reg Issues.* 2015;7:54-66.
- Ware JE, Keller SD, Kosinski M. SF-12: how to score the SF-12 physical and mental health summary scales. 1998.
- Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand.* 1983;67(6):361-370.
- Terkawi AS, Tsang S, AlKahtani GJ, Al-Mousa SH, Al Musaed S, AlZoraigi US, et al. Development and validation of Arabic version of the Hospital Anxiety and Depression Scale. *Saudi J Anaesth.* 2017;11:S11-18.
- Dehghan L, Dalvand H, Feizi A, Samadi SA, Hosseini SA. Quality of life in mothers of children with cerebral palsy: The role of children's gross motor function. *J Child Health Car.* 2016;20(1):17-26.
- Glinac A, Matović L, Delalić A, Mešalić L. Quality of Life in Mothers of Children with Cerebral Palsy. *ACTA Clin Croat.* 2017; 56(2): 299-307.
- Lee MH, Matthews AK, Park C. Determinants of Health-related Quality of Life Among Mothers of Children With Cerebral Palsy. *J Pediatr Nurs.* 2019;44:1-8.
- Schneider RE, Ng P, Zhang X, Andersen J, Buckley D, Fehlings D, et al. The Association Between Maternal Age and Cerebral Palsy Risk Factors. *Pediatr Neurol.* 2018;82:25-28.
- McIntyre S, Taitz D, Keogh J, Goldsmith S, Badawi N, Blair E. A systematic review of risk factors for cerebral palsy in children born at term in developed countries. *Dev Med Child Neurol.* 2013;55(6):499-508.
- Khayatzaadeh MM, Rostami HR, Amirjalali S, Karimloo M. Investigation of quality of life in mothers of children with cerebral palsy in Iran: association with socio-economic status, marital satisfaction and fatigue. *Disabil Rehabil.* 2013;35(10):803-808.
- Sen E, Yurtsever S. Difficulties experienced by families with disabled children. *J Spec Pediatr Nurs.* 2007;12(4):238-252.
- Curran AL, Sharples PM, White C, Knapp M. Time costs of caring for children with severe disabilities compared with caring for children without disabilities. *Dev Med Child Neurol.* 2001;43(8):529-533.

34. Brehaut JC, Kohen DE, Raina P, Walter SD, Russell DJ, Swinton M, et al. The health of primary caregivers of children with cerebral palsy: How does it compare with that of other Canadian caregivers? *Pediatrics*. 2004;114(2):e182-191.
35. Adiga D, Gupta A, Khanna M, Taly AB, Thennarasu K. Sleep disorders in children with cerebral palsy and its correlation with sleep disturbance in primary caregivers and other associated factors. *Ann Indian Acad Neurol*. 2014;17(4):473-476.
36. Murphy N, Caplin DA, Christian BJ, Luther BL, Holobkov R, Young PC. The function of parents and their children with cerebral palsy. *PM&R*. 2011;3(2):98-104.
37. Byrne MB, Hurley DA, Daly L, Cunningham CG. Health status of caregivers of children with cerebral palsy. *Child Care Health Dev*. 2010;36(5):696-702.
38. Wayte S, McCaughey E, Holley S, Annaz D, Hill CM. Sleep problems in children with cerebral palsy and their relationship with maternal sleep and depression. *Acta Paediatr Oslo* 1992. 2012;101(6):618-623.
39. Nevšimalová S. Sleep and sleep-related disorders in women. *Cas Lek Cesk*. 2019;158(7-8):321-322.
40. Ohayon MM, Carskadon MA, Guilleminault C, Vitiello MV. Meta-analysis of quantitative sleep parameters from childhood to old age in healthy individuals: developing normative sleep values across the human lifespan. *Sleep*. 2004;27(7):1255-1273.
41. Tonetti L, Fabbri M, Natale V. Sex difference in sleep-time preference and sleep need: a cross-sectional survey among Italian pre-adolescents, adolescents, and adults. *Chronobiol Int*. 2008;25(5):745-759.
42. Mindell JA, Sadeh A, Kwon R, Goh DYT. Relationship Between Child and Maternal Sleep: A Developmental and Cross-Cultural Comparison. *J Pediatr Psychol*. 2015;40(7):689-696.
43. Gugala B, Penar-Zadarko B, Pieciak-Kotlarz D, Wardak K, Lewicka-Chomont A, Futyma-Ziaja M, et al. Assessment of Anxiety and Depression in Polish Primary Parental Caregivers of Children with Cerebral Palsy Compared to a Control Group, as well as Identification of Selected Predictors. *Int J Environ Res Public Health*. 2019;16(21).
44. Cheshire A, Barlow JH, Powell LA. The psychosocial well-being of parents of children with cerebral palsy: a comparison study. *Disabil Rehabil*. 2010;32(20):1673-1677.
45. Kalmbach DA, Anderson JR, Drake CL. The impact of stress on sleep: Pathogenic sleep reactivity as a vulnerability to insomnia and circadian disorders. *J Sleep Res*. 2018;27(6):e12710.
46. Nakajima S, Okajima I, Sasai T, Kobayashi M, Furudate N, Drake CL, et al. Validation of the Japanese version of the Ford Insomnia Response to Stress Test and the association of sleep reactivity with trait anxiety and insomnia. *Sleep Med*. 2014;15(2):196-202.
47. Kalmbach DA, Pillai V, Arnedt JT, Anderson JR, Drake CL. Sleep system sensitization: evidence for changing roles of etiological factors in insomnia. *Sleep Med*. 2016;21:63-69.
48. Raina P, O'Donnell M, Rosenbaum P, Brehaut J, Walter SD, Russell D, et al. The health and well-being of caregivers of children with cerebral palsy. *Pediatrics*. 2005;115(6):e626-636.
49. Chu J, Richdale AL. Sleep quality and psychological wellbeing in mothers of children with developmental disabilities. *Res Dev Disabil*. 2009;30(6):1512-1522.
50. Almasri N, Palisano RJ, Dunst C, Chiarello LA, O'Neil ME, Polansky M. Profiles of family needs of children and youth with cerebral palsy. *Child Care Health Dev*. 2012;38(6):798-806.
51. Yilmaz H, Erkin G, Nalbant L. Depression and anxiety levels in mothers of children with cerebral palsy: a controlled study. *Eur J Phys Rehabil Med*. 2013;49(6):823-827.
52. Newman CJ, O'Regan M, Hensey O. Sleep disorders in children with cerebral palsy. *Dev Med Child Neurol*. 2006;48(7):564-568.
53. Ostojic K, Paget S, Kyriagis M, Morrow A. Acute and Chronic Pain in Children and Adolescents With Cerebral Palsy: Prevalence, Interference, and Management. *Arch Phys Med Rehabil*. 2020;101(2):213-219.
54. Horwood L, Mok E, Li P, Oskoui M, Shevell M, Constantin E. Prevalence of sleep problems and sleep-related characteristics in preschool- and school-aged children with cerebral palsy. *Sleep Med*. 2018;50:1-6.
55. Manuel J, Naughton MJ, Balkrishnan R, Paterson Smith B, Koman LA. Stress and adaptation in mothers of children with cerebral palsy. *J Pediatr Psychol*. 2003;28(3):197-201.
56. Scherer N, Verhey I, Kuper H. Depression and anxiety in parents of children with intellectual and developmental disabilities: A systematic review and meta-analysis. *PloS One*. 2019;14(7):e0219888.
57. Romeo DM, Brogna C, Quintiliani M, Baranello G, Pagliano E, Casalino T, et al. Sleep disorders in children with cerebral palsy: neurodevelopmental and behavioral correlates. *Sleep Med*. 2014;15(2):213-218.
58. Hollway JA, Aman MG. Sleep correlates of pervasive developmental disorders: a review of the literature. *Res Dev Disabil*. 2011;32(5):1399-1421.
59. Lélis ALPA, Cardoso MVLM, Hall WA. Sleep disorders in children with cerebral palsy: An integrative review. *Sleep Med Rev*. 2016;30:63-71.
60. France KG, Blampied NM. Management of pediatric sleep disorders and disturbances: effective services and programs and impacts on the social and emotional development of young children. 2013.
61. Mol EM, Monbaliu E, Ven M, Vergote M, Prinzie P. The use of night orthoses in cerebral palsy treatment: sleep disturbance in children and parental burden or not? *Res Dev Disabil*. 2012;33(2):341-349.
62. Foster L, Brown R, Phillips B, Carlson BL. Easing the burden of caregiving: the impact of consumer direction on primary informal caregivers in Arkansas. *The Gerontologist*. 2005;45(4):474-485.
63. Ryan SE, Campbell KA, Rigby PJ, Fishbein-Germon B, Hubley D, Chan B. The impact of adaptive seating devices on the lives of young children with cerebral palsy and their families. *Arch Phys Med Rehabil*. 2009;90(1):27-33.
64. Ribeiro MFM, Sousa ALL, Vandenberghe L, Porto CC. Parental stress in mothers of children and adolescents with cerebral palsy. *Rev Lat Am Enfermagem*. 2014;22(3):440-447.
65. Sofronoff K, Farbotko M. The Effectiveness of Parent Management Training to Increase Self-Efficacy in Parents of Children with Asperger Syndrome. *Autism Int J Res Pract*. 2002;6:271-286.
66. Barak-Levy Y, Atzaba-Poria N. Paternal versus maternal coping styles with child diagnosis of developmental delay. *Res Dev Disabil*. 2013;34(6):2040-2046.