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ORIGINAL ARTICLE

Sleep quality in women with systemic lupus erythematosus: contributing factors and effects on health-related quality of life

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Abstract

Aim: Sleep quality disturbances are common in patients with systemic lupus erythematosus (SLE). We evaluated sleep quality and its contributors in women with SLE. Also we evaluated the effects of sleep quality disturbance on patients' health-related quality of life (HRQoL).

Methods: Sleep quality was assessed in 77 women with SLE (age 36.5 ± 10.1 years) using the Pittsburgh Sleep Quality Index (PSQI). Disease activity and cumulative disease damage were assessed with standard indices. Patients completed the Hospital Anxiety and Depression Scale and LupusQoL. Univariate and multivariate analyses were performed to find contributors of poor sleep quality and association of sleep quality with HRQoL.

Results: Poor sleep quality was present in 44 patients (57.1%). Poor sleepers were older ($P = 0.015$) and had higher body mass index ($P = 0.027$) and more severe anxiety ($P < 0.001$) and depression symptoms ($P < 0.007$) compared with good sleepers. In the logistic regression model, age ($\beta = 1.16$, $P = 0.006$), disease activity ($\beta = 1.10$, $P = 0.050$), and anxiety/depression composite score ($\beta = 1.16$, $P = 0.008$) were independent contributors of poor sleep quality. Poor sleepers had impaired HRQoL in almost all domains of the LupusQoL than good sleepers ($P < 0.05$).

Conclusion: Poor sleep quality is common in women with SLE and significantly impairs their HRQoL. Age, disease activity and psychological factors were determinants of sleep quality in our study. Studies with objective sleep measures as well as interventional studies are warranted in this regard.

Key words: anxiety, depression, quality of life, sleep, systemic lupus erythematosus.

INTRODUCTION

Sleep disturbances are common in patients with systemic lupus erythematosus (SLE). Studies with subjective sleep measures have shown that up to 80% of SLE patients have poor sleep quality.[1–4] Poor or insufficient sleep in SLE patients can worsen fatigue, a common complaint in these patients, and impair health-related quality of life (HQoL) and cognitive function.[5] Moreover, it has been shown in the general population that poor sleep quality increases the risk of cardiovascular and coronary heart diseases.[6] Although there is no direct evidence in this regard, sleep quality disturbance may play a role in enhanced cardiovascular disease seen in SLE patients.[7] Therefore, studying sleep and identifying factors contributing to sleep disturbances in SLE patients is of great importance.

There has been a controversy among the results of previous studies regarding the factors contributing to

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sleep quality disturbances in SLE patients. Some studies have shown an association between disease activity and subjective sleep disturbances,[3,8] but other studies demonstrated no clear relationship in this regard.[9,10] There are also studies indicating a major role for psychological factors, mainly depression, for sleep disturbances in SLE patients, but other psychological disorders such as anxiety are less studied.[2,3,10] Other contributing factors for impaired sleep quality in these patients are reported as prednisone use[2,10] and lack of exercise,[2] although controversy is present regarding prednisone use.[4]

Despite the importance of sleep disturbances in SLE patients, only a limited number of studies have been conducted up to now. While the appropriate management of sleep disturbances requires comprehensive knowledge on the underlying mechanisms and associated factors in each specific population, results of previous studies have been controversial in this regard. Considering the lack of data, in this study we aimed to determine sleep quality and its associated factors in SLE patients. Also, we evaluated the effects of sleep quality disturbance on various dimensions of quality of life which has not previously been well studied.

METHODS

Patients and settings

This cross-sectional study was conducted on women with SLE referring to an outpatient clinic of rheumatology in Isfahan City (Iran) between January and July 2013. Known SLE patients, according to the American College of Rheumatology (ACR) revised criteria for SLE,[11,12] who were at least 18 years of age and had no major cognitive deficits that would interfere with questionnaire completion were consecutively included into the study. Patients were invited during their scheduled appointment at the clinic to participate in the study. Sleep quality data of the female population (matched by age) from a general population-based study in our society[13] was used as the control. The Ethics Committee of the Isfahan University of Medical Sciences approved the study and consent to participate was obtained from all patients.

Assessments

Data including age, years of education, weight, height, physical activity (never/rarely, sometimes, and regular), SLE duration, comorbidities, prednisolone use and dosage, and laboratory data were gathered by reviewing patients' documents and interviews with patients. A rheumatologist measured disease activity and cumulative disease damage using the Systemic Lupus Erythematosus Disease Activity Index 2000 (SLEDAI-2K)[14] and the Systemic Lupus International Collaborative Clinics/ACR Damage Index (SLICC/ACR DI),[15] respectively.

Patients completed a self-administered questionnaire composed of standard instruments for the evaluation of sleep quality, psychological symptoms and quality of life. Sleep quality was measured by the Pittsburgh Sleep Quality Index (PSQI) providing data on seven components of sleep quality: sleep latency, sleep duration, sleep efficiency, sleep disturbance, need for sleep medications, daytime dysfunction due to sleepiness and overall sleep quality. The global score range from 0 to 21 with scores ≥ 6 indicating poor sleep quality.[16] The Hospital Anxiety and Depression Scale (HADS) was used to measure anxiety and depressive symptoms. The HADS provides scores of 0–21 for each of the anxiety and depression subscales, with scores of ≥ 8 indicating a clinically important case.[17] The Lupus quality of life (LupusQol) was applied to evaluate disease-specific QoL in various dimensions of physical health, emotional health, body image, pain, planning, fatigue, intimate relationships and burden to others. Each domain's score ranges from 0 (worst QoL) to 100 (best QoL).[18] For these self-rated questionnaires, a Persian version with appropriate psychometric properties was used.[19–21]

Statistical analysis

Data were analyzed using the SPSS software for windows version 16.0 (SPSS Inc., Chicago, IL, USA). Independent samples *t*-test (Mann–Whitney *U*-test) and Chi-square test were used for comparing quantitative (non-parametric) and qualitative variables, respectively, between the two groups of patients and controls, and also between good sleepers and poor sleepers. Regression analyses were computed to examine predictors of global as well as each component of sleep quality and to test independent association of sleep quality with QoL. A *P*-value of < 0.05 was considered as statistically significant in all analyses.

RESULTS

Patient characteristics

From a total of 100 invited patients, 19 could not fill out the self-administered study questionnaire mostly because of having not enough time at the appointment. Eighty-one patients agreed to participate and 77 completely filled out the self-reported questionnaires. From

patients' documentation data we found no difference between those who entered the study and those who did not with regard to age ($P = 0.350$), level of education ($P = 0.497$), body mass index (BMI) ($P = 0.455$) or duration of disease ($P = 0.980$) and disease activity ($P = 0.651$). Table 1 summarizes the demographic and clinical characteristics of these patients. The mean ± SD age was 36.5 ± 10.1 years. Fifteen (19.4%) of the patients had active disease, 24 (31.1%) had a cumulative damage index of ≥ 1, and most of the patients were taking prednisolone (77.9%). Only 20 (25.9%) of the patients had regular physical activity. Fifty-five (71.4%) and 35 (46.1%) of the patients had anxiety and depressive disorders, respectively.

Sleep quality

The PSQI global score for the SLE patients was 7.0 ± 4.6 (range 1–19), with 44 patients (57.1%) classified as 'poor sleepers' (global PSQI ≥ 6). Table 2 summarizes the global score and the component scale scores for the PSQI for our sample in comparison with controls (ages 20–50 years). Comparisons showed that SLE patients have significantly higher scores on global sleep quality ($P < 0.001$), and components of sleep efficiency ($P = 0.006$), sleep duration ($P = 0.006$), sleep disturbance ($P < 0.001$), and need for sleep medications ($P < 0.001$). Differences regarding the overall sleep quality component were not significant ($P = 0.057$).

Table 1 Characteristics of the study participants ($n = 77$)

	Mean ± SD or no. (%)
Age, years	36.5 ± 10.1
Education, years	11.5 ± 3.6
Physical activity	
Never	14 (18.1)
Sometimes	43 (55.8)
Regular	20 (25.9)
BMI, kg/m^2	24.7 ± 4.8
SLE duration, year	8.3 ± 3.8
SLEDAI-2K	3.1 ± 3.6 (median 2)
SLICC/ACR DI	0.49 ± 0.88 (median 0)
Concomitant diseases	
Hypertension	19 (24.6)
Diabetes	1 (1.2)
Kidney disease	25 (32.4)
Other rheumatologic disease	9 (11.6)
Prednisolone use	60 (77.9)
Prednisolone dose, mg/day	46.0 ± 37.2

BMI, body mass index; SLE, systemic lupus erythematosus; SLEDAI-2K, Systemic Lupus Erythematosus Disease Activity Index 2000; SLICC/ACR DI, Systemic Lupus International Collaborative Clinics/American College of Rheumatology Damage Index.

Table 2 Pittsburgh Sleep Quality Index scores in our patients compared with published data of general population

	Patients $n = 77$	Controls $n = 840$	*P*-value
Global sleep quality score	7.06 ± 0.46	5.68 ± 3.43	<0.001
Component score			
Sleep efficiency	0.75 ± 1.11	0.46 ± 0.87	0.006
Sleep duration	1.02 ± 1.15	0.73 ± 0.86	0.006
Sleep latency	1.45 ± 0.98	1.37 ± 1.07	0.527
Sleep disturbance	1.54 ± 0.62	1.06 ± 0.48	<0.001
Need for sleep medications	0.61 ± 1.06	0.27 ± 0.74	<0.001
Daytime dysfunction due to sleepiness	1.04 ± 0.89	1.14 ± 1.04	0.411
Overall sleep quality	1.07 ± 0.77	0.90 ± 0.75	0.057

Univariate comparisons of poor sleepers with good sleepers

Comparison of patients with and without poor sleep quality is summarized in Table 3. Compared to good sleepers, those with poor sleep quality were older ($P = 0.015$) and had higher BMI ($P = 0.027$) and also higher levels of anxiety ($P < 0.001$) and depression ($P = 0.007$). Also, poor sleepers had a non-significantly higher prednisolone dosage consumed compared with good sleepers ($P = 0.066$). Differences between poor sleepers and good sleepers regarding physical activity and SLE activity were not statistically significant (Table 3).

Determinants of sleep quality

The results of the logistic regression model predicting poor sleep quality are shown in Table 4. According to the high correlation between anxiety and depression scores ($r = 0.80$), the composite anxiety and depression score (total HADS score) was included into the model dealing with multicollinearity. Age ($\beta = 1.16$, $P = 0.006$), disease activity ($\beta = 1.10$, $P = 0.050$) and composite anxiety-depression score ($\beta = 1.16$, $P = 0.008$) were significant determinants of poor sleep quality. There was also a trend of association between the prednisolone dose and poor sleep quality ($\beta = 1.01$, $P = 0.094$).

Table 3 Comparison of patients with and without poor sleep quality

	PSQI ≥ 6 n = 44	PSQI < 6 n = 33	*P*-value
Age, years	39.0 ± 10.0	33.3 ± 9.5	0.015
Education, years	11.4 ± 3.5	11.7 ± 3.8	0.743
Physical activity			
Never	9 (20.4)	5 (15.1)	0.105
Sometimes	28 (63.6)	15 (45.4)	
Regular	7 (15.9)	13 (39.3)	
BMI, kg/m^2	25.8 ± 4.9	23.3 ± 4.4	0.027
Concomitant diseases			
Hypertension	13 (29.5)	6 (18.1)	0.175
Kidney disease	16 (36.6)	9 (27.2)	0.253
Other rheumatologic disease	5 (11.3)	4 (12.1)	0.610
SLE duration, years	7.8 ± 3.5	8.8 ± 4.1	0.240
SLEDAI-2K	3.6 ± 4.0	2.5 ± 3.1	0.210
SLICC/ACR DI	0.62 ± 1.03	0.31 ± 0.59	0.209
Anxiety	11.5 ± 3.8	8.4 ± 3.4	<0.001
Depression	8.0 ± 4.0	5.4 ± 3.8	0.007
Prednisolone use	27 (61.3)	15 (45.4)	0.285
Prednisolone dose, mg/day	51.6 ± 37.3	36.5 ± 36.3	0.066

BMI, body mass index; PSQI, Pittsburgh Sleep Quality Index; SLE, systemic lupus erythematosus; SLEDAI-2K, Systemic Lupus Erythematosus Disease Activity Index 2000; SLICC/ACR DI, Systemic Lupus International Collaborative Clinics/American College of Rheumatology Damage Index.

Table 4 Results of logistic regression model predicting poor sleep quality

	β (95% CI)	*P*-value
Age	1.16 (1.04, 1.29)	0.006
Education	1.84 (0.86, 3.94)	0.115
BMI	1.09 (0.92, 1.29)	0.304
Physical activity	1.82 (0.48, 6.80)	0.372
Disease duration	0.92 (0.74, 1.14)	0.449
SLEDAI-2K	1.10 (1.00, 1.44)	0.050
SLICC/ACR-DI	1.70 (0.76, 3.82)	0.193
Prednisone dose	1.01 (0.99, 1.03)	0.094
Total HADS score	1.16 (1.04, 1.29)	0.008

BMI, body mass index; HADS, Hospital Anxiety and Depression Scale; SLEDAI-2K, Systemic Lupus Erythematosus Disease Activity Index 2000; SLICC/ACR, Systemic Lupus International Collaborative Clinics/American College of Rheumatology.
Model Nagelkerke r^2 = 0.427.

The most significant contributors of each of the components of sleep quality based on linear regression analysis are summarized in Table 5. Age contributed to sleep latency (β = 0.33, P = 0.005), daytime dysfunction due to sleepiness (β = 0.35, P = 0.006) and overall sleep quality (β = 0.41, P = 0.001). Disease activity was associated with sleep latency (β = 0.25, P = 0.036) and sleep disturbance (β = 0.39, P = 0.035). Anxiety was associated with sleep latency (β = 0.32, P = 0.007), sleep disturbance (β = 0.47, P < 0.001) and the overall sleep quality (β = 0.52, P < 0.001). Depression was contributed to sleep efficiency (β = 0.36, P = 0.013), need for sleep medications (β = 0.27, P = 0.031) and daytime dysfunction due to sleepiness (β = 0.54, P < 0.001).

Table 5 Linear regression analysis of major contributors of each of the sleep quality components

Sleep components	Contributors	β	*P*-value
Sleep efficiency	Disease duration	−0.315	0.004
	Depression	0.366	0.013
Sleep latency	Age	0.339	0.005
	Disease activity	0.252	0.036
	Anxiety	0.327	0.007
Sleep disturbance	Disease activity	0.397	0.035
	Anxiety	0.479	<0.001
Need for sleep medications	Depression	0.273	0.031
Daytime dysfunction due to sleepiness	Age	0.351	0.006
	Education level	0.482	<0.001
	Depression	0.540	<0.001
Overall sleep quality	Age	0.415	0.001
	Anxiety	0.523	<0.001

Effects of sleep quality on health-related quality of life

Comparison of poor sleepers and good sleepers in terms of QoL is summarized in Table 6. Patients with poor sleep quality had significantly lower QoL in all domains of the LupusQoL scale, except 'burden to

Table 6 Comparison of quality of life between poor sleepers and good sleepers

LupusQoL domains	PSQI ≥ 6 n = 44	PSQI < 6 n = 33	*P*-value
Physical health	61.3 ± 27.0	79.5 ± 19.8	0.002
Emotional health	42.0 ± 24.4	64.9 ± 22.6	<0.001
Body image	53.1 ± 27.6	77.7 ± 18.4	<0.001
Pain	57.7 ± 28.6	81.8 ± 21.6	<0.001
Planning	63.5 ± 29.5	81.3 ± 24.8	0.007
Fatigue	54.7 ± 24.7	74.0 ± 20.0	<0.001
Intimate relationships	63.1 ± 30.9	81.7 ± 27.9	0.015
Burden to others	47.6 ± 33.8	61.1 ± 31.0	0.080

PSQI, Pittsburgh Sleep Quality Index.

others' ($P = 0.08$). Considering observed associations of demographic, disease-specific and psychological factors with sleep quality, we conducted linear regression analysis for each of the LupusQoL components to determine independent association of sleep quality with quality of life. Sleep quality was independently and significantly associated with emotional health ($\beta = -0.22$, $P = 0.017$) and pain ($\beta = -0.27$, $P = 0.028$). Sleep quality was not significantly associated with physical health ($\beta = -0.17$, $P = 0.163$), body image ($\beta = 0.003$, $P = 0.997$), planning ($\beta = -0.15$, $P = 0.212$), fatigue ($\beta = -0.06$, $P = 0.583$), intimate relationships ($\beta = -0.16$, $P = 0.194$) or burden to others ($\beta = -0.02$, $P = 0.830$).

DISCUSSION

The aim of the present study was to determine sleep quality and its associated factors in SLE patients, and also to evaluate the effects of sleep quality disturbance on SLE patients' QoL. We found poor sleep quality in 57% of our SLE patients. Compared with data from a population-based study in our society,[13] our SLE patients had higher frequency of poor sleep quality than the general population (37%) and also higher scores in most of the PSQI components, except sleep latency and daytime dysfunction due to sleepiness. Although we might overestimate the frequency of poor sleep quality according to the study response rate, these results are similar to previous studies reporting a prevalence of 55–62% of sleep disturbances in patients with SLE. These studies showed that SLE patients have more severe disturbances in almost all components of sleep quality than controls.[2,3] A few studies which applied polysomnography for the evaluation of sleep in SLE patients reported sleep-related respiratory and movement disorders as the main sleep disorders in SLE patients.[8,9] These results show that various types of sleep disorders are highly frequent in SLE patients and deserve great attention.

Contributing factors to sleep quality disturbance in SLE patients are yet unclear. While an association between SLE activity and sleep disturbance is expected, the results of previous studies have been different in this regard. We found an association between disease activity and poor sleep quality in the regression analysis controlling for different factors. We also found associations between disease activity and sleep quality components. The association between sleep quality and disease activity is also reported by some previous studies.[3,8,22] Such association may be direct and due to symptoms such as pain, headache and other clinical symptoms of SLE.[22] Besides these studies with subjective sleep quality measures, a polysomnographic study also showed that disease activity is associated with decreases in sleep efficiency and increases in sleep fragmentation.[5] However, there are studies that found no direct association of disease activity and sleep quality in SLE patients.[2,4,10] In these studies an indirect association is still plausible, since patients with more active disease are more likely to be taking corticosteroids and less likely to have regular physical activity that are reported as important determinants of global sleep quality in SLE patients by some studies.[2,10] Prednisone use is reported to be associated with daytime somnolence.[10] We found a non-statistically significant association between the dose of prednisolone and sleep quality in both univariate and multivariate analyses. In contrast, some other studies found no association between taking prednisolone and sleep quality.[4] Differences between previous studies' results might be related to differences in patients' characteristics, sleep measure tools, as well as SLE activity scales.

Factors other than disease characteristics can affect sleep quality in SLE patients, and a biopsychosocial approach is needed in this regard. Previous subjective studies showed that depression is a significant contributor to sleep quality disturbances in SLE patients.[2,3,10] A polysomnographic study also showed an association of depression with objective sleep measures, respiratory disturbance index and oxygen desaturations.[8] We found a strong correlation of sleep quality with anxiety and depression in bivariate associations and with composite anxiety and depression scores in the regression model. It is possible that anxiety and depression have different effects on different components of sleep quality. In the study of Vina and colleagues, anxiety was independently related to daytime somnolence and snoring, while depression was related to sleep disturbance, adequacy and quantity.[10] In our study, anxiety was related to some of the sleep quality components, including sleep latency, sleep disturbance and overall sleep quality. In comparison, depression was related to sleep efficiency, need for sleep medications and daytime dysfunction due to sleepiness. It must be noted that our studied population was relatively younger (mean age = 36.5 years) than some of the other similar studies (mean age = 45.5).[2,10] The frequency and role of anxiety and depression in sleep quality may be different by age; the severity of anxiety symptoms was more than depressive symptoms in our study. Therefore, differences in studied population characteristics as well as

using different psychological measurement tools may contribute to the differences between the previous studies' results. Few studies have evaluated both anxiety and depression in relation to sleep quality in SLE patients. Also, anxiety and depression are highly correlated and a large and more heterogeneous sample of patients is required for precise multivariate analyses including both factors. Hence, further studies are still warranted in this regard.

Health-related QoL is considered as one of the main outcome measures for SLE patients and finding its contributing factors is of importance. We found diminished QoL in poor sleepers in almost all dimensions of the LupusQoL compared with good sleepers. Association between sleep quality and QoL remained significant for emotional health and pain after controlling for demographic, disease-related and psychological factors. Lack of association for body image and intimate relationships might be confounded by factors such as anxiety/depression. A few studies that are available in this regard also showed an impact of poor sleep quality on QoL of SLE patients.[1,4] Associations of sleep disorders and sleep quality disturbances with pain and fatigue in SLE patients are also reported by some previous studies.[9,23] It must be noted that fatigue in SLE patients is multidimensional with physical and mental components. The study by Da Costa and colleagues showed an association between sleep disturbance and physical but not mental fatigue.[23] The QoL instrument we used in our study has few questions for evaluating fatigue and was not comprehensive in this regard, which may explain our results.

There are some limitations to our study. First, this study had no adequate control group and, since we recruited SLE patients from a single clinic of rheumatology, findings of this study cannot be generalized to all SLE patients in our society. Second, we only used a self-reported measure of sleep quality and did not specifically evaluate sleep disorders. Sleep disorders such as obstructive sleep apnea and periodic limb movement disorder which are frequent in SLE patients can impair sleep quality of these patients.[8,9] Therefore, more studies using objective sleep measures are warranted. Third, the cross-sectional design of our study does not allow examining causal relationships between variables. In this regard, prospective studies are needed to find those factors that must be modified in order to improve sleep quality in SLE patients. Finally, our sample size was relatively small and, considering multiple potential contributors of sleep quality, studies with larger samples of patients are required for more precise analyses.

CONCLUSIONS

Sleep quality disturbances are common in women with SLE and significantly impair their QoL. Age, disease activity and anxiety/depression were significant determinants of sleep quality in our study. Psychological factors are major contributors to poor sleep quality in SLE patients, which highlights the need for having a biopsychosocial approach toward the management of sleep problems in these patients. Studies with objective sleep measures, prospective studies, as well as interventional studies, are warranted in this regard.

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CONFLICT OF INTEREST STATEMENT

The authors declare that there is no conflict of interest.

AUTHORS CONTRIBUTIONS

LM and AGh generated the idea and designed the study. NH and ZSB conducted the study and gathered data. AGh and LM analyzed data and wrote the manuscript draft. All authors studied and revised the manuscript. The final manuscript was approved by all authors.

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