

Sleep quality, clinical and psychological manifestations in women with Systemic Lupus Erythematosus

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Abstract

Aim: Sleep problems are a common complaint in Systemic Lupus Erythematosus (SLE) patients. We analyzed sleep quality with subjective and objective measures in a sample with SLE and its possible relationships with the main manifestations of the disease.

Method: 21 women with SLE and 20 healthy women participated in the study. All participants were evaluated with actigraphy for a week and they completed self-report instruments of sleep quality, quality of life, fatigue, anxiety, depression and perceived stress. Comparison analyses between the two groups were done using *Chi*-square and *t*-Student. The association between sleep quality and the remaining variables was explored using Pearson correlation coefficients.

Results: SLE patients had higher fragmentation index in the actigraphic analysis and a perception of poorer sleep quality more fatigue, anxiety and depression than the control group. Bivariate analyses showed that the perception of more sleep disturbance and daytime dysfunction was associated with a lower health-related quality of life, more fatigue, emotional discomfort and more perceived stress. Also the fragmentation index in the actigraphy was significantly related to the perception of poorer quality of sleep.

Conclusion: SLE women had a poorer sleep quality (objective and subjective). These alterations could play a modulatory role in clinical and psychological manifestations of the disease and affect the quality of life in this population. More research is needed to clarify these relations and to determine the potential benefits of interventions directed to improve sleep in the clinical managing of the patients with SLE.

Keywords: actigraphy; objective sleep measures; sleep quality; systemic lupus erythematosus.

INTRODUCTION

Systemic Lupus Erythematosus (SLE) is an autoimmune disease which etiology is unknown. The prevalence is about 20-70 per 100.000 in general population, being more frequent in women (90% or more) than in men.¹ SLE includes several clinical manifestations and can affect multiple organs and body systems, mainly muscles and joints, brain and peripheral nervous system, lungs, heart, kidneys, skin, serous membranes and blood components.² The pharmacological treatment could include nonsteroidal anti-inflammatory drugs, antimalarials, corticosteroids and cytotoxic agents in order to

prevent disease flares and to delay organ failure and mortality. Symptoms and side effects of treatment represent a great impact on the patient's life, being affected daily functioning and psychosocial aspects.³⁻⁴

Furthermore, sleep problems and poor sleep quality are common complaints in patients with rheumatic diseases, including SLE.⁵ In a recent review about sleep disturbances in SLE patients of the year 2014, Palagini et al. found that 56-80.5% of the patients reported sleep disturbances and poor sleep quality. The most frequent alterations were increased sleep latency, sleep fragmentation, increased number of awakenings and reduced sleep efficiency compared to the healthy population.⁶ Nevertheless, the few studies that have analysed this question had several methodological limitations, such as the great variability of samples or the use of different assessment techniques. Very few studies have included objective sleep measures like actigraphy or polysomnography (PSG).⁶ Thus, although some investigations have explored the sleep difficulties of SLE patients, prevalence data and characteristics of sleep in SLE remain incomplete and inconclusive.

On the other hand, an increasing number of studies have begun to explore the role of sleep quality in clinical, psychological and functional manifestations of people with SLE. There is some evidence that SLE patients with sleep problems have a poorer health-related quality of life,⁷ more fatigue⁸ and higher levels of anxiety and depression.^{7, 9, 10} However, no study has evaluated simultaneously these aspects including subjective and objective sleep measures. In addition, an important moderator of psychological health in these patients is self-perceived stress,¹¹ and its possible relation with sleep quality has not yet been evaluated.

Therefore, the aim of the study was: 1) to analyze sleep quality (subjective and objective) of SLE patients compared with healthy controls, and 2) to explore the possible relationships of sleep quality with quality of life, fatigue, anxious and depressed mood and self-perceived stress.

METHODOLOGY

Participants

A total of 21 women with SLE and 20 healthy women participated in the study. SLE sample were outpatients of Systemic Autoimmune Disease Unit of Virgen de las Nieves University Hospital (Granada, Spain).

The inclusion criteria for SLE patients were: 1) to be a woman aged between 18 and 67 years old; 2) to have a good reading comprehension; 3) to meet at least four of American College of Rheumatology (ACR) criteria for SLE¹²⁻¹³; 4) to have the diagnosis of SLE at least one year, and 5) to have a stable medication at least one month before the beginning of the study. Exclusion criteria were: 1) the presence of other medical diseases or pregnancy; 2) the presence of sleep apnea, restless leg syndrome, myoclonus or circadian rhythm disorder; 3) a high dependency of hypnotic medication and 4) the presence of serious psychological problems such as psychotic disorders, depression with suicidal ideation, substance abuse or other.

The sample of healthy women came from non-clinical contexts and was match in sociodemographic characteristics with the sample of SLE women. In this case inclusion criterial were: 1) to be a woman aged between 18 and 67 years old; 2) to have a good reading comprehension; 3) to be free of any medical or psychological disease and not be pregnant. Exclusion criteria were the same as for the clinical sample.

This research was approved by the Ethics Committee Research Center Granada (CEI-Granada).

Measures

Sociodemographic and clinical data

Information about age, education level, employment status, marital status, number of children and years from the SLE diagnosis were collected. Additionally, current perceived health was assessing using a numeric scale from 1 to 4 where each number indicates the health quality.

Actigraphy

The objective sleep assessment was made by actigraphy. The actigraph is a wrist-worn device that records activity, estimating if the participant is asleep or awake.¹⁴ In general, wrist actigraphy is considered a valid and useful technique for sleep assessment, being a less costly alternative and easier to use than PSG.¹⁵ In this study we used actigraphs Motionwatch 8 model and Motionware 1.1.15 software (CamNtech, Software GmbH, Colonia, Germany) for the data dump. The following parameters of actigraphy were obtained: Time in bed, Actual sleep (%), Actual wake (%), Sleep efficiency (%), Sleep latency (%) and Fragmentation Index.

Self-report instruments

The *Pittsburgh Sleep Quality Index* (PSQI) includes 19 items that explore seven dimensions of sleep quality: subjective sleep quality, sleep latency, sleep duration,

habitual sleep efficiency, sleep disturbance, use of sleeping medication and daytime dysfunction. Each component has a score range between 0 (no dysfunction) to 3 (severe dysfunction). The PSQI global score has a possible range of 0-21 points.¹⁶

The *Lupus Quality of Life* (LupusQoL) is a disease-specific health-related quality of life instrument for adults with SLE, assessing five domains: physical health, emotional health, body image, burden to others and intimate relationships. The score for each domain ranges between 0 (worst health-related quality of life) and 100 (best health-related quality of life).¹⁷

The *Multidimensional Fatigue Inventory* (MFI) assesses five dimensions of fatigue: general fatigue, physical fatigue, mental fatigue, reduced motivation and reduced activity. Each component score ranges from 1 (no alteration) to 5 (severe alteration).¹⁸

The *Hospital Anxiety and Depression Scale* (HADS) was designed to evaluate anxious state and depressed mood in patients with physical illnesses. The HADS includes 14 items that generate two separate scores for anxiety and depression ranging between 0 and 21. A higher the score indicates more severe anxiety or depression.¹⁹

The *Perceived Stress Scale* (PSS) is a measure of the degree to which situations of one's life are perceived as stressful. The score ranges from 0 to 56, where higher scores indicate higher perception of stress.²⁰

Spanish versions of these instruments were used. All of them have good psychometric properties.²¹⁻²⁵

Procedure

In a first session, after providing information about the study and signing the informed consent, we realized a brief interview collecting the sociodemographic and clinical data. Also, in order to screen environmental, behavioural or medical alterations that could cause sleep problems, a semi-structured interview about insomnia was conducted.²⁶ Finally, participants were given instructions to use the actigraph for one week and instructions to complete self-report instruments. The duration of the complete session was approximately between 1-1.5 hour. A week later, in a second session, all material was collected.

Data analysis

Data were analyzed using SPSS software for Windows version 20.0. First, sociodemographic and clinical characteristics of both groups were compared using *Chi-square* tests (for dichotomous variables) and *t-Student* (for continuous variables). Then, the possible differences in all variables between the clinical sample and the control group

were explored by independent samples *t*-test. Levene's test was used to determine equality of variances. Finally, for the clinical sample, the relationships between subjective sleep quality and other psychological variables, as well as between the actigraphy parameters and other self-report measures were analysed using the Pearson correlation coefficients. Significance for all tests was set at $p < 0.05$.

RESULTS

Sociodemographic and clinical data

Comparing SLE women with healthy women (Table 1), we observed that there was no difference between them in sociodemographic measures (age, education level, employment status, marital status and number of children), although, we found values close to the significance in education level. Moreover, as expected we found differences in the current health perception: none of the healthy women considered their health "Bad" versus 4.8% of SLE women. In addition, most of the SLE patients rated their health as "Acceptable" (42.9%) or "Good" (47.6%) and only 4.8% considered it "Excellent". However, among healthy women the majority health perception was "Good" (60%), followed by "Excellent" (30%) and "Acceptable" (10%). Finally, there were no differences in medication between the two groups except in the use of corticosteroid, very common in SLE patients.

Comparison analysis

Self-report measures

We found statistically significant differences between the two groups in sleep quality assessed by the PSQI (Table 2). The global index of PSQI and six of seven components (subjective sleep quality, sleep latency, sleep duration, sleep disturbance, use of sleeping medication and daytime dysfunction) showed that SLE patients perceived a lower quality in their sleep than healthy women did. On the other hand, the difference in habitual sleep efficiency compared to healthy participants was not significant, although we observed lower sleep efficiency in the SLE group.

Regarding the health-related quality of life assessed by the LupusQoL and applied only to the clinical sample (Table 2), we observed that the most affected domains were emotional health and burden to others. In this sample, the other domains (physical health, body image and intimate relationships) were less affected by the disease.

Concerning to fatigue, we found that the SLE group showed significantly higher levels of fatigue than control group in all domains evaluated by the MFI (Table 2).

In the same way, significantly higher levels of anxiety and depression assessed by the HADS were observed among SLE women compared with healthy women. However, the levels of perceived stress were not different between the two groups, even though SLE patients had higher scores (Table 2).

Actigraphy

By comparing actigraphy parameters in both samples (Table 3), we only found significant differences in sleep fragmentation, thus, we observed higher scores in sleep fragmentation index among SLE women compared with healthy women. Nevertheless, *p*-values close to significance were observed for actual sleep, actual wake and sleep efficiency. The data indicated a trend for the SLE group to sleep fewer hours, more time awake at night and lower sleep efficiency than the comparison group.

Correlation analysis

Subjective sleep quality and psychological variables

The Pearson correlation coefficients for each component of subjective sleep quality (PSQI) and psychological variables (Table 4) showed significant association between more sleep disturbances and some domains of health-related quality of life (less emotional health and more perception of burden to others), fatigue (more physical fatigue and less motivation and activity) and higher levels of anxiety and depression and perceived stress. Regarding the daytime functioning, we found that worse daytime dysfunction was significantly related with poorer emotional health, more mental fatigue, reduced motivation and activity and higher levels of depression and perceived stress. However, duration of sleep had a positive and significant association with the LupusQoL's domain of burden to others, and negative with physical fatigue and reduced motivation. In concrete, patients with shorter duration of sleep had less perception of burden to others and showed less physical fatigue and more activity. Furthermore, patients with lower sleep efficiency had a better perception of their body image and a lower perception of burden to others. For the other components of PSQI as well as for the global index of sleep quality, we did not find other significant correlations between measures evaluated.

Actigraphy parameters and psychological variables

Analyzing the relation between the different actigraphy parameters and self-report measures, we found that sleep fragmentation index was positively correlated with subjective sleep quality, daytime dysfunction and the global index of sleep quality (see

Table 5). So greater sleep fragmentation was associated with poorer sleep quality, more daytime dysfunction and higher perceived alteration in the global index of PSQI. Moreover, longer time in bed was associated with more perception of sleep disturbance, lower emotional health, less motivation and activity level and more anxiety and depression. In addition, a higher sleep latency was significantly associated with worse sleep efficiency and more use of sleeping medication in the PSQI. On the contrary, the other actigraphy parameters (actual sleep, actual wake and sleep efficiency) were not correlated with psychological variables evaluated in this sample.

DISCUSSION

The aim of this study was to evaluate the sleep quality (objective and subjective) in SLE patients compared with a healthy sample of women, and to explore the possible relation between sleep alteration and other psychological variables (health-related quality of life, fatigue, anxiety and depression and perceived stress). We found that SLE patients informed of poorer sleep quality, as showed the differences in PSQI scores with regard to the healthy sample in subjective sleep quality, sleep latency, sleep duration, sleep disturbance, use of sleeping medication, daytime dysfunction and the PSQI global index. These results are similar to those obtained in other studies, for example in the review of Palagini et al., in which more than half of SLE patients had sleep problems, an increased sleep latency, more awakenings during the night and lower sleep efficiency than healthy population.⁶

In health-related quality of life, we found very similar results that were obtained in the Spanish validation of LupusQoL, being the most affected domains emotional health and burden to others.²² The differences in fatigue and mood between SLE patients and healthy controls also were congruent with previous studies in which the patients were showing higher levels of fatigue,²⁷ anxiety and depression than healthy participants.⁶ The difference in perceive stress was not statistically significant, however, a *p*-value close to the significance (0.79) was found.

Focusing now on the relationship between sleep quality and the remaining variables, we found an association between three domains in which patients had a lower quality of life (burden to others, emotional health and body image) and indicators of sleep difficulties assessed both subjectively (subjective sleep duration, sleep efficiency, sleep disturbances and daytime dysfunction) and objectively (time in bed). It seems that a poor sleep quality was associated with lower quality of life comparing SLE patients with and

without self-reported sleep problems.⁷ However, the direction of the relations between the domains of burden to others and body image with duration and efficiency of sleep is the contrary to we were expecting. More alteration in both components of sleep quality (shorter sleep duration and less sleep efficiency) was associated with higher scores in quality of life in these domains. A recent study conducted a linear regression analysis between the components of LupusQoL and sleep quality (PSQI global index) in SLE patients with sleep disturbances. They find that only emotional health was associated independently and significantly with poor quality of sleep, finding no association with other components of quality of life, including body image and burden to others.⁷ In fact, in this study we didn't find an association between body image and burden to others and actigraphy parameters like actual sleep or sleep efficiency. Given these relationships that were expected in the opposite direction, we can only prove through the aforementioned study and our actigraphy data that these domains measured by the LupusQoL not appear to be consistently related to poor sleep quality, according to the regression analysis carried out with the objective measures.⁷ Therefore, regardless the other components, we can think emotional health is the most associated domain with sleep quality as in this sample. Further research should analyse if they find the same results in the relationships of these dimensions of both questionnaires.

Moreover, we find an association between some indicators of sleep difficulties (sleep duration, sleep disturbance, daytime dysfunction and time in bed) and some components of fatigue (physical, mental and reduced motivation and activity). More sleep disturbances were associated with higher level of physical fatigue and more reduction in motivation and activity. Also higher levels of daytime dysfunction were related to more mental fatigue and lower motivation and activity. These findings are similar to those found in other studies examining this relationship in SLE patients.⁸ On the other hand, the perception of shorter sleep duration was associated with less physical fatigue and more activity, contrary to expectations. It is possible that patients who have more symptoms of fatigue are trying to extend their sleep as compensatory strategy (so it would be an increased sleep duration), but this suggestion should be investigated in the future.

Anxious and depressed mood were also related to sleep problems in SLE. We observed that higher levels of anxiety and depression correlated with more sleep disturbance and more time in bed. In addition, patients with higher scores in depression perceived a worse daytime dysfunction. As in our study, the relationship between depression levels and daytime dysfunction have previously been reported in SLE

population, as well as between anxiety and sleep disturbances.⁷ However, the connection is not significant for other components of subjective sleep quality.⁷ Several studies have found that anxiety and depression correlate with perceived alterations of sleep,⁹⁻¹⁰ however, we must consider that some of them use of different assessment tools to employees in this study and it could influence the results. The complex and reciprocal relation between depression and sleep problems has wide support in the evidence. For example, some studies using regression models found the level of depression as the main determinant of sleep quality in SLE patients.^{6, 28} Finally, we found a significant relationship between perceived stress and sleep disturbances and daytime dysfunction. Although no studies have explored this relationship in SLE population, it has been found that perceived stress is a good predictor of sleep problems in other clinical populations as for rheumatoid arthritis patients.²⁹

To the best of our knowledge, there are only two studies with PSG, which showed that SLE patients had more sleep problems, lower sleep efficiency and a greater number of awakenings³⁰ or the presence of movement and respiratory disorders overnight.³¹ Although PSG and actigraphy are not fully comparable measures, our findings go in the direction of the studies using PSG.³⁰⁻³¹ We found a higher sleep fragmentation in SLE patients than controls. However, in other parameters there were no differences, but we observed a trend toward lower sleep efficiency and less sleep and more awake time at night in SLE patients compared to controls. Very few studies have employed objective sleep measures in SLE population. The present study is the first using actigraphy to assess objective sleep in SLE patients. Also we found few significant correlations between indicators of poor quality sleep assessed with objective and subjective measures. We found only a study comparing sleep perceptions with objective measures of sleep in SLE patients. At this regard, the unique study that has analysed sleep perceptions to objective measures (PSG) in SLE patients did not report association between sleep complaints and sleep disturbances assessed by PSG.³⁰ It is quite common to find discrepancies between perceived sleep quality and objective measures (PSG and actigraphy), specially among people with severe sleep problems. This lack of concordance between subjective and objective sleep measures in SLE patients could partly be explained by the fact that people with severe sleep problems use to misperceive their sleep quality in comparison with healthy controls. For example, persons with insomnia tend to overestimate sleep latency and to underestimate the total sleep time.³²

This study has several limitations to consider. First, the reduced sample employed here must be extended in future studies including also men. In another hand, there is a tendency to certain differences with the comparison group in educational level, although the difference is not significant. Moreover, sleep is measured by activity, not sleep itself³³ which could have influenced the results of objective sleep assessment we have obtained. However, although the “gold standard” to study sleep continues being PSG,⁶ in general nowadays it is accepted that actigraphy shows reasonable level of agreement with PSG and the good cost-benefit and great viability for clinical application of actigraphy are remarkable advantages. Future studies using actigraphy and PSG simultaneously can help to determine the relationship between the two forms of assessment and the usefulness of each one in SLE.

To conclude, this study found that SLE patients had a poorer quality of sleep (subjective and objective), which may have been related to a deterioration in the quality of life, more symptoms of fatigue and higher levels of anxiety, depression and perceived stress as compared with healthy sample. Based on this preliminary results and because of the lack of studies conducted to date in this field, future research should deepen the study of sleep in this disease. Sleep can be influencing a further deterioration in the clinical features of the disease and a worse quality of life of these patients. Get a more accurate knowledge in this field would help to implement effective interventions in this population to improve sleep quality leading to an improvement not only of the sleep but also of others clinical symptoms, emotional health and quality of life.

CONFLICT OF INTEREST STATEMENT

The authors declare that there is no conflict of interest.

REFERENCES

- 1 Pons-Estel G, Alarcón GS, Scofield L, Reinlib L, Cooper GS (2010) Understanding the epidemiology and progression of systemic lupus erythematosus. *Semin Arthritis Rheum* **39**, 257-268.
- 2 Lahita RG (2004) The clinical presentation of systemic lupus erythematosus. In RG Lahita (ed.), *Systemic lupus erythematosus* pp. 435-448. Academic Press, San Diego.

- 3 Seawell AH, Danoff-Burg S (2004) Psychosocial research on systemic lupus erythematosus: A literature review. *Lupus* **13**, 891-899.
- 4 Wong M, La Cava A (2011) Lupus, the current therapeutic approach, *Drugs of Today* **47**, 289-302.
- 5 Abad VC, Sarinas PSA, Guilleminault C (2008) Sleep and rheumatologic disorders. *Sleep Med Rev* **12**, 211-228.
- 6 Palagini L, Tani C, Mauri M, *et al.* (2014) Sleep disorders and systemic lupus erythematosus. *Lupus* **23**, 115-123.
- 7 Mirbagher L, Gholamrezaei A, Hosseini N, Sayed Bonakdar Z (2016) Sleep quality in women with systemic lupus erythematosus: Contributing factors and effects on health-related quality of life. *Int J Rheum Dis* **19**, 305-311.
- 8 Tench CM, McCurdie I, White PD, D´Cruz DP (2000) The prevalence and associations of fatigue in systemic lupus erythematosus. *Rheumatology (Oxford)* **39**, 1249-1254.
- 9 Kasitanon N, Achsavalertsak U, Maneeton B *et al.* (2013) Associated factors and psychotherapy on sleep disturbances in systemic lupus erythematosus. *Lupus* **22**, 1353-60.
- 10 Vina ER, Green SL, Trivedi T, Kwoh CK, Utset TO (2013) Correlates of sleep abnormalities in systemic lupus: A cross-sectional survey in an urban, academic center. *J Clin Rheumatol* **19**, 7-13.
- 11 Navarrete-Navarrete N, Peralta-Ramírez MI, Sabio JM, Martínez-Egea I, Santos-Ruiz A, Jiménez-Alonso J (2010) Quality-of-life predictor factors in patients with SLE and their modification after cognitive behavioural therapy. *Lupus* **19**, 1632-1639.
- 12 Tan EM, Cohen AS, Fries JF *et al.* (1982) The 1982 revised criteria for the classification of systemic lupus erythematosus. *Arthritis Rheum* **25**, 1271-7.
- 13 Hochberg MC (1997) Updating the American College of Rheumatology revised criteria for the classification of systemic lupus erythematosus. *Arthritis Rheum* **40**, 1725.
- 14 Van Someren EJW (2011) Actigraphic monitoring of sleep and circadian rhythms. *Handb Clin Neurol*, **98**, 55-63.
- 15 Marino M, Li Y, Rueschman MN, Winkelman JW *et al.* (2013) Measuring sleep: Accuracy, sensitivity, and specificity of wrist actigraphy compared to polysomnography. *Sleep*, **36**, 1747-1755.

- 16 Buysse D J, Reynolds CF, Monk TH, Berman SR, Kupfer DJ (1989) The pittsburgh sleep quality index: A new instrument for psychiatric practice and research. *Psychiatry Res*, **28**, 193-213.
- 17 McElhone K, Abbott J, Shelmerdine J, *et al.* (2007) Development and validation of a disease-specific health-related quality of life measure, the LupusQol, for adults with systemic lupus erythematosus. *Arthritis Rheum*, **57**, 972-979.
- 18 Smets EM, Garssen B, Bonke B, De Haes JC (1995) The multidimensional fatigue inventory (MFI) psychometric qualities of an instrument to assess fatigue. *J Psychosom Res*, **39**, 315-325.
- 19 Zigmond AS, Snaith RP (1983) The hospital anxiety and depression scale. *Acta Psychiatr Scand*, **67**, 361-370.
- 20 Cohen S, Kamarck T, Mermelstein R (1983) A global measure of perceived stress. *J Health Soc Behav*, **24**, 385.
- 21 Royuela A, Macías J (1997) Propiedades clinimétricas de la versión castellana del cuestionario de Pittsburgh. *Vigilia-Sueño*, **9**, 81-94.
- 22 González-Rodríguez V, Peralta-Ramírez MI, Navarrete-Navarrete N, Callejas-Rubio J, Santos Ruiz AM, Khamashta M (2010) Adaptation and validation of the spanish version of a disease-specific quality of life measure in patients with systemic lupus erythematosus: The lupus quality of life. *Medicina Clínica*, **134**, 13-16.
- 23 Fillion L, Gélinas C, Simard S, Savard J, Gagnon P (2003) Validation evidence for the french canadian adaptation of the multidimensional fatigue inventory as a measure of cancer-related fatigue. *Cancer Nurs*, **26**, 143-154
- 24 Herrero MJ, Blanch J, Peri JM, De Pablo J, Pintor L, Bulbena A (2003) A validation study of the hospital anxiety and depression scale (HADS) in a spanish population. *Gen Hosp Psychiatry*, **25**, 277-283.
- 25 Remor E (2006) Psychometric properties of a european spanish version of the perceived stress scale (PSS). *Span J Psychol*, **9**, 86-93.
- 26 Morin CM (ed.) *Insomnio: Asistencia y tratamiento psicológico*. Ariel, Barcelona.
- 27 McKinley PS, Ouellette SC, Winkel GH (1995) The contributions of disease activity, sleep patterns, and depression to fatigue in systemic lupus erythematosus. A proposed model. *Arthritis Rheum*, **38**, 826-834.
- 28 Costa DD, Bernatsky S, Dritsa M, *et al.* (2005) Determinants of sleep quality in women with systemic lupus erythematosus. *Arthritis Rheum*, **53**, 272-278.

- 29 Treharne GJ, Lyons AC, Hale ED, *et al.* (2007) Sleep disruption frequency in rheumatoid arthritis: Perceived stress predicts poor outcome over one year. *Musculoskeletal Care*, **5**, 51-64.
- 30 Iaboni A, Ibanez D, Gladman DD, Urowitz MB, Moldofsky H (2006) Fatigue in systemic lupus erythematosus: Contributions of disordered sleep, sleepiness, and depression. *J Rheumatol*, **33**, 2453-2457.
- 31 Valencia-Flores M, Resendiz M, Castaño VA, *et al.* (1999) Objective and subjective sleep disturbances in patients with systemic lupus erythematosus. *Arthritis Rheum*, **42**, 2189-2193.
- 32 Harvey AG, Tang NKY (2012) (Mis)perception of sleep in insomnia: A puzzle and a resolution. *Psychol Bull*, **138**, 77-101.
- 33 Krystal AD, Edinger JD (2008) Measuring sleep quality. *Sleep Med*, **9**, 10-17.

Table 1. Sociodemographic and clinical characteristics

Variables	SLE women (n=21)	Healthy women (n=20)	P
Age, M (SD)	38.33 (11.39)	37.20 (11.71)	0.755
Years with symptoms, M (SD)	1.66 (1.99)	-	-
Years since SLE diagnosis	13.91 (8.23)	-	-
Education level (%)			
Uneducated	0	5	0.060
Primary education	4.8	5	
Secondary education	4.8	5	
Bachelor	23.8	0	
Professional instruction	23.8	5	
University studies	42.9	80	
Work status (%)			
Student	14.3	30	0.079
Currently employed	42.9	65	
Retired	9.5	0	
Unemployed	23.8	5	
Sick leave for permanent disability	9.5	0	
Marital status (%)			
Single	42.9	55	0.833
Married	38.1	30	
Widowed	2.4	0	
Separated	4.9	5	
Divorced	4	10	
Number of children (%)			
0	57.1	55	0.678
1	14.3	15	
2	23.8	15	
3	4.8	15	
Current health (%)			
Bad	4.8	0	0.027*
Acceptable	42.9	10	
Good	47.6	60	
Excellent	4.8	30	
Medication (%)			
Antidepressants	10	0	0.147
Hypnotics	5	0	0.311
Opioids	0	0	-
Analgesics	5	0	0.311
Corticosteroids	85.7	14.3	0.002*

* $p < 0.05$. P-values referred to Chi-square tests for dichotomous variables and t -test for continuous variables.

Table 2. Comparison in self-report measures between SLE patients and control group

Self-report measures	SLE women (n=21)	Healthy women (n=20)	<i>T</i>	<i>p</i>
Sleep quality-PSQI, M (SD)				
Subjective sleep quality	1.29 (0.64)	0.80 (0.69)	2.32	0.026*
Sleep latency	1.67 (0.79)	0.95 (0.82)	2.83	0.007**
Sleep duration	1.38 (0.80)	0.70 (0.65)	2.95	0.005**
Habitual sleep efficiency	0.76 (0.94)	0.35 (0.67)	1.60	0.117
Sleep disturbances	1.62 (0.74)	1.15 (0.36)	2.59	0.015*
Use of sleeping medication	0.62 (1.02)	0.05 (0.22)	2.48	0.021*
Daytime dysfunction	1.29 (0.78)	0.80 (0.52)	2.32	0.026*
Global index of quality of sleep	8.62 (3.13)	4.80 (2.74)	4.13	0.000**
Quality of life-LupusQoL, M (SD)				
Physical health	72.09 (19.88)	-	-	-
Emotional health	62.93 (22.42)	-	-	-
Body image	70.67 (24.32)	-	-	-
Burden to others	57.50 (28.11)	-	-	-
Intimate relationships	73.30 (28.82)	-	-	-
Fatigue-MFI, M (SD)				
General fatigue	3.61(0.85)	2.35 (0.59)	5.51	0.000**
Physical fatigue	3.75 (0.92)	2.30 (0.85)	5.19	0.000**
Mental fatigue	3.05 (1.17)	1.72 (0.55)	4.68	0.000**
Reduced motivation	2.33 (1.08)	1.72 (0.42)	2.39	0.024*
Reduced activity	3.00 (1.24)	1.86 (0.58)	3.77	0.001**
Anxiety and depression-HADS, M (SD)				
Anxiety	8.38 (4.76)	3.95 (2.25)	3.83	0.001**
Depression	5.05 (3.68)	1.40 (1.84)	4.03	0.000**
Perceived stress-PSS, M (DT)	25.05 (9.84)	20.00 (7.24)	1.87	0.069

* $p < 0.05$; ** $p < 0.01$

Table 3. Comparison analysis for actigraphy parameters between the SLE patients and the control group

Actigraphy parameters M (DT)	SLE women (n=21)	Healthy women (n=20)	<i>t</i>	<i>p</i>
Time in bed (hours)	7:58 (1:02)	7:39 (0:57)	1,02	0.311
Actual sleep (%)	85.26 (3.98)	87.62 (3.80)	-1.91	0.063
Actual wake (%)	14.74 (3.98)	12.38 (3.80)	1.91	0.063
Sleep efficiency (%)	82.32 (4.63)	85.13 (4.49)	-1.91	0.063
Sleep latency (%)	0:12 (0:11)	0:09 (0:06)	1.32	0.193
Fragmentation index	27.93 (8.78)	21.85 (7.23)	2.38	0.022*

* $p < 0.05$

Table 4. Correlational analysis between subjective sleep quality and psychological variables in SLE patients

	Sleep quality-PSQI							
	Subjective sleep quality	Sleep latency	Sleep duration	Habitual sleep efficiency	Sleep disturbance	Use of sleeping medication	Daytime dysfunction	Global index
Quality of life-LupusQoL								
Physical health	0.231	0.081	0.164	0.338	-0.092	-0.059	0.083	0.191
Emotional health	-0.143	-0.137	0.427	0.047	-0.552*	0.087	-0.533*	-0.117
Body image	0.115	0.092	0.240	0.476*	-0.427	0.354	-0.024	0.260
Burden to others	-0.101	-0.385	0.475*	0.542*	-0.655**	0.192	-0.367	-0.017
Intimate relationships	0.229	-0.026	0.299	0.394	-0.300	-0.047	-0.176	0.106
Fatigue-MFI								
General fatigue	0.072	0.154	-0.271	-0.150	0.294	0.083	0.397	0.135
Physical fatigue	-0.105	0.085	-0.569**	-0.342	0.473*	-0.092	0.206	-0.116
Mental fatigue	0.241	0.076	0.054	0.262	0.471	-0.084	0.661**	0.398
Reduced motivation	0.241	0.237	-0.311	-0.128	0.559**	-0.093	0.619**	0.242
Reduced activity	0.265	0.390	-0.436*	-0.287	0.718**	-0.206	0.588**	0.204
Anxiety and depression-HADS								
Anxiety	0.289	0.404	-0.118	0.110	0.567**	0.082	0.397	0.424
Depression	0.226	0.381	-0.226	0.133	0.448*	0.045	0.498*	0.204
Perceived stress-PSS	0.179	0.232	-0.160	-0.171	0.607**	-0.316	0.458*	0.158

* $p < 0.05$; ** $p < 0.01$ **Table 5.** Correlation analyses between actigraphy parameters and self-report measures in SLE women

	Actigraphy parameters					
	Time in bed	Actual sleep	Actual wake	Sleep efficiency	Sleep latency	Fragmentation index
Sleep quality-PSQI						
Subjective sleep quality	0.166	-0.417	-0.417	-0.382	0.075	0.473*
Sleep latency	0.334	-0.264	-0.264	-0.345	0.307	0.242
Sleep duration	-0.316	-0.080	-0.080	-0.064	-0.108	0.248
Habitual sleep efficiency	0.227	-0.335	-0.335	-0.434	0.465*	0.361
Sleep disturbance	0.512*	-0.369	0.369	-0.242	-0.114	0.353
Use of sleeping medication	-0.007	0.263	-0.263	-0.019	0.553*	-0.144
Daytime dysfunction	0.379	-0.388	0.388	-0.291	-0.052	0.492*
Global index of sleep quality	0.307	-0.363	0.363	-0.442	0.345	0.481*
Quality of life-LupusQoL						
Physical health	0.160	-0.236	0.236	-0.255	0.102	0.260
Emotional health	-0.468*	0.283	-0.283	0.185	0.005	-0.269
Body image	-0.003	-0.040	0.040	-0.168	0.363	0.021
Burden to others	-0.308	0.121	-0.121	-0.088	0.049	-0.085
Intimate relationships	-0.078	-0.078	0.078	-0.038	-0.038	0.094
Fatigue-MFI						
General fatigue	0.274	0.196	-0.196	0.162	0.100	-0.197
Physical fatigue	0.372	0.190	-0.190	0.176	0.096	-0.289
Mental fatigue	0.425	-0.348	0.348	-0.250	0.054	0.440
Reduced motivation	0.472*	-0.269	0.269	-0.199	0.053	0.326
Reduced activity	0.548*	-0.271	0.271	-0.145	-0.071	0.173
Anxiety and depression-HADS						
Anxiety	0.515*	-0.348	0.348	-0.380	0.260	0.421
Depression	0.502*	-0.344	0.344	-0.381	0.301	0.376
Perceived stress-PSS	0.369	-0.320	0.320	-0.215	-0.098	0.378

* $p < 0.05$