ORIGINAL RESEARCH

Self-reported nonrestorative sleep in fibromyalgia – relationship to impairments of body functions, personal function factors, and quality of life

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Purpose: The purpose of this study was: 1) to determine variables that might characterize good or bad sleep; and 2) to describe the relationship between sleep, impairment of body functions, personal function factors, and quality of life based on quality of sleep in women with fibromyalgia (FM).

Methods: This cross-sectional descriptive study included 224 consecutive patients diagnosed at a specialist center. These patients were mailed a questionnaire concerning sleep, body functions, personal factors, and health-related quality of life. In total, 145 completed questionnaires were collected.

Results: Using sleep variables (sleep quality, waking up unrefreshed, and tiredness when getting up), we identified two subgroups – the good sleep subgroup and the bad sleep subgroup – of women with FM. These subgroups exhibited significantly different characteristics concerning pain intensity, psychological variables (depressed mood, anxiety, catastrophizing, and self-efficacy), impairments of body functions, and generic and health-related quality of life. The good sleep subgroup reported a significantly better situation, including higher employment/ study rate. The bad sleep subgroup reported a greater use of sleep medication. Five variables determined inclusion into either a good sleep or a bad sleep subgroup: pain in the evening, self-efficacy, anxiety, and according to the Short Form health survey role emotional and physical functioning.

Conclusion: This study found that it was possible to identify two subgroups of women with FM based on quality of sleep variables. The two subgroups differed significantly with respect to pain, psychological factors, impairments of body functions, and perceived quality of life, where the subgroup with bad sleep had a worse situation.

Keywords: activities of daily living, chronic pain, sleep disturbance

Introduction

In Western populations, the prevalence of fibromyalgia (FM) is approximately 2%–5%.[1–4] and the diagnosis is six times more common in women than men.[1] In addition to experiencing pain, FM patients experience fatigue, cognitive dysfunction, stiffness, mood disturbances, and nonrestorative sleep.[5–7] Guymer et al[8] showed that fatigue levels were significantly influenced by age and sleep disturbances, and sleep disturbances were significantly predicted by fatigue. In two studies, more than 90% of FM patients reported disturbed and nonrestorative sleep.[9,10] In addition, FM patients have reported difficulties falling or staying asleep, nonrestorative sleep, and waking up early in the morning.[10,11] According to Moldofsky,[10] nonrestorative sleep is not the same as insomnia, as it is essentially a qualitative phenomenon. Restorative or refreshing

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sleep depends on the amount one sleeps and when one sleeps. People who experience nonrestorative sleep characterize their sleep as light or superficial.[10]

According to the American College of Rheumatology (ACR), three core symptoms of nonrestorative sleep should be used when diagnosing FM: waking up feeling unrefreshed; cognitive difficulties; and fatigue.[12]

Sleep duration and nightly wake time did not, according to Anderson et al,[13] predict clinical FM pain, although Schaefer et al[9] showed that sleep disturbance measured by Medical Outcomes Study Sleep Scale increased significantly in severe FM. Furthermore, Roizenblatt et al[14] described that compared with healthy controls, most patients with FM perceived their sleep to be of poor quality, reporting it as nonrestorative, and reported worsening pain symptoms after nonrestorative sleep. Bigatti et al[15] found that FM patients exhibited persistent poor sleep quality, for instance, sleep duration and sleep latency, that eventually leads to increased pain, disability, and depression. A causal relationship and interaction may exist between FM, sleep, and mood disorders.[16]

Sleep disturbances can affect a patient's health-related quality of life (HRQoL); a comparison between matched controls and persons with FM showed a statistically significant difference between sleep difficulty symptoms, such as initiating and maintaining sleep, and HRQoL.[17] Consequences of the sleep difficulty symptoms such as social isolation and decreased physical activity were shown to severely impact HRQoL and, further, the effect extended beyond HRQoL.[17] The impact of symptoms was also shown in an interview study investigating general quality of life of working women with FM. The women highlighted the importance of having social relations, being active, and participating in society as essential for experiencing general quality of life.[18]

The aim of this study was: 1) to determine variables that might characterize good or bad sleep; and 2) to describe the relationship between sleep, impairment of body functions, personal function factors, and quality of life based on quality of sleep in women with FM.

Methods

The project was approved by the Research Ethics Committee of the Faculty of Health Sciences, Linköping University, Sweden.

Design

This study used a cross-sectional, descriptive design.[19] The participants completed a mailed questionnaire and instruments. The participants were sent a reminder 8 weeks after receiving the questionnaire and instruments.

Participants

Participants diagnosed with FM according to the 1990 ACR criteria[20] were consecutively enrolled from a pain clinic at a university hospital in southeast Sweden. In total, 224 consecutive patients were mailed a questionnaire. Eight weeks later a reminder was sent to the 93 patients who did not respond in the first instance. In the end, 173 (77%) responded and 28 (13%) did not want to participate in the study. In addition, 51 (23%) people did not respond at all, leaving 145 (64%) completed questionnaires available for the study.

Data collection instruments

Background variables included sex, age, family (marital status, children living at home), education (number of years), and employment/studies (full or part time). Further, medication usage was reported in an open-ended question.

Impairments of body functions

Questions about the participants' time since diagnosis, duration of symptoms, and pain characteristics (occurrence and alterations in pain) were included in the questionnaire. The participants indicated their perception of pain on a 10 cm visual analogue scale anchored at "no pain" and "worst imaginable pain". Visual analogue scale was also used to assess quality of sleep ("How was your sleep during the night?") from "very good" to "extremely bad", freshness in the morning ("How refreshed do you feel in the morning?") from "completely rested" to "not rested at all", and degree of tiredness ("How tired do you feel when getting up?") from "no tiredness" to "worst imaginable tiredness". Questions on depressed mood and fatigue were rated on a four-grade scale: "no, hardly ever"; "no, seldom"; "yes, sometimes"; and "yes, often".

Personal function factors

The fibromyalgia impact questionnaire (FIQ) measures the impact of the syndrome and includes questions on physical function, symptoms, interference of pain with work, sick leave, and the number of days the person felt well during the previous week. Each item is standardized on a scale between 0 and 10 points.[21] A higher score indicates greater impact. The Swedish version of the instrument has been validated.[22]

The Coping Strategy Questionnaire consists of six subscales that assess patient self-rated use of cognitive and behavioral strategies to cope with pain.[23] Each coping strategy

subscale consists of six items measured with a numerical rating scale indicating how frequently the strategy was used to cope with pain. An additional two single-item questions assessed effectiveness ratings of control over pain and ability to decrease pain. The Coping Strategy Questionnaire takes approximately 5 minutes to complete. The instrument has been tested in women with FM,[24] and the subscales have been shown to be reliable, valid, and sensitive to change. In this study, the subscale "catastrophizing" was used.

The Beck Anxiety Inventory contains 21 items that measure physiological and emotional symptoms of anxiety and discriminates symptoms of anxiety from those of depression.[25] Scores can range from 0 to 63 with higher scores indicating more anxiety. The scale was translated into Swedish in a previous study,[26] which indicated that the scale was internally consistent (Cronbach's alpha =0.88) and had a correlation of $r=0.49$ with the FIQ anxiety item.

The Arthritis Self-Efficacy Scale (ASES) is a 21-item scale divided into three subscales on which patients rate their ability to perform specific activities using a scale of 10%–100% surety.[27] The subscales include items on control of pain and the ability to do physical activities and other functions, such as ability to handle fatigue. Higher scores indicate higher self-efficacy. The scale has been validated in the Swedish version.[28]

Quality of life

The Quality of Life Scale, Swedish version (QOLS-S) is composed of 16 items that together describe quality of life using six categories: physical and material well-being; health; relations with other people; personal development and fulfilment; recreation; and independence.[29] Patients estimate satisfaction with their current situation on a seven-point Likert-type scale; the higher the total score, the higher the degree of satisfaction. Preliminary psychometric testing in Sweden reported good internal consistency reliability ($r=0.84$ for a 4-week interval) and evidence of construct validity (alpha =0.82 at time I and alpha =0.88 at time II) in rheumatic disease populations.[29] A descriptive review of the QOLS-S[30] reviewed the entire body of work to date, while another study[31] described construct validity using a larger sample of chronically ill and healthy subjects in the US and Sweden. Construct validity was also tested in a Swedish sample of 113 women with FM,[32] and the content validity was tested using focus group methodology.[19]

The 36-Item Short-Form Health Survey (SF-36) measures health status in eight domains: physical functioning; role physical; bodily pain; general health; vitality; social functioning; role emotional; and mental health.[33] The scale ranges from 0 to 100, where a higher score indicates better health status. The Swedish version of the SF-36 has been validated.[34]

Statistics

Descriptive statistics were used to describe the characteristics of the sample, and differences between groups were identified using the Mann–Whitney U test for independent groups or the chi-square statistics for nominal variables.

The three sleep variables – "sleep quality", "waking up refreshed", and "tiredness when getting up" – were submitted to K-means cluster analysis. An iterative procedure was done in which each participant's values were repeatedly assigned to cluster membership on the basis of distance to the center. The analysis resulted in two separated clusters. The K-means model was chosen since it is a well-known method for data mining to establish the most homogeneous groups.

A discriminant analysis was done with cluster membership as the grouping variable and pain intensity, fatigue, depressed mood, anxiety, self-efficacy, catastrophizing, physical function, and quality of life as independent variables. All analyses were done using SPSS version 20.0 (IBM Corporation, Armonk, NY, USA); P-values <0.05 were considered significant.

Results

The cluster analysis resulted in two subgroups. As intended, the two subgroups differed significantly on all three grouping variables. The first subgroup (n=43) – good sleep – was characterized by scoring good sleep quality (mean value [m] =3.8), waking up refreshed (m=4.2), and not so tired when getting up (m=3.9). The second subgroup (n=102) – bad sleep – was characterized by scoring bad sleep quality (m=7.0), waking up unrefreshed (m=8.4), and tired when getting up (m=7.8) (Table 1).

Table 2 presents demographics and medication usage. When comparing the background variables for the two subgroups, we found no significant differences in age, marital status, number of children living at home, or pain duration. The good sleep subgroup had a significantly higher proportion of women with university education than the bad sleep subgroup. The good sleep subgroup also had significantly higher employment/study rate, and more of these women worked full time. The bad sleep subgroup reported significantly higher usages of sleep medication.

The two subgroups were investigated for possible differences concerning pain variables. Compared to the good sleep subgroup, the bad sleep subgroup scored significantly

Table 1 Groups, "good sleep" and "bad sleep", based on K-means cluster analysis on the following sleep variables: "sleep quality", "waking up unrefreshed", and "tiredness when getting up"

Variables	Group					Scdfc
	Good sleep (n=43)		Bad sleep (n=102)		P-value	
	Mean	SD	Mean	SD		
Sleep						
Quality	3.8	2.0	7.0	1.9	<0.001	
Waking up unrefreshed	4.2	2.1	8.4	1.2	<0.001	
Tiredness when getting up	3.9	1.7	7.8	1.2	<0.001	
Pain						
In the morning	4.8	2.5	6.7	2.0	<0.001	0.25
In the evening	5.4	2.3	6.9	1.8	<0.001	0.34
Worst during the day	5.8	2.4	7.4	1.7	<0.001	−0.18
Mean during day	4.6	2.1	6.0	1.7	<0.001	−0.14
During movement	4.8	2.4	6.6	1.9	<0.001	−0.07
At rest	3.8	2.4	5.6	2.0	<0.001	0.17
Depressed mood	2.4	0.9	2.9	0.9	0.003	−0.07
Fatigue	3.1	0.8	3.7	0.5	<0.001	0.11
BAI	6.1	5.6	15.3	10.9	<0.001	0.33
CSQ catastrophizing	7.4	6.0	13.3	8.6	<0.001	−0.14
FIQ	53.3	18.2	61.9	17.2	0.011	0.13
ASES						
Pain	57.8	19.1	40.3	17.9	<0.001	0.20
Function	78.2	16.5	60.3	20.4	<0.001	−0.12
Symptoms	66.6	17.0	46.4	16.8	<0.001	−0.52
QOLS-S	85.7	13.7	73.6	14.9	<0.001	−0.01
SF-36						
Physical function	59.3	19.4	43.6	17.2	<0.001	−0.30
Role physical	32.7	36.8	11.4	19.2	<0.001	−0.15
Role emotional	66.7	42.9	49.3	45.5	0.039	0.35
Social function	69.2	25.6	49.9	25.0	<0.001	0.07
Bodily pain	39.3	18.5	26.5	14.1	<0.001	0.08
Vitality	42.2	19.2	21.8	16.8	<0.001	−0.29
Mental health	74.7	15.7	60.2	22.1	<0.001	−0.19
General health	46.6	22.5	35.4	18.3	0.006	0.15

Notes: The two groups have been compared with respect to the variables below the Sleep section. Mean values ± one SD are reported. For statistical comparison of the groups, Mann–Whitney U test was used; P-values are given, and P≤0.05 was regarded as significant. Scdfc are given.
Abbreviations: BAI, Beck Anxiety Inventory; CSQ, Coping Strategy Questionnaire; FIQ, fibromyalgia impact questionnaire; ASES, Arthritis Self-Efficacy Scale; QOLS-S, Quality of life Scale, Swedish version; Scdfc, standardized canonical discriminant function coefficients; SD, standard deviation; SF-36, The 36-Item Short-Form Health Survey.

Table 2 Background variables of the whole group of women with fibromyalgia and the subgroups "good sleep" and "bad sleep", based on K-means cluster analysis on the sleep variables: "sleep quality", "waking up unrefreshed", and "tiredness when going up"

Variables	Total (n=145)	Good sleep (n=43)	Bad sleep (n=102)	P-value
Age, years, mean (SD)	47.0 (10.1)	47.0 (10.1)	47.4 (10.2)	ns
Family, n (%)				ns
Single	28 (19)	10 (23)	18 (18)	
Married	116 (80)	33 (77)	82 (80)	
Missing Answers	1 (1)	0 (0)	2 (2)	
Children living at home, n (%)				ns
Yes	66 (45)	20 (47)	45 (44)	
No	66 (45)	18 (42)	48 (47)	
Missing Answers	13 (10)	5 (11)	9 (9)	
Education, n (%)				<0.05
9 years	42 (29)	10 (23)	32 (31)	
12 years	74 (51)	18 (42)	55 (54)	
University	26 (18)	13 (30)	13 (13)	
Missing Answers	3 (2)	2 (5)	2 (2)	
Employment/ studies, n (%)				<0.001
Full time	17 (12)	10 (23)	7 (7)	
Part time	40 (28)	8 (19)	32 (31)	
Not working/ studying	88 (60)	25 (58)	63 (62)	<0.05
Sleep medication, n (%)				
Yes	26 (18)	3 (7)	23 (22)	
No	119 (82)	40 (93)	79 (78)	

Notes: For statistical comparison of the subgroups Mann–Whitney U test was used; P-values are given, and P≤0.05 was regarded as significant.
Abbreviations: ns, nonsignificant; SD, standard deviation.

As assessed by FIQ, the bad sleep subgroup reported a significantly greater impact of FM on daily living. In addition, the bad sleep subgroup reported a significantly higher degree of catastrophizing.

General health, general quality of life, and HRQoL were assessed by QOLS-S, SF-36, and the item "general health last week". All scales showed a significant difference between the two subgroups: the good sleep subgroup reported a better perceived general health, general quality of life, and HRQoL than the bad sleep subgroup (Table 1).

The discriminant analysis resulted in a significant model (P<0.001) where ASES symptoms, pain in the evening, anxiety, role emotional, and physical function, according to SF-36 had the highest predictive loading for group belonging based on the standardized canonical discriminant function coefficients (Table 1). The model correctly classified 84.5% of the original grouped cases and 74.5% of the cross-validated cases.

higher on all pain variables (pain in the morning, pain in the evening, pain at worst during the day, mean pain during the day, pain when moving, and pain at rest). In addition, the bad sleep subgroup had significantly higher anxiety scores (Beck Anxiety Inventory). The good sleep group showed a higher degree of self-efficacy compared to the bad sleep subgroup, a difference that was significant.

Discussion

This cross-sectional study investigated the relationships between sleep in women with FM and impairment of body functions, personal function factors, and quality of life, and described the characteristics of different subgroups based on sleep. Five major findings were identified:

- Using sleep variables, we identified subgroups in a group of female patients with FM.
- The two subgroups showed significantly different characteristics concerning pain intensity, psychological variables, impairment, and quality of life: the good sleep subgroup reported a significantly better situation than the bad sleep subgroup.
- The good sleep subgroup had a higher employment/study rate than the bad sleep subgroup.
- The bad sleep subgroup used more sleep medication than the good sleep subgroup.
- The variables (according to the discriminant analysis) determining which subgroup the patients belonged to were the ASES subscale "symptoms", pain in the evening, anxiety, and role emotional and physical function according to SF-36.

In this study, 70% of the women reported nonrestorative sleep, a finding that is similar to Consoli et al[35] who reported a frequency of 75%. However, this percentage is still a somewhat lower number compared to the cross-sectional study performed by Schaefer et al.[9] Eighty-one percent of their participants reported nonrestorative sleep and 90% of the general population with FM reported nonrestorative sleep.[10] Compared to the studies of Schaefer et al[9] and Consoli et al,[35] the women in our study were of the same age and worked outside their home to the same degree. Therefore, differences in sleep disturbances may be due to different measures used to investigate sleep problems.

There were no differences in either age or children living at home between the two groups in our study. Previous research has shown that having children living at home makes it difficult for women with FM to work.[36] The good sleep subgroup had higher education and more were working outside their homes. These two factors may imply that the higher education, the more possibility the women had to control and influence their work situation and experience a supportive environment, resulting in better and more opportunities to remain in a work role.[37] White and Harth[2] also showed that education level was a predictor for work capacity, and Bigatti et al[15] found that higher education predicted better sleep. Hence, good sleep may influence the possibility to remain employed and, in that way, being able to experience participation in society. In this

study, 40% of the women worked outside their homes, which is in reasonable agreement with other reports where work disability varies from 25% to 50% in patients with prolonged or chronic pain.[38] The bad sleep subgroup were more often employed part time compared with the good sleep subgroup, a difference that may have indicated that sleep disturbances negatively influenced work.

The bad sleep subgroup had a significantly worse situation concerning pain intensity in all variables (ie, in the morning, evening, at worst and mean during the day, when moving, and at rest). Roizenblatt et al[14] and Bigatti et al[15] found that sleeping problems lead to more severe pain. Furthermore, Anderson et al[13] found that sleep problems may have an important role in the maintenance of pain since there may be a reciprocal relationship between sleep disorders and pain as sleep disturbance can be regarded as both a consequence of and a causal or maintenance mechanism for pain.

Some studies have suggested that non-benzodiazepine hypnotics can improve sleep and possibly fatigue in FM patients.[39,40] The frequency of hypnotic medication use in our study might seem quite low: 22% in the bad sleep subgroup and 7% in the good sleep subgroup. However, population surveys show that between 0.7% and 7% of adults reported use of hypnotics,[41] and 28% of people with major current insomnia used sleep-enhancing medication.[42] Thus, not all people experiencing poor sleep try to solve their problem by using hypnotic drugs or are not offered medication by their physician. This also seems to be the case among patients with FM in this study. According to Spaeth et al,[43] the first step is to obtain the patient's sleep history, such as activities before sleep, attitudes toward sleep, dietary and other intakes, daytime activities, and information about sleep initiation, perpetuation, and duration. Furthermore, it is recommended that nonpharmacological therapies should be considered as the first-line treatment for FM.

Results in this study agrees with the results of Wagner et al[17] who showed that sleep disturbances affected persons with FM, an obvious HRQoL of issue. In this study, a generic quality of life measure (QOLS-S) was also used to add information about quality of life in general, and the bad sleep subgroup showed a worse situation even here. This may suggest that a nonrestorative sleep impacted their whole life situation extending beyond HRQoL; meaning that social relations, the possibility of being active, and the ability to participate in society were affected. The bad sleep subgroup showed a statistically significantly worse situation in all variables (impairment of body functions and personal function factors) measured in this study and may explain the lower quality of life.

In this study, it was also obvious that people's ability to control and manage their own situation was of significant importance for their sleep problems, where a lower self-efficacy leads to a worse situation concerning perceived sleep. Anxiety compared with depressed mood showed a significantly higher importance in this study. Previous studies – eg, Bigatti et al[15] – showed that poor sleep quality can lead to depression. In this study, we did not use a specific validated depression scale and that may be a weakness. Still, we used questions concerning depressed mood used in previous studies. This may explain the different results, as variables are measured in different ways.

The discriminant analysis resulted in a significant model ($P<0.001$) where a lower self-efficacy, physical functioning, and role emotional according to the SF-36, and a higher level of anxiety had the highest predictive loading for group belonging, findings that suggest that factors such as impairment of body functions, but especially personal function factors, are of importance for a nonrestorative sleep and should be considered to a greater extent in health care.

Limitations

The participants were drawn from a clinic at tertiary health care level and may thus represent more disabled people than could be expected in a general FM population. The data may not be representative for persons managed in the primary care setting.

This cross-sectional study has some limitations: the results are only confined to a specific time and the people with FM are not a homogenous group. These limitations may have influenced the results and should be taken into consideration as the women only reported their state of health and their difficulties at the time of the cross-sectional study. While analyzing data, we have not corrected for multiple comparisons. Instead, all of the individual P-values have been reported, in line with Rothman's[44] suggestion to make the analyses transparent.

A weakness in this study is the lack of not using validated sleep and depression questionnaires. Since the investigations with the questionnaire and enclosed instruments were extensive, we choose to use some specific questions investigating nonrestorative sleep and depression.

Conclusion

This study found that it was possible to identify two subgroups of women with FM based on quality of sleep variables. The two subgroups differed significantly with respect to pain, psychological factors, impairments of body functions, and

perceived quality of life, where the subgroup with bad sleep had a worse situation. It is important to assess and address sleep problems with a holistic approach in clinical practice so as to gain adequate treatment and a better whole life situation for patients with FM.

Disclosure

The authors report no conflicts of interest in this work.

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