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Prevalence of Fibromyalgia Syndrome in Infertile Women and Its Effects on Quality of Life and Sleep

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Abstract; Infertility is a very common problem which may have social, cultural, and economical consequences. Fibromyalgia also frequently affects women of reproductive age. Both conditions impair quality of life and adversely influence sleep quality, as well. The aim of this study was to evaluate the association between female infertility and fibromyalgia as well as their effects on quality of life, sleep quality, and several reproductive hormones. This study included 52 infertile women and 38 women who attended to the obstetrics and gynecology outpatient clinic for family planning purposes. The diagnosis of fibromyalgia was made as per American College of Rheumatology (ACR) criteria. Study participants were asked to complete Pittsburgh Sleep Quality Index (PSQI), the 36-item Short Form Health Survey (SF-36), and fibromyalgia impact questionnaire (FIQ). The frequency of fibromyalgia was not significantly different between the groups. Infertile women in this study were younger, had significantly lower educational status, and less likely to be employed compared with the control group. Among the SF-36 subscales physical functioning, role physical, vitality, mental health, social functioning, and bodily pain scores were lower in the control group than the infertile group. PSQI total score was not different between the groups. Although infertility is known to be stressful, the burden of caring for small children is also high for mothers which should be taken into consideration while evaluating the effects of infertility, and motherhood on quality of life and sleep quality of women at childbearing age.

INTRODUCTION

A formal definition of infertility is "the failure to achieve a successful pregnancy after 12 months or more of appropriate, timed unprotected intercourse or therapeutic donor insemination"[1]. Infertility is a prevalent problem affecting 1 in every 7 marriages worldwide [2]. Infertility is a stressful and traumatic condition which may have social, cultural, and economical consequences [3]. Especially social pressure may be stressful for infertile women, which may trigger several psychosomatic problems [4].

Fibromyalgia (FM) is characterized by chronic widespread pain, tiredness, and sleep disturbance [5]. Anxiety, depression, and impairment in activities of daily living also accompany this disorder. Although the exact etiology is yet to be known, disturbance in the regulation of the autonomic and neuro-endocrine systems seems to be crucial considering characteristic sleep pattern changes and alterations in neuroendocrine neurotransmitters such as serotonin, cortisol, substance P, and growth hormone [6]. Fibromyalgia has a frequent co-occurrence with mood disorders, moreover hypothalamic pituitary adrenal (HPA) axis is implicated in the development of both conditions [7]. The association between fibromyalgia and infertility has rarely been investigated previously. In women with myofascial face pain, reduced fecundity was found in the group with fibromyalgia [8]. Also a previous study in endometriosis patients, which is a common cause of infertility, found a higher rate of FM [9]. High levels of stress in infertile women may cause de novo or exacerbate existing fibromyalgia by means of HPA axis or other endocrine pathways.

Approximately 80% of fibromyalgia patients report poor sleep. In the fibromyalgia population there is a strong and dose dependent association between fibromyalgia symptoms and sleep quality. Few research studies have been conducted on sleep disturbances in infertility. Pal et al. studied sleep disturbances in infertile women using single item query "do you experience disturbed sleep?", and got positive answers from 34% of the participants [10]. The authors found that after controlling for race, body mass index, and vasomotor symptoms, probability of sleep disturbance was 20 times higher among women with diminished ovarian reserve. Lin et al. also evaluated infertile women receiving intrauterine insemination

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and showed that greater than 35% of women reported sleep disturbances [11]. The most plausible pathway accounting for the relationship between sleep disturbance and infertility is the HPA activation.

Fibromyalgia has many chronic somatic and psychological symptoms which may cause poorer health related quality of life (HRQOL). HRQOL of fibromyalgia patients has been compared with many other disease states including rheumatoid arthritis, chronic obstructive pulmonary disease, congestive heart failure, hypertension, and diabetes and was found to be worse than those disorders [12]. Infertility is also associated with impaired HRQOL. Infertile women reported poorer marital adjustment and HRQOL compared with controls.

Anti-Mullerian hormone (AMH) is secreted by the granulosa cells of early antral follicles. AMH level shows a strong correlation with the number of primordial follicles remaining in ovaries [13]. Serum AMH level is used as a marker for reproductive potential for women and as a reliable predictor when a woman will reach menopause. AMH levels were assessed in several musculoskeletal disorders. In women with rheumatoid arthritis, spondyloarthritis, or Behcet's disease, AMH levels were found to be lower than controls.

The aim of this study was to investigate the frequency of FM in female patients attending an infertility clinic and to determine the associations between infertility, FM, life quality, sleep, and several reproductive hormones, including AMH.

MATERIALS and METHODS

Patients and controls

This study included women of reproductive age (15-49) who were assessed at the fertility clinic of Cumhuriyet University hospital due to infertility between January to March 2018. Screening interviews were performed with 85 infertile patients. Among them 13 patients refused to participate in the study. Eight patients were excluded because their ages were not appropriate for the study. A patient was excluded because she was illiterate. History of major depression or systemic diseases were also exclusion criteria and eleven patients were excluded because they had previous diagnoses of major depressive disorder or they were using antidepressant treatment. The control group included women at the same age period who had at least 1 child and admitted to the Obstetrics and Gynecology outpatient clinic of Cumhuriyet University hospital for family planning purposes.

Method

The patients and the controls who accepted to participate in the study were seen once to complete the study surveys and evaluation for fibromyalgia. Age, weight, height, and the cause of infertility were recorded. Blood samples were obtained and prolactin, follicular stimulating hormone (FSH), luteinizing hormone (LH), and AMH levels were measured. Patients and control subjects were asked to complete Short Form-36 (SF-36), fibromyalgia impact questionnaire (FIQ), and Pittsburgh Sleep Quality Index (PSQI).

Diagnosis of fibromyalgia was made by a physical therapy and rehabilitation specialist as per American College of Rheumatology (ACR) 2010 FM diagnostic criteria [14]. Symptom severity index (SSI) and widespread pain index (WPI) scores of the subjects who were diagnosed with FM were recorded.

Surveys

Short Form-36 (SF-36): This is a valid and frequently used questionnaire to evaluate quality of life. SF-36 was developed by Ware et al [15]. Validity and reliability of its Turkish version was studied [16]. It is not specific to an age, disease, or treatment group. It includes general health concepts. It is developed to be used in clinical practice and research. It includes 36 items in 8 subscales, namely physical functioning, role physical, bodily pain, role emotional, social functioning, general health, mental health, and vitality. The total score for each component ranges between 0-100 and higher scores indicate higher quality of life.

Pittsburgh Sleep Quality Index (PSQI): This self-report scale was developed by Buysse et al. to assess sleep quality in clinical populations over a 1 month period. It includes nineteen individual items which generate seven "component" scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction [17]. Each component is scored between 0-3. Higher scores indicate worse sleep quality. Validity and reliability study of the Turkish version of PSQI was performed by Agargun et al. [18].

Fibromyalgia Impact Questionnaire (FIQ): The FIQ was developed by Burchardt et al. to evaluate current health status of women with FM [19]. It consists of 10 items. The questionnaire measures physical functioning, work status,

depression, anxiety, morning tiredness, pain stiffness, fatigue, and well being over the past week. Each item is scored on a scale between 0-10 (the total score may be between 0-100). FIQ is a self rated scale. Validity and reliability study of the Turkish version of the scale was performed by Sarmer et al. [20].

Statistical analysis

To summarize the data obtained from the study the results were presented as mean ± standard deviation or median and interquartile range. Categorical variables were summarized as number and percentage. Normality checks of the numerical data were performed by the Kolomogorov Smirnov test. Chi-square test and Fisher Freeman Halton tests were used to compare education status, employment status, and FM rates according to infertility status. Independent Samples t test was used for continuous variables when the data demonstrated normal distribution and Mann-Whitney U test was used when the distribution was not normally distributed. "sm.ancova" function in "sm" package of R software was used to control the effect of age on several SF-36 components and "Raov" function in "Rfit" package was used to control the effects of working status and education. Spearman's Rho correlation coefficient was used to evaluate the association between numerical variables. Univariate and multiple logistic regression models were used to investigate the risk factors that affect FM and the results were given as odds ratio and 95% confidence interval. Jamovi software was used for the statistical analyses and $p<0.05$ was accepted as statistically significant.

RESULTS

This study included 52 infertile women and 38 controls. The mean age of infertile women (29.4 ± 4.8 years) was lower (32.8 ± 5.9) than controls (p=0.005). The mean weight, height, and body mass index (BMI) were similar between the patient and control groups. The control group had a significantly higher educational status (p=0.003) and more likely to be employed (p<0.001) than the infertile group (Table 1).

The frequency of FM was not different between the infertile (11/52) and the control (9/38) groups (p=0.977). The median SSS was significantly higher in the control group (p=0.007) while the median WPI was not different between the groups. FIQ was also not different between the groups. Among the SF-36 subscales physical functioning, role physical, vitality, mental health, social functioning, and bodily pain were lower in the control group than the infertile group (Table 2). PSQI total score was not different between the groups. Among PSQI subdomains median score in sleep duration domain was higher (p=0.036) in the control group than in the infertile group. Other PSQI subdomain scores were similar between the groups (Table 2).

Comparisons were made according to the presence of FM. The median age, height, weight, BMI, education status, and employment status were similar between the patients with and without FM (Table 3). FSH, LH, and AMH levels weren't statistically significantly different. Among the SF36 domains the median values for Physical Functioning, Role Physical, Bodily Pain, and Change in Health were significantly lower in FM patients (p=0.002, p=0.002, p<0.001, and p=0.036; respectively). PSQI total score and its subjective sleep quality, and sleep disturbance subscales were higher in FM patients (p=0.040, p=0.046, and p=0.005, respectively) (Table 3).

Correlation analyses were performed to assess the relationship between the levels of reproductive hormones such as FSH, LH, and AMH in infertile women and clinical parameters for fibromyalgia, quality of life and sleep quality. Positive and significant correlations were found between AMH levels and role emotional, and bodily pain components of SF-36 and habitual sleep efficiency component of PSQI (r=0.314, r=0.278, and r=0.407; respectively). A positive correlation was also found between LH level and bodily pain

Table 1. Comparison of several sociodemographic variables among women with and without infertility

	Infertility		
	No (n=38)	Yes (n=52)	p
Age	32.8 ± 5.9	29.4 ± 4.8	0.005
Weight	68.2 ± 12.9	66.2 ± 10.4	0.450
Height	162.0 ± 6.2	160.6 ± 6.4	0.321
BMI	26.0 ± 4.7	25.7 ± 3.9	0.756
Education Level (%)			
Secondary School	9 (23.7)	27 (51.9)	0.003
High School	9 (23.7)	15 (28.8)	
University	20 (52.6)	10 (19.2)	
Employment Status (%)			
Unemployed	9 (23.7)	42 (80.8)	<0.001
Employed	29 (76.3)	10 (19.2)	

Statistics for normally distributed variables were given as mean (± standard deviation). Descriptive statistics for categorical variables were given as number (%). P values in bold were accepted as statistically significant (p<0.05).
**: Independent Samples t test was used.*
***: Pearson Chi-Square test was used.*

Table 2. Comparison of several variables according to the fertility status of the participants.

	Infertility			Factor - P value*		Covariate - P value**
	No (n=38)	Yes (n=52)	p	Employment	Education	Age
WPI (median [IQR])	3.0 [2.0 - 5.0]	3.0 [0.0 - 8.5]	0.669	-	-	-
SSS (median [IQR])	6.0 [4.0 - 8.0]	4.0 [1.0 - 6.0]	0.007			
FM (%)				-	-	-
No	29 (76.3)	41 (78.8)	0.977	-	-	-
Yes	9 (23.7)	11 (21.2)		-	-	-
Physical Function (median [IQR])	87.5 [55.0 - 100.0]	100.0 [88.8 - 100.0]	0.009	0.426	0.763	0.052
Role Physical (median [IQR])	62.5 [0.0 - 100.0]	100.0 [50.0 - 100.0]	0.025	0.999	0.999	0.193
Role Emotional (median [IQR])	67.0 [0.0 - 100.0]	100.0 [0.0 - 100.0]	0.179	-	-	-
Viability (median [IQR])	40.0 [31.2 - 58.8]	55.0 [50.0 - 66.2]	0.001	0.407	0.931	0.065
Mental Health	52.0 [44.0, 67.0]	68.0 [60.0, 76.0]	<0.001	0.999	0.700	0.001
Social Functioning (median [IQR])	63.0 [38.0 -100.0]	81.5 [63.0 - 100.0]	0.022	0.460	0.277	0.124
Bodily Pain (median [IQR])	68.0 [45.0 - 80.0]	90.0 [68.0 - 100.0]	0.001	0.785	0.675	0.006
General Health Perception	58.3 ± 22.4	61.2 ± 15.5	0.500	-	-	-
FIQ (median [IQR])	55.0 [43.0 - 57.0]	50.6 [44.9 - 54.0]	0.239	-	-	-
1 – Subjective sleep quality (median [IQR])	1.0 [1.0 - 2.0]	1.0 [1.0 - 1.0]	0.148	-	-	-
2 – Sleep latency (median [IQR])	1.0 [0.0 - 2.0]	1.0 [1.0 - 2.0]	0.759	-	-	-
3 – Sleep duration (median [IQR])	1.0 [0.0 - 1.0]	0.0 [0.0 - 1.0]	0.036	0.999	0.999	0.439
4 – Habitual sleep efficiency (median [IQR])	0.0 [0.0 - 0.0]	0.0 [0.0 - 0.0]	0.368	-	-	-
5 – Sleep disturbance (median [IQR])	1.0 [1.0 - 2.0]	1.0 [1.0 - 1.0]	0.181	-	-	-
6 – Sleep medications (median [IQR])	0.0 [0.0 - 0.0]	0.0 [0.0 - 0.0]	NaN	-	-	-
7 – Daytime sleep dysfunction (median [IQR])	0.5 [0.0 - 1.8]	0.0 [0.0 - 1.0]	0.189	-	-	-
PSQI (median [IQR])	5.0 [3.0 - 8.0]	5.0 [3.0 - 6.0]	0.351	-	-	-

IQR, Interquartile Range; FM, fibromyalgia; WPI, widespread pain index; SSS, symptom severity scale; BMI, Body Mass Index; FIQ, fibromyalgia impact questionnaire; PSQI, Pittsburgh Sleep Quality Index.
Descriptive statistics for normally distributed variables were given as mean ± SD and Independent Samples t test was used for comparison. Descriptive statistics for variables that didn't have normal distribution were given as median [IQR] and Mann Whitney U test was used for comparison. Descriptive statistics for categorical variables were given as number (%). P values in bold were accepted to be statistically significant (p<0.05).
**: An R software package "Rfit" (Rank Estimation for Linear Models), "raov" function was used.*
***: An R software package "sm" (Smoothing Methods for Nonparametric Regression and Density Estimation)," sm.ancova" function was used*

(r=0.288) (Table 4).

DISCUSSION

In this study we evaluated the relationships between infertility, fibromyalgia, reproductive hormones, quality of life, and sleep quality. The results of this present study did not show any difference in FM frequency between infertile women and control subjects.

Sinaii et al. demonstrated increased prevalence of FM in patients with endometriosis which is one of the main causes of infertility [9]. On the other hand, Nunes et al. couldn't find a difference in the prevalence of fibromyalgia between women with and without endometriosis [21]. Some factors may account for the lack of a positive relationship in our study results between FM and infertility. Our study didn't include a diagnostic interview and examination of patients, instead it relied on self-report forms completed by the patients which may have augmented the prevalence rate. Moreover, our study sample included women with infertility with reasons other than endometriosis. Thus, this may have obscured a possible significant relationship. Raphael and Marbach et al. examined fecundity in 162 women with myofacial pain syndrome some of which also had fibromyalgia [8]. The authors found that only women with fibromyalgia had decreased rates of fecundity and they discussed HPA axis malfunction as a possible explanation for the association between infertility and chronic pain syndromes. In our study, small sample size might have decreased the chance to find a relationship between FM and infertility.

In our study, infertile women had higher quality of life scores than women who had children. This may be surprising at first but there are several factors that may explain such a relationship. Lau et al. evaluated 192 infertile couples in China and showed that lower income and lower education status were among the causes of lower quality of life [22]. Bien et al. investigated quality of life of women who are childless by choice and found that financial status and education were sig-

Table 3. Comparison of several variables according to the presence of fibromyalgia.

	FM		
	Hayır (n=41)	Evet (n=11)	p
Age (median [IQR])	28.0 [26.0 - 31.0]	31.0 [28.5 - 35.0]	0.056**
Weight(median [IQR])	66.0 [58.0 - 70.0]	72.0 [65.5 - 77.0]	0.071**
Height (median [IQR])	160.0 [155.0 - 165.0]	163.0 [160.0 - 166.5]	0.357**
BMI (median [IQR])	24.8 [21.8 - 28.0]	28.6 [25.6 - 29.3]	0.097**
Education level (%)			
Secondary school	24 (58.5)	3 (27.3)	0.107*
High school	11 (26.8)	4 (36.4)	
University	6 (14.6)	4 (36.4)	
Employment status (%)			
Unemployed	35 (85.4)	7 (63.6)	0.190*
Employed	6 (14.6)	4 (36.4)	
TSH (median [IQR])	2.0 [1.4 - 2.9]	3.2 [2.0 - 3.3]	0.139**
Prolactin (median [IQR])	18.0 [14.0 - 25.5]	22.0 [17.0 - 25.1]	0.560**
FSH (median [IQR])	7.2 [5.6 - 8.2]	6.0 [5.4 - 6.8]	0.235**
LH (median [IQR])	6.2 [4.9 - 8.1]	4.8 [4.3 - 7.2]	0.319**
AMH (median [IQR])	3.3 [1.4 - 5.5]	1.8 [0.7 - 4.0]	0.180**
Physical functioning (median [IQR])	100.0 [95.0 - 100.0]	80.0 [75.0 - 90.0]	0.002**
Role physical (median [IQR])	100.0 [75.0 - 100.0]	25.0 [0.0 - 87.5]	0.002**
Role emotional (median [IQR])	100.0 [33.0 - 100.0]	0.0 [0.0 - 100.0]	0.056**
Vitality (median [IQR])	55.0 [50.0 - 70.0]	50.0 [40.0 - 62.5]	0.138**
Mental health (median [IQR])	68.0 [60.0 - 76.0]	68.0 [60.0 - 76.0]	0.937**
Social functioning (median [IQR])	88.0 [63.0 - 100.0]	63.0 [63.0 - 81.5]	0.060**
Bodily pain (median [IQR])	90.0 [88.0 - 100.0]	58.0 [53.0 - 69.0]	<0.001**
General Health Perception (median [IQR])	60.0 [50.0 - 80.0]	50.0 [47.5 - 60.0]	0.060**
PSQI (median [IQR])	4.0 [3.0 - 5.2]	6.0 [4.5 - 7.5]	0.040**
1 – Subjective sleep quality (median [IQR])	1.0 [1.0 - 1.0]	1.0 [1.0 - 2.0]	0.046**
2 – Sleep latency (median [IQR])	1.0 [0.0 - 2.0]	1.0 [1.0 - 1.5]	0.792**
3 – Sleep duration (median [IQR])	0.0 [0.0 - 1.0]	0.0 [0.0 - 1.5]	0.140**
4 – Habitual sleep efficiency (median [IQR])	0.0 [0.0 - 0.0]	0.0 [0.0 - 0.0]	0.176**
5 – Sleep disturbance (median [IQR])	1.0 [1.0 - 1.0]	2.0 [1.0 - 2.0]	0.005**
6 – Sleep medications (median [IQR])	0.0 [0.0 - 0.0]	0.0 [0.0 - 0.0]	NaN**
7 – Daytime sleep dysfunction (median [IQR])	0.0 [0.0 - 1.0]	1.0 [0.0 - 1.0]	0.434**

IQR, Interquartile Range; FM, fibromyalgia; BMI: Body Mass Index, PSQI: Pittsburgh Sleep Quality Index; TSH, thyroid stimulating hormone; FSH, follicule stimualting hormone; LH, luteinizing hormone; AMH, anti-Mullerian hormone, NaN: Not-a-Number
Descriptive statistics for normally distributed variables were given as mean ± SD verilip and Independent Samples t test was used for comparison. Descriptive statistics for variables that didn't have normal distribution were given as median [IQR] and Mann Whitney U test was used for comparison. Descriptive statistics for categorical variables were given as number (%). P values in bold were accepted to be statistically significant (p<0.05).
**: Pearson Chi-square test was used. **: Mann Whitney U test was used.*

nificant factors and a high education level and a good financial

Table 4. Correlations between several clinical parameters and hormone levels in infertile patients.

	TSH	Prolactin	FSH	LH	AMH
WPI	0.182	0.137	-0.064	-0.122	-0.177
SSS	0.182	0.044	-0.147	-0.063	-0.210
Physical Functioning	-0.003	-0.145	-0.014	0.276	0.291
Role physical	-0.118	-0.165	-0.155	0.306	0.384
Role emotional	-0.190	0.039	-0.069	0.235	0.314*
Vitality	-0.059	-0.052	0.019	0.260	0.234
Mental health	-0.048	-0.042	-0.092	0.124	0.266
Social functioning	-0.100	0.128	-0.113	0.135	0.261
Bodily pain	-0.174	-0.126	-0.176	0.288*	0.278*
General health questionnaire	-0.093	0.104	0.122	0.051	-0.015
PSQI, total	0.246	0.009	0.098	-0.077	0.167
Subjective sleep quality	0.202	-0.138	0.006	-0.174	0.145
Sleep latency	0.255	-0.021	0.043	-0.022	0.158
Sleep duration	0.357*	-0.009	-0.083	-0.153	-0.013
Habitual sleep efficiency	0.227	0.157	-0.098	0.019	0.407*
Sleep disturbance	-0.004	0.024	0.153	-0.080	0.110
Sleep medication	NaN	NaN	NaN	NaN	NaN
Daytime dysfunction	0.133	0.072	0.195	0.007	0.077

*WPI, widespread pain index; SSS, symptom severity index; Correlation coefficients in bold were accepted to be statistically significant (*p<0.05). Spearman's Rho correlation coefficient was used. NaN: Not-a-Number*

standing predicted better quality of life [23]. In a study performed in American population, it was found that childless individuals earned more and accumulated more wealth than those who had children [24]. In our study, infertile women had a higher education status and a higher employment rate which may have caused higher quality of life scores than women who had children. To investigate the effects of age, education level and employment status, we controlled these covariates with statistical methods and we found that working status, and education did not affect any of the significant parameters. Age affected only mental health and bodily pain components. These results suggested that having children imposes adverse effects on quality of life independent from working status and education.

Quality of life in FM is a frequently investigated topic and we found consistent findings with previous studies. Verbunt et al. evaluated 54 visitors of a rehabilitation department and found lower quality of life scores in physical functioning (37.8), role limitations because of physical health (8.3), bodily pain (30.8), vitality (34.6), and general health (38.5) domains of SF-36 [25]. Martinez et al. studied FM patients from a rheumatology outpatient clinic and demonstrated lower scores in all 8 domains of SF-36 [26]. We also found significantly lower scores in physical functioning, role physical, and bodily pain dimensions of SF-36 scales which suggest that pain and physical limitations due to disease impair the quality of life in FM patients. We found significant positive correlations between AMH level and Role Emotional and Bodily Pain components of SF-36 in infertile women. One possible explanation for the association of AMH with bodily pain and role emotional dimensions of PCOS is through polycystic ovarian syndrome (PCOS). PCOS is a treatable cause of infertility and AMH levels consistently rise in this disorder. Studies in women with PCOS consistently demonstrated poor quality of life in all domains of SF-36. Jones et al. found that role emotional had the greatest negative impact on HRQoL in women with PCOS [27].

Our results showed worse sleep duration component of PSQI in infertile women compared with the control group. This finding is in accordance with Goldstein et al.'s study which showed sleep disorders in 57% of women receiving IVF treatment during the pretreatment period [28]. Huang et al. also demonstrated that 56.2% of infertile women had less than 7 hours of sleep per day and 43.3% had PSQI score more than 5 indicating poor sleep quality [29]. They also found high anxiety levels in infertile women which may be the cause of sleep difficulties experienced by these women.

The results of our study showed an association between AMH levels and habitual sleep efficiency component of PSQI. To the best of our knowledge, no previous study has reported findings about such a relationship. Pal et al. asked 'do you experience disturbed sleep?' to infertile women and found a significant relationship between diminished ovarian reserve and sleep disturbance [10]. The authors proposed that decreased testosterone and estrogen levels may underlie this relationship. They also suggested that low fertility potential may have increased the anxiety level of these subjects and led to sleep disturbance.

We also found a significant relationship between TSH level and sleep duration component of SF-36. A previous study found that TSH levels surged under acute sleep deprivation [30]. Our finding also suggest that TSH levels increase in patients with decreased sleep duration.

Small sample size is the main limitation of this study. In addition, sleep quality was measured with a subjective tool and the subjects were not grouped according to the causes of infertility. Yet, this study provides important clues regarding the relations among infertility, fibromyalgia, sleep quality, and quality of life.

CONCLUSION

Infertility is a common problem which causes stress and impairs quality of life of infertile women. However caring for small children imposes a high burden on mothers with accompanying sleep disturbances and financial hardships which may cause stress levels equal to or even higher than the former group. Many factors including economic, social, and gender role related ones should be assessed when evaluating the effects of infertility, and motherhood on quality of life and sleep quality of women at childbearing age.

Conflict of interest

The authors have no conflicts of interest to declare.

REFERENCES

1. Practice Committee of the American Society for Reproductive Medicine. Definitions of infertility and recurrent pregnancy loss.

Fertil Steril. 2008;89(6):1603.

2. Ashraf DM, Ali D, Azadeh DM. Effect of infertility on the quality of life, a cross- sectional study. *J Clin Diagn Res*. 2014;8(10):13-15.
3. Aarts JW, Huppelschoten AG, van Empel IW, Boivin J, Verhaak CM, Kremer JA, et al. How patient-centred care relates to patients' quality of life and distress: a study in 427 women experiencing infertility. *Hum Reprod*. 2012;27(2):488-495.
4. Yusuf L. Depression, anxiety and stress among female patients of infertility; A case control study. *Pak J Med Sci*. 2016;32(6):1340-1343.
5. Hauser W, Ablin J, Fitzcharles MA, Littlejohn G, Luciano JV, Usui C, et al. Fibromyalgia. *Nat Rev Dis Primers*. 201513;1:15022:1-16.
6. Jahan F, Nanji K, Qidwai W, Qasim R. Fibromyalgia syndrome: an overview of pathophysiology, diagnosis and management. *Oman Med J.* 2012;27(3):192-195.
7. Tanriverdi F, Karaca Z, Unluhizarci K, Kelestimur F. The hypothalamo-pituitary-adrenal axis in chronic fatigue syndrome and fibromyalgia syndrome. *Stress.* 2007;10(1):13-25.
8. Raphael KG, Marbach JJ. Comorbid fibromyalgia accounts for reduced fecundity in women with myofascial face pain. *Clin J Pain.* 2000;16(1):29-36.
9. Sinaii N, Cleary SD, Ballweg ML, Nieman LK, Stratton P. High rates of autoimmune and endocrine disorders, fibromyalgia, chronic fatigue syndrome and atopic diseases among women with endometriosis: a survey analysis. *Hum Reprod*. 2002;17 (10):2715-2724.
10. Pal L, Bevilacqua K, Zeitlian G, Shu J, Santoro N. Implications of diminished ovarian reserve (DOR) extend well beyond reproductive concerns. *Menopause*. 2008;15(6):1086-1094.
11. Lin JL, Lin YH, Chueh KH. Somatic symptoms, psychological distress and sleep disturbance among infertile women with intrauterine insemination treatment. *J Clin Nurs*. 2014;23(11-12):1677-1684.
12. Hoffman DL, Dukes EM. The health status burden of people with fibromyalgia: a review of studies that assessed health status with the SF-36 or the SF-12. *Int J Clin Pract*. 2008;62(1):115-126.
13. Hansen KR, Hodnett GM, Knowlton N, Craig LB. Correlation of ovarian reserve tests with histologically determined primordial follicle number. *Fertil Steril*. 2011;95(1):170-175.
14. Wolfe F, Clauw DJ, Fitzcharles MA, Goldenberg DL, Katz RS, Mease P, et al. The American College of Rheumatology preliminary diagnostic criteria for fibromyalgia and measurement of symptom severity. *Arthritis Care Res* (Hoboken). 2010;62(5):600-610.
15. Ware JE, Jr., Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Med Care.* 1992;30(6):473-483.
16. Koçyigit H, Aydemir O, Olmez N, Memis A. [Reliability and validity of SF-36 for Turkish]SF-36'nin Turkce icin guvenilirligi ve gecerliligi. *Ege Fiz Ted Reh Derg.* 1999;12:102-106.
17. Buysse DJ, Reynolds CF, 3rd, 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.
18. Ağargün M, Kara H, Anlar Ö. [Validity and reliability of Pittsburgh sleep quality index] Pittsburgh uyku kalitesi İndeksi'nin geçerliliği ve güvenirliliği. *Turkish Journal of Psychiatry*. . 1996;7(2):107-115.
19. Burckhardt CS, Clark SR, Bennett RM. The fibromyalgia impact questionnaire: development and validation. *J Rheumatol*. 1991;18(5):728-733.
20. Sarmer S, Ergin S, Yavuzer G. The validity and reliability of the Turkish version of the Fibromyalgia Impact Questionnaire. *Rheumatol Int.* 2000;20(1):9-12.
21. Nunes FR, Ferreira JM, Bahamondes L. Prevalence of fibromyalgia and quality of life in women with and without endometriosis. *Gynecol Endocrinol*. 2014;30(4):307-310.
22. Lau JT, Wang Q, Cheng Y, Kim JH, Yang X, Tsui HY. Infertility-related perceptions and responses and their associations with quality of life among rural chinese infertile couples. *J Sex Marital Ther.* 2008;34(3):248-67.
23. Bien A, Rzonca E, Iwanowicz-Palus G, Lecyk U, Bojar I. The quality of life and satisfaction with life of women who are childless by choice. *Ann Agric Environ Med*. 2017;24(2):250-253.
24. Plotnick RD. Childlessness and the economic well-being of older *Americans. J Gerontol B Psychol Sci Soc Sci.* 2009;64(6):767-776.
25. Verbunt JA, Pernot DH, Smeets RJ. Disability and quality of life in patients with fibromyalgia. *Health Qual Life Outcomes*. 2008; 22;6:8:1-8.
26. Martinez JE, Barauna Filho IS, Kubokawa K, Pedreira IS, Machado LA, Cevasco G. Evaluation of the quality of life in Brazilian women with fibromyalgia, through the medical outcome survey 36 item short-form study. *Disabil Rehabil*. 2001;20;23(2):64-68.
27. Jones GL, Benes K, Clark TL, Denham R, Holder MG, Haynes TJ, et al. The Polycystic Ovary Syndrome Health-Related Quality of Life Questionnaire (PCOSQ): a validation. *Hum Reprod*. 2004;19 (2):371-377.
28. Goldstein CA, Lanham MS, Smith YR, O'Brien LM. Sleep in women undergoing in vitro fertilization: a pilot study. *Sleep Med*. 2017;32:105-113.

29. Huang LH, Kuo CP, Lu YC, Lee MS, Lee SH. Association of emotional distress and quality of sleep among women receiving in-vitro fertilization treatment. *Taiwan J Obstet Gynecol*. 2019;58(1):168-172.
30. Van Cauter E, Tasali E. Endocrine physiology in relation to sleep and sleep disturbances. In: Kryger M, Roth T, Dement W, editors. Principles and practice of sleep medicine. Elsevier; 2017. p. 202-219.