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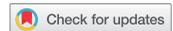
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The relationship between sleep quality and lifestyle in postmenopausal Iranian women: a cross-sectional study

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ABSTRACT

One of the most frequent symptoms in postmenopausal women is sleep disturbance. This study aimed to determine the relationship between sleep quality and lifestyle factors in postmenopausal women. Postmenopausal women ($n = 252$) in Ahvaz, Iran with an age range of 45–55 years, were enrolled from April to December 2015. The study tools included the Lifestyle Questionnaire (LSQ) and Pittsburgh Sleep Quality Index. The LSQ contains 10 lifestyle factors: physical health, physical activity, weight control and nutrition, psychological health, spiritual health, social health, medications and narcotics avoidance, illness prevention, accident prevention, and environmental health. Data were analyzed using, chi-square, Pearson correlation coefficients, analysis of variance, and multiple linear regressions. In unadjusted analyses, physical health, physical activity, nutrition, mental health, spiritual health, social health, and medication and narcotics avoidance scores were significantly higher in women without sleep disruption than in those with light and moderate sleep disruption ($p < .001$). Adjusting for confounding factors, sleep disruption was directly related to duration since the final menstrual period ($p < .001$), and inversely related to physical health ($p = .04$) and spiritual health ($p = .028$). Lifestyle factors were related to sleep disruption in postmenopausal women. Policymakers should consider education on healthy lifestyles for women.

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KEYWORDS

Health status; lifestyle factors; menopause; sleep quality

Introduction

Menopause is defined as the end of menstrual periods, and it physiologically results from the natural depletion of ovarian follicles, resulting in permanent amenorrhea (Freedman 2014). Some postmenopausal women have few or no symptoms and thus are not necessarily in need of medical treatment. The signs and symptoms of menopause are characterized by the onset of irregular menses, hot flashes, and night sweats (Nordqvist 2017). Menopause is also associated with changes in behavior and other biological functions, such as mood swings, anxiety, stress, forgetfulness, and sleep disturbances (Weber et al., 2013). During menopause, estrogen levels decrease; this may be associated with a decline in cognitive functioning, in addition to depressive disorders (Schmidt et al, 2005; Twiss et al. 2007; Weber, Rubin, and Maki 2013).

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Throughout their lives, women are more prone to have greater sleep disturbances than men, especially during pregnancy and menopause (Kravitz and Joffe 2011). The causes for sleep disorders in postmenopausal women can be divided broadly into psychological and physical. However, changes in sleep patterns after menopause are frequently the result of physical factors (Weber, Rubin, and Maki 2013). Psychological factors, such as feeling overworked, daily emotional stress, and fatigue can cause sleep problems, regardless of whether a woman is postmenopausal (Kravitz et al, 2011). Sleep disturbances in the perimenopause have almost the same prevalence as postmenopausally (Xu et al, 2014).

Postmenopausal sleep disorders have been related to disruptions in hormone levels; a decrease in estrogen causes various side effects, including a decrease in the serotonin levels, which is used to produce melatonin, a sleep hormone (Guidozzi et al. 2014). In general, sleep disorders in postmenopausal women are a multifactorial problem, including factors such as; hot flashes, depressive disorders, sleep-related breathing disorders, increased age, and environmental and behavioral factors (Baker et al. 2018).

Sometimes a simple change in lifestyle can provide significant relief for sleep disorders in postmenopausal women (Jehan et al. 2015). Although it has been established that sleep problems are linked to a decrease in estrogen levels, the biggest practical step to resolving sleep problems may be lifestyle modifications, such as maintaining a healthy diet and exercise routine (Moudi et al. 2018).

The population in Iran includes five million postmenopausal women, and the mean age at the final menstrual period of these women is 49.6 ± 4.5 years (Farahmand et al, 2013). Additionally, some of these postmenopausal women experience sleep problems (Taira et al. 2012). Although some studies have been conducted to investigate the relationship between a health-promoting lifestyle and sleep quality in Iranian pre- and postmenopausal women (Moudi et al. 2018) or in rotating factory shift workers (male and female) (Ghods et al. 2017), the number of studies on this topic has been low, and further information is needed on this issue to inform preventive strategies. Therefore, this study aimed to determine the relationship between sleep quality and lifestyle factors, physical health and spiritual health in postmenopausal Iranian women. We hypothesized that sleep quality would be positively related to healthy lifestyle factors.

Materials and methods

Study participants

This cross-sectional study included 252 postmenopausal women who met the study inclusion criteria and were randomly selected from 10 health centers in Ahvaz, Iran. Postmenopausal women aged 45–55 years who experienced natural menopause confirmed by menstrual cessation for at least one year or a follicle-stimulating hormone level ≥ 40 IU (Polesel et al. 2017) were eligible for inclusion in the study. Women who had sleep disturbances before menopause, who were using menopausal hormone therapy, had hypothyroidism, had experienced any stressful events during the past year, or had depressive disorders were excluded. This study started in April and was completed in December 2015. The design of the study was approved by the Ethics Committee of Ahvaz

Jundishapur University of Medical Sciences. All women provided written informed consent for use of their data for research.

Sampling

A sample size of 252 women was determined through a pilot study of 20 postmenopausal who met the inclusion criteria, using the following formula:

$$n = \frac{(Z_{1-\alpha/2} + Z_{1-\beta})^2}{\left(\frac{1}{2}Ln \frac{1+r}{1-r}\right)^2} + 3 \Rightarrow n = \frac{(1.96 + 1.65)^2}{\left(\frac{1}{2}Ln \frac{1+0.5}{1-0.5}\right)^2} + 3 = 63 * 2 * 2 = 252$$

$$Z_{1-\alpha/2} = 1.96 \Leftarrow CI = 95\% \text{ for type I error of } 5\%$$

$$Z_{1-\beta} = 1.65 \Leftarrow 80\% \text{ power}$$

$r = 0.5$ from pilot study (correlation between sleep disruption and lifestyle)

Three hundred fifty postmenopausal women were screened using the inclusion criteria, and 275 met the inclusion and exclusion criteria. Twenty-three of these women refused to participate; 252 provided consent to participate.

Measures

Three questionnaires were used to collect data, including a demographic questionnaire, the Lifestyle Questionnaire (LSQ), and the Pittsburgh Sleep Quality Index (PSQI) for diagnosing sleep disruption.

The LSQ contains 10 factors: physical health (eight questions), physical activity (seven questions), weight control and nutrition (seven questions), psychological health (seven questions), spiritual health (six questions), social health (seven questions), medications and narcotics avoidance (six questions), illness prevention (seven questions), accident prevention (seven questions) and environmental health (seven items). A four-item Likert scale, including never, sometimes, often, and always (0 to 3 points possible for each item) as responses, was used to score the factors. The total possible score thus ranged from 0 to 144. A higher total score and for each factor represents a better lifestyle. The LSQ was designed by Lali, Abedi, and Kojbaf (2012) and its validity and reliability were confirmed in 300 Iranian teachers.

The PSQI contains 19 self-report questions and five questions that are to be completed by participants' spouse. In this study, we only considered the participants' self-reported questions. Of these 19 questions, 15 multiple choice questions measured the frequency of subjective sleep problems and sleep quality, and four questions were about sleeping in bed, waking time, latency period of sleep and subjective quality of sleep. This questionnaire has seven domains, and each domain has a score from 0 to 3 (indicating no problem to severe problem), with the total possible score thus ranging from 0 to 21. A score of ≥ 5 indicates poor sleep quality. The validity and reliability of this scale were determined by Backhaus et al. (2002). Additionally, Farrahi Moghaddam et al. (2013) confirmed the validity and reliability of this scale in Iran. According to the PSQI, women were classified into one of

four possible groups as follows: <5, without sleep disruption; 5–10, mild sleep disruption; 11–16, moderate sleep disruption; and 17–21, severe sleep disruption.

The body mass index (BMI) was calculated based on the self-reported weight and height of participants (weight in kg/[height in m²]).

Statistics

To evaluate the relationship between lifestyle factors and sleep disruption, Pearson's correlation coefficient and linear regression models were used. Analysis of variance was used to detect differences between groups, and a post hoc test was used to detect the group that was responsible for the differences. Multiple linear regression was used to assess the relationship between sleep disruption and lifestyle factors after adjusting for confounding variables that were significantly ($p < .05$) related to each measure of sleep disruption including age, menopause duration, body mass index, women's education, job, and economic situation. The criteria used to assess the fit of the regression models was r^2 . The multiple linear regression models using stepwise method retained variables associated with each outcome at $p < .05$ and were used for measuring the relationship between sleep disruption and lifestyle factors. Data were analyzed using SPSS version 21 statistical software (IBM Corp). P values less than .05 considered significant.

Results

According to the PSQI, each woman was classified into one of four groups. None of the participants had severe sleep disruption; therefore, each woman was classified into one of three groups of normal sleep, mild or moderate sleep disruption. Participants' average age was higher in the women with moderate sleep disruption than in the other two groups ($p < .001$). Women without sleep disruption were younger and had the shortest duration since the final menstrual period (2.21 ± 1.23 years, $p < .001$).

Women in the three sleep disruption groups differed significantly in mean in body mass index (BMI, 26.76 ± 1.80 , 27.36 ± 1.68 and 27.81 ± 1.79 kg/m² in the normal sleep, mild sleep disruption, and moderate sleep disruption groups, respectively, $p = .01$). The three groups also differed significantly in age, education, duration since the final menstrual period, BMI, occupation, and economic status ($p < .005$) (Table 1).

In unadjusted analyses, women with normal sleep had significantly better physical health, physical activity, nutrition, mental health, spiritual health, social health, avoidance of drugs and narcotics, environmental health, disease prevention and accident prevention than that in the women with the mild and moderate sleep disruption ($p < .001$) (Table 2).

Also in correlation analyses, an inverse relationship was observed between physical health, physical activity, nutrition, mental health, spiritual health, social health, drug and narcotics avoidance, environmental health, accident prevention and disease prevention and sleep disruption ($p < .001$), and between the total lifestyle score ($r = -0.641$) and sleep disruption, suggesting that as the sleep disruption score increased, the overall lifestyle score and its factors were worse or in the less healthy direction (Table 3).

Further in unadjusted analyses, a significant positive relationship was observed between age ($\beta = 0.159$) and duration since the final menstrual period ($\beta = 0.227$), and negative correlations were observed between body mass index ($\beta = -0.134$), physical

Table 1. Sociodemographic characteristics of women in three groups of normal sleep, mild and moderate sleep disruption.

Variable	Normal sleep n=61	Mild sleep disruption n=135	Moderate sleep disruption n=38	Average Overall	P value
Mean \pm SD					
Age (years)	50.34 \pm 1.78	51.30 \pm 1.65	52.03 \pm 1.88	51.18 \pm 1.80	<.001
Number of pregnancies	5.39 \pm 1.42	5.02 \pm 1.39	4.81 \pm 1.50	5.09 \pm 1.43	.13
Number of deliveries	4.82 \pm 1.31	4.64 \pm 1.33	4.47 \pm 1.39	4.66 \pm 1.34	.44
Number of children	4.56 \pm 1.43	4.29 \pm 1.30	4.16 \pm 1.42	4.34 \pm 1.36	.29
Age at final menstrual period (years)	48.56 \pm 1.47	48.68 \pm 1.50	49.42 \pm 1.63	48.54 \pm 1.52	.61
Duration since final menstrual period (years)	2.21 \pm 1.23	3.13 \pm 1.09	4.11 \pm 1.17	3.05 \pm 1.28	<.001
Body mass index (kg/m ²)	26.76 \pm 1.80	27.36 \pm 1.68	27.81 \pm 1.79	27.28 \pm 1.75	.01
N (%)					
Women's education					
Illiterate	6 (9.8)	7 (4.6)	4 (10.5)	17 (6.7)	.028
Elementary	21 (34.4)	27 (17.6)	5 (13.2)	53 (21)	
Secondary education	17 (27.9)	70 (45.8)	12 (31.6)	99 (39.3)	
Diploma	13 (21.3)	42 (27.5)	15 (39.5)	70 (28.7)	
College	4 (6.6)	7 (4.6)	2 (5.3)	13 (5.2)	
Woman's job					
Employee	5 (8.2)	22 (14.4)	7 (18.4)	34 (13.5)	.03
Housewife	56 (91.8)	131 (85.6)	31 (81.6)	218 (86.5)	
Marital status					
Married	59 (97.6)	144 (94.1)	35 (92.1)	238 (94.4)	.59
Widow	2 (3.3)	9 (5.9)	3 (7.9)	14 (5.6)	
Economic situation					
Good	19 (31.1)	38 (24.8)	0 (0)	57 (22.6)	<.001
Fair	31 (50.80)	88 (57.5)	23 (60.5)	142 (56.3)	
Poor	11 (18)	27 (17.6)	15 (39.5)	53 (21)	

Table 2. Unadjusted relations between lifestyle factors and sleep disruption in postmenopausal women.

Variables	Sleep disruption			Test value (F)	p-Value
	Normal sleep	Mild	Moderate		
Lifestyle aspects	Means \pm SD				
Physical health	20.51 \pm 4.6	16.89 \pm 4.27	14.53 \pm 4.83	25.34	<.001
Physical activity	15.41 \pm 4.53	10.88 \pm 4.25	7.42 \pm 4.36	43.13	<.001
Nutrition	17.07 \pm 3.7	13.61 \pm 3.59	10.53 \pm 4.32	37.75	<.001
Mental health	17.16 \pm 4.05	14.77 \pm 3.52	11.79 \pm 4.09	25	<.001
Spiritual health	15.62 \pm 3.15	13.00 \pm 3.26	11.11 \pm 4.03	23.29	<.001
Social health	18.51 \pm 3.33	16.50 \pm 3.27	12.92 \pm 5.75	25.85	<.001
Avoid drugs and narcotics	14.36 \pm 2.82	11.33 \pm 3.01	8.11 \pm 4.25	46.20	<.001
Environmental Health	15.3 \pm 4	10.40 \pm 4.1	6.73 \pm 4.58	54.7	<.001
Disease prevention	16.3 \pm 2.5	12.8 \pm 4.4	7.7 \pm 5.9	44.8	<.001
Accident prevention	17.21 \pm 3.3	14.05 \pm 3.1	11.07 \pm 4.2	40	<.001
Total score of lifestyle factors	118.65 \pm 25.64	96.98 \pm 25.07	76.41 \pm 31.63	73.2	<.001

health ($\beta = -0.187$), physical activity ($\beta = -0.241$), nutrition ($\beta = -0.210$), mental health ($\beta = -0.133$), and spiritual health ($\beta = -0.172$) and sleep disruption ($p < .05$) (Table 4).

After using multiple linear regression to adjust for confounding factors, sleep disruption had a positive relationship with duration since the final menstrual period ($\beta = 0.214$,

Table 3. The correlations between lifestyle factors and sleep disruption.

Lifestyle	<i>r</i>	<i>p</i> -Value
Physical health	−0.421	<.001
Physical activity	−0.481	<.001
Nutrition	−0.452	<.001
Mental health	−0.437	<.001
Spiritual health	−0.445	<.001
Social health	−0.433	<.001
Avoid drugs and narcotics	−0.578	<.001
Environmental health	−0.602	<.001
Accident prevention	−0.551	<.001
Disease prevention	−0.535	<.001
Lifestyle total score	−0.641	<.001

Table 4. Multiple linear regression for the relation of factors with sleep disruption.

Model	β	<i>t</i>	<i>p</i> -Value
Age per year	0.159	2.85	.005
Duration since final menstrual period	0.227	3.94	<.001
Body mass index	−0.134	−2.43	.016
Physical health score	−0.187	−3.07	.002
Physical activity	−0.241	−3.58	<.001
Nutrition score	−0.210	−3.29	.001
Mental health score	−0.133	−2.19	.02
Spiritual health score	−0.172	−2.84	.005
Social health score	−0.113	−1.90	.058

Table 5. Multiple linear regression for the relation of lifestyle factors to sleep disruption.

	Nonstandardized coefficients		Standardized coefficients		<i>p</i> -Value
	β	Standard error	β	<i>t</i>	<i>p</i> -Value
Constant	1.162	0.117		9.92	<.001
Physical health score	−0.016	0.006	−0.191	−2.86	.004
Duration since final menstrual period	0.072	0.019	0.214	3.81	<.001
Spiritual health score	−0.015	−0.007	−0.132	−2.21	.028

$p < .001$) and an inverse relationship with physical health ($\beta = -0.191$, $p = .04$) and spiritual health ($\beta = -0.132$, $p = .028$) (Table 5).

Discussion

The present study's unadjusted results showed that a higher sleep disruption score was related to lower overall lifestyle score and lower scores for its component factors. In unadjusted linear analyses physical health, physical activity, nutrition, mental health, spiritual health, social health and medication, and narcotics avoidance scores were significantly higher in women with normal sleep than in women with mild and moderate sleep disruption. However, only the relationship between physical health and spiritual health with sleep quality remained significant after adjustment for confounding variables. In a study examining the relationship between sleep quality and the general health, Gadie

et al. (2017) found results comparable to our study's findings, showing significant positive relationships between sleep quality and general health and its components (i.e., mental health, cognitive and physical health).

In the current study, participants who did not have sleep disruption had the highest scores on spiritual health in the adjusted multiple regression models. Zhang et al. (2007) conducted a study to assess sleep quality and related factors in postmenopausal women. Their results showed that depressive symptoms, anxiety and mental health disorders were significantly related to the quality of sleep. Psychological problems, such as anxiety, sadness, depressive symptoms, and bipolar disorders, can be important factors related to sleep problems because of the associated high levels of cortisol (a stress hormone) (Tavallayi et al. 2008).

Prayer, spiritual belief, and approaches to spirituality and belief in a superior power help people feel relaxed, and this can strengthen the bodily system, including the immune system, cardiovascular system, and digestive systems; thus, physical and mental health are achieved and sleep quality improves (Salander 2006). Kravitz et al. (2008) conducted a study to assess the prevalence of sleep problems and their relationships with demographic factors and the psychological and social health of postmenopausal women. They found that people who were socially active compared to those who were not had better sleep. These results are consistent with our findings.

The current study's findings indicated that sleep disruption was directly related to the duration since the final menstrual period. Ghorbani et al (2012) found a significant relationship between duration since the final menstrual period and poor sleep quality; however, Seib, Anderson, and Lee (2014) reported that longer menopause duration was not significantly correlated with sleep disorders, which is inconsistent with the present study's results.

Overall, the results of this study showed that women with better physical and spiritual health had less sleep disruption.

Limitations of study

In this study, we relied on participants' self-report, which may have been affected by recall bias and social acceptability bias. Additionally, we could not assess the quality of sleep from the husbands' viewpoint. Knowing the spouses' views may provide more comprehensive information. Furthermore, the design of this study was cross-sectional, which does not permit assessment of the temporal and thus potentially causal relation of variables. Additionally, the non-representative sample potentially limits the generalizability of results. Finally, we did not assess vasomotor symptoms of the participating women. Most postmenopausal women have vasomotor symptoms (hot flashes), and these have been strongly associated with sleep disruption (De Zambotti et al. 2014) and with some of the lifestyle factors examined so that the lack of inclusion of these symptoms was likely to have resulted in residual confounding.

Conclusion

In this study, lifestyle factors were related to sleep disruption in postmenopausal Iranian women. Policymakers should consider providing education on healthy lifestyles for postmenopausal women.

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Author contribution

MT, MI, and PA were responsible for the design of study. MI did the data collection. PA MI and MT analyzed and interpreted data. MI was involving to write thesis in Persian. PA was responsible to write the manuscript in English.

Conflict of interest

The authors report no conflicts of interest.

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