



Comparison of Sleep patterns in Menopausal and Non-menopausal Women: Results of the First Phase of Shahedieh Cohort Study

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ABSTRACT

Background: Sleep disorders adversely affect human health. The present study aimed to compare the sleep patterns of menopausal and non-menopausal women.

Methods: This case-control study was based on the data of the first phase of Shahedieh cohort study in Yazd, Iran during 2015-2016. The case group included menopausal women (n = 1,709), and the control group included non-menopausal women (n = 3,121). The study variables were assessed by the questions regarding the menopause status and sleep. Data analysis was performed in SPSS version 20.

Results: The sleep duration of the menopausal and non-menopausal women was 7.1 ± 1.3 and 7.4 ± 1.3 hours, respectively ($P = 0.001$). Most of the menopausal women reported the restless legs syndrome during sleep, naps during the day without specific activity, and using sleeping pills more than twice weekly. After adjusting the effect of the other variables, the possibility of the sleep duration of less than six hours or more than eight hours in the menopausal women was 13 times higher than the non-menopausal women, while the correlation was not considered significant (OR = 1.13; 95% CI = 0.98-1.29; $P = 0.07$).

Conclusion: The prevalence of sleep disorders (e.g., sleep latency, restless legs syndrome, naps during the day, use of sleeping pills) was higher in the menopausal women.

1. Introduction

With increased longevity and life expectancy in recent decades, more women are expected to experience menopause. It is predicted that 1.2 billion women will be menopausal by 2030, with the total number reaching 4.7 million per year [1]. Therefore, the issues in women's lives will increase inevitably. Menopause occurs naturally in some women (natural menopause), while it requires surgery in others (surgical menopause) [2]. During the menopausal transition, women experience changes such as sleeping disorders, heart problems, hot flashes, night

sweats, joint and muscular pain, mental disorders (e.g., anxiety, depressive, irritability, and exhaustion), and sexual issues, which occur due to the declined body hormones [3].

It has also been reported that 40-60% of premenopausal and postmenopausal women suffer from sleep disorders [4]. In the study by Batool *et al.* (2014) sleep problems were most commonly reported by menopausal women, and 93% of educated menopausal women and 77% of uneducated menopausal women experienced these issues [3].

Sleep disorders in menopausal women could reduce the quality of life, while also causing physical and mental health issues, such as depression, anxiety, and excessive use of



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sleeping pills [5,6]. Some studies have indicated that the main cause of sleep disorders in menopausal women is the decreased levels of estrogen in this period [7]. Proper sleep contributes to the development, repair, learning, and strengthening of the memory. However, inadequate sleep may lead to fatigue, decreased concentration, decreased appetite, aggression, anxiety, and various cognitive and behavioral disorders [8].

Sleep disorders may manifest as insomnia or inappropriate sleep. Insomnia may appear as sleep latency, alternate waking during the night, waking up early in the morning or a combination of these modes. Inappropriate sleep may manifest in the form of short or long sleep durations, lower subjective sleep quality, restless legs syndrome (RLS), and respiratory complications in sleep, such as apnea or snoring [9]. In a study in this regard, Wang *et al.* (2015) reported the high risk of osteopenia and osteoporosis in postmenopausal women with delayed bedtime, as well as decreased nocturnal sleep duration, increased daytime sleep, and napping duration [10].

Considering that adequate sleep is essential to physical and mental health and menopausal women may experience sleep disorders, attention should be paid to their lifestyle and educational interventions to improve the possible sleep problems. According to the findings of Taavoni *et al.* (2014) 70% of menopausal women have sleep disorders [11], while Sussman *et al.* (2015) have reported that 17% of menopausal women have insomnia [12]. Furthermore, the results obtained by Nisar and Sohoo have indicated that 85.3% of premenopausal women and 79.2% of postmenopausal women had sleep problems, which was statistically significant [13].

Several studies have investigated the association of sleep and menopause, proposing different results. Evidence suggests that sleep disorders are significantly more prevalent in postmenopausal women [14-16], whereas other findings have denoted no significant correlation between sleep and menopause [17,18]. Moreover, we cannot overlook the effects of factors such as the sleep disorders caused by the natural aging process in postmenopausal women. In this regard, Xu and Lang have emphasized on an independent correlation between menopause and sleep beyond the effects of aging and other confounders although the association may not be significant [19].

Considering that cohort studies have a large sample size and the accuracy of their results is relatively high and no studies have exclusively compared the sleep quality of menopausal and non-menopausal women in Yazd province (Iran), the present study aimed to investigate and compare the sleep patterns in menopausal and non-menopausal women.

2. Materials and Methods

This case-control study was conducted in Yazd, Iran in 2019.

2.1. Data Collection

Considering the significance level of 5%, test power of 90%, odds ratio (OR) of 1.5, the frequency of insomnia in the control group ($P=7\%$) [4], and ratio of the control group to

the case group ($=2$), 853 women were considered as the case group, and 1,706 women were assigned to the control group. Since the number of the samples in Shahedieh cohort study was higher than our sample size, all the women participating in Shahedieh cohort study were examined for higher accuracy by observing the same ratio. Therefore, our sample size consisted of 1,709 menopausal women as the case group and 3,121 non-menopausal women as the control group.

In the present study, data were obtained from the first (recruitment) phase of Shahedieh cohort study (www.shahedieh.ssu.ac.ir) conducted in Shahedieh, Ashkezar, and Zarch cities, which are located in the center of Iran and annexed to Yazd city, on adults aged 35-70 years. Shahedieh cohort study is part of the Prospective Epidemiological Research Studies of the Iranian Adults (PERSIAN) cohort study (<http://persiancohort.com/cohortsites/yazd/>). The mentioned study aimed to assess the prevalence of non-communicable and occupational diseases and their risk factors [11].

Shahedieh region was selected considering the availability of the residents, non-immigrants from other cities, intact ethnicity, and indigenous cooperation. In total, 10,194 adults aged 35-70 years consented to participate in the study, including 4,940 from Shahedieh city, 3,780 from Zarch city, and 1,474 from Ashkezar city. The study was initiated on 5 May 2015, and the enrollment phase was concluded in September 2016.

Data were collected by a trained cohort team. The inclusion criteria of the study were the age of 35-70 years, permanent residence in the mentioned district over the past nine months continuously, and willingness to participate in the study. The individuals who met the inclusion criteria were gradually invited to the interviews, which were conducted to obtain the required data on clinical examinations, blood and urine tests, and paraclinical tests. In Shahedieh cohort study, data collection was performed by a general practitioner, nutritionist, and public health expert using questionnaires and clinical tests.

2.2. Data Analysis

The variables of the present study included education level, occupation status, marital status, body mass index (BMI), and menopause status, including the type of menopause (natural/surgical), age at the onset of menopause, and use of hormonal drugs. In addition, the required data regarding sleep included the routine bedtime, routine time of waking up in the morning, sleeping during the day, RLS, daytime naps, and use of sleeping pills. On the other hand, the weight of the subjects was classified based on the BMI as underweight ($BMI < 18.5 \text{ kg/m}^2$), normal ($BMI: 18.5 - < 25 \text{ kg/m}^2$), overweight ($BMI: 25.0 - < 30 \text{ kg/m}^2$), and obese ($BMI \geq 30.0 \text{ kg/m}^2$).

Data analysis was performed in SPSS version 20.0 using descriptive statistics, Chi-square, independent t-test, the analysis of variance (One-way ANOVA), and logistic regression analysis. In all the statistical analyses, P -value of less than 0.05 was considered significant.

The study protocol was approved by the Ethics

Committee of Shahid Sadoughi University of Medical Sciences, Iran (code: IR.SSU.SPH.REC.1397.155).

3. Results and Discussion

Shahedieh cohort study was conducted on 1,709 menopausal women (35.4%) and 3,121 non-menopausal women (64.6%). In the present study, the mean age at menopause was 48.1 ± 5.6 years. Natural menopause was reported in 1,271 women (74.4%), while 438 cases (25.6%) had surgical menopause (induced menopause). Additionally, 231 menopausal women (13.5%) used hormone therapy. Table 1 shows the frequency distribution of the demographic variables.

According to the obtained results, the majority of the women in both groups were married and housewives. The comparison of the education level between the two groups showed that 12.6% of the menopausal women and 15.8% of the non-menopausal women had academic education. The mean BMI of the menopausal and non-menopausal women was 30.2 ± 4.9 and 29.4 ± 5.1 kg/m², respectively ($P < 0.001$). The BMI classification is presented in Table 1. Accordingly, 86.8% of the menopausal women and 81.6% of the non-menopausal women were overweight or obese.

The mean sleep duration of the menopausal and non-menopausal women was 7.1 ± 1.3 and 7.4 ± 1.3 hours, respectively ($P = 0.001$). The majority of the women in both groups (54.8% of menopausal and 60.6% of non-menopausal women) went to bed at 10-11 PM. Furthermore, 25.1% of the menopausal women and 15.7% of the non-menopausal women went to bed before 10 PM, while 20.1% of the menopausal women and 23.6% of the non-menopausal women went to bed after 11 PM ($P < 0.001$).

In the current research, most of the women in both groups (60.1% of menopausal and 58.3% of non-menopausal women) woke up at 5-6 AM. Waking up before 6 AM was significantly more common in the menopausal women compared to the non-menopausal women (8.7% vs. 2.3%), while waking up after 8 AM was significantly less common in the non-menopausal women compared to the non-menopausal women (5.7% vs. 8%) ($P < 0.001$). However, no significant associations were observed between the sleep duration and use of hormone therapy, type of menopause, and age at the onset of menopause.

In the present study, the mean sleep latency in the menopausal and non-menopausal women was 34.6 and 21.5 minutes, respectively ($P < 0.001$). Further analysis indicated that the mean sleep latency was 41.87 minutes in the menopausal women receiving hormone therapy and 33.1 minutes in the women without hormone therapy ($P = 0.03$). Another important finding of the current research was that sleeping during the day was more common in the non-menopausal women compared to the menopausal women, and mean sleep duration during the day was 72.5 and 77.5 minutes in the menopausal and non-menopausal women, respectively ($P = 0.001$).

In addition, the prevalence of RLS during sleep, daytime naps without specific activity, and use of sleeping pills more than twice a week was higher in the menopausal women compared to the other group ($P < 0.001$) (Table 2).

According to the information in Table 3, there were significant correlation between the type of menopause, routine bedtime ($P = 0.01$), daytime naps ($P < 0.001$), and use of sleeping pills ($P = 0.01$). According to the information in Table 3, 39.1% and 12.5% of the women with natural menopause had daytime naps and used sleeping pills, respectively. In addition, the women with natural menopause went to bed earlier at night compared to the women with surgical menopause. As is shown in Table 3, hormone replacement therapy, daytime naps ($P = 0.02$), and routine bedtime were significantly correlated ($P = 0.001$). The menopausal women receiving hormone replacement drugs also had less frequent daytime naps. According to the information in Table 3, the menopausal women who used no hormonal drugs slept earlier at night.

Our findings indicated no significant correlation between the age at menopause onset and sleep questions. However, sleeping during the day was significantly more frequent in the women diagnosed with depression in both groups ($P = 0.01$). The most interesting finding of the current research was that higher BMI was associated with the increased sleeping during the day ($P = 0.005$), sleep latency ($P = 0.001$), use of sleeping pills ($P < 0.001$), and RLS ($P = 0.01$). On the other hand, no significant associations were observed between sleep and menopause status with the demographic characteristics of marital status, occupation status, and education level

Table 1: Distribution of demographic variables in menopausal and non-menopausal women

Variable	Menopausal women		Non-menopausal women		Pvalue	
	N	%	N	%		
Education level	illiterate	366	21.4	459	14.7	0.000
	Elementary School	555	32.5	988	31.7	
	Secondary School	259	15.2	552	17.7	
	Diploma	312	18.3	624	20	
	Associate Degree	57	3.3	111	3.6	
	Bachelor's degree	135	7.9	313	10	
Employment status	Master's degree and higher	24	1.4	71	2.2	0.006
	Yes	618	36.2	1274	40.8	
	No	1090	63.8	1847	59.2	
Marital status	Single	8	0.5	14	0.4	0.34
	Married	1630	95.4	2994	96	
	Widow	64	3.7	92	3	
	divorced	6	0.4	18	0.6	
BMI	Underweight (<18.5)	8	0.5	24	0.8	0.000
	Normal (18.5-24.9)	214	12.7	540	17.6	
	Overweight (25-29.9)	617	36.7	1201	39.1	
	Obese (30<)	841	50.1	1306	42.5	

*Chi-square; reason for discrepancy between numbers in table and sample size is missing observations

Table 2: Distribution of sleep variables in menopausal and non-menopausal women

Variable		Menopausal women		Non-menopausal women		Pvalue
		N	%	N	%	
Sleep duration (hours)	<6	188	11	175	5.6	0.001
	6-8	1235	72.6	2332	74.8	
	>8	279	16.4	609	19.5	
Sleep latency (minutes)	<15	911	53.5	2014	64.6	0.001
Marital status	16-30	205	12	456	14.6	
	31-60	370	21.7	446	14.3	
	>60	217	12.7	200	6.4	
sleep during the day	Yes	1155	67.8	2289	73.5	0.001
	No	548	32.2	826	26.5	
Restless Legs Syndrome	Yes	269	15.8	381	12.2	0.001
	No	1338	78.6	2666	85.5	
	I don't know	96	5.6	70	2.2	
Nap during the day (without authority)	Yes	625	36.7	544	17.5	0.001
	No	1078	63.3	2573	82.5	
Use of sleeping medications	Yes	233	13.7	238	7.6	0.001
	No	1470	86.3	2879	92.4	
	I don't know	520	52.7	1669	76.9	

*Chi-square; reason for discrepancy between numbers in table and sample size is missing observations

In the present study, we used the logistic regression analysis to determine the importance of menopause in explaining the variations in sleep duration (Table 4).

According to the obtained results, sleep duration could not be explained by menopause. After adjusting the effects of other variables, the possibility of the sleep duration of less than six hours or more than eight hours in the menopausal women was 13 times higher than the non-menopausal women, while the correlation was not considered significant (OR = 1.13; CI = 0.98-1.29; P = 0.07). The present study aimed to investigate the sleep patterns in menopausal and non-menopausal women. According to the findings, the duration of nighttime sleep was shorter in the menopausal women compared to the non-menopausal women (P = 0.001). Furthermore, the comparison of the menopausal women with the non-menopausal women indicated that the menopausal women went to bed earlier than the non-menopausal women and woke up earlier in the morning as well. Moreover, sleep latency was more frequent in the menopausal women compared to the non-menopausal women, and their sleep duration was shorter than the non-menopausal women. A study conducted on women aged 40-59 years in the United States showed that less than seven hours of sleep at night in menopausal women (56.0%) was more common than premenopausal women (32.5%) and postmenopausal women (40.5%). Additionally, the postmenopausal women were more likely than the premenopausal women to have trouble falling asleep (27.1% vs. 16.8%) [20]. A research in this regard was performed in San Francisco, demonstrating that women in the early premenopausal stage reported shorter sleep duration (P= 0.007) and lower sleep quality (P = 0.05) compared to premenopausal women [21]. The results of the present study indicated that the possibility of less than six hours or more than eight hours of sleep in the menopausal women was 13 times higher than the non-menopausal women, while the association was not considered significant (P= 0.07).

Another important finding of the current research was that sleep disorders (RLS and daytime naps) and use of sleeping pills were more frequent in the menopausal women compared to the non-menopausal women. According to the National Sleep Foundation (NSF),

menopausal sleep disorders do not necessarily reduce sleep duration, while they may impair the quality of sleep [22].

This finding is consistent with the previous research into the brain area, indicating that sleep disorders are more common in menopausal women [11, 23], while in line with the study by Golyan Tehrani, which showed the prevalence of insomnia to be high in menopausal women [24].

A study conducted on Chinese women aged 40-60 years indicated that the prevalence of sleep disturbance was higher in the women with a menopausal status, ranging from 34.8% in premenopausal women to 40.9% in postmenopausal women [25]. In addition, Ohayon has suggested that the main cause of sleep disturbance in menopause is the decreased levels of sex hormones [26]. Menopausal women may experience numerous changes during this period (e.g., hot flashes, night sweats, fatigue, and insomnia) due to the declined sex hormones, such as estrogen.

The results of the present study demonstrated that the women with natural menopause slept earlier at night and were less likely to use sleeping pills. On the other hand, the women who did not receive hormone replacement therapy during menopause took more naps during the day and slept earlier at night. On the same note, Zenobi and Mousavi evaluated the effect of hormone replacement therapy on the sleep quality of menopausal women, reporting that estrogen replacement therapy significantly reduced sleep disorders in the menopausal women. Sleep disorders are often caused by hot flashes and night sweats, which are accompanied by hormonal changes. Estrogen reduces sleep latency and the number of the awakenings during the night, thereby increasing sleep duration. Therefore, estrogen replacement therapy could significantly reduce morning fatigue and daytime sleepiness, while also facilitating falling asleep at night [27]. However, hormone therapy could have adverse effects by influencing Peptide and increase the risk of stroke, breast and endometrial cancer, thromboembolic disorders, liver disorders, and Alzheimer's disease. Motaghi *et al.* (2018) believe that medicinal plants should be used as a replacement for menopausal hormone therapy [28].

In the current research, the evaluation of the correlation between the BMI and sleep disorders showed that RLS, daytime naps, sleep latency, and the use of sleeping pills were more common in the women with higher BMI.

Table 3: Association of sleep patterns and menopause status

Variables		Type of menopause				Use of hormone therapy					
		Natural		Surgical		Yes			No		
		N	%	N	%	N	%	N	%	N	%
Do you take naps during the day, even when you have little activity?	Yes	496	39.1	129	29.6	68	29.6	508	37.4		
	No	771	60.9.4	307	70.4	162	70.4	851	62.6		
	<i>P</i> value	0.000				0.02					
Do you use sleeping pills, regularly (more than 2 times a week)?	Yes	159	12.5	74	17	191	83	176	13		
	No	1108	87.5	362	83	39	17	1183	87		
	<i>P</i> value	0.01				0.2					
What time do you usually go to bed at night?	19-21	69	5.4	19	4.4	7	3	72	5.3		
	21-22	273	21.5	66	15.1	30	13	286	21		
	22-23	678	53.5	255	58.5	124	53.9	749	55.1		
	23-24	74	5.8	22	5	19	8.3	75	5.5		
	> 24	173	13.7	74	17	50	21.7	177	13		
		<i>P</i> value	0.01				0.001				

*Chi-square

In the study by Marien and Rodenstein, high BMI was associated with apnea and other sleep disorders [29]. Our findings in this regard are consistent with the study by Rezaei et al. (2012) which indicated that BMI of higher than 25 kg/m² was correlated with poor sleep quality [30]; this association has also been reported in other studies [31, 32]. In the study by Ayrim et al. (2014) the prevalence of snoring increased significantly with weight gain after menopause [33].

In the present study, the menopausal women who woke up after 8 AM ($P = 0.04$) and those who slept after 12 AM ($P < 0.001$) had higher BMI compared to the other menopausal women. Additionally, the non-menopausal women who slept after 12 AM had higher BMI ($P < 0.001$). No significant association was observed between the BMI and sleep duration, which is consistent with the findings of Taheri [34].

Several studies have described the methods used to improve sleep disorders in menopausal women; such examples are medication, herbal supplementation, nutritional therapy, and physical activity. In a research in this regard, Eftekhari et al. (2009) stated that treatment with Premarin could significantly reduce sleep disturbances and insomnia in menopausal women [35]. Previous findings have also indicated that aromatherapy with lavender and chamomile is effective in improving sleep disorders [36,37]. Furthermore, walking and physical activity have been shown to effectively enhance sleep disorders [38].

One of the limitations of the present study was that the sleep variables were not compared in three groups (premenopausal, perimenopausal, postmenopausal) because we used pre-collected data.

Table 4: Regression analysis of menopause as predictor of sleep duration

Variables	OR	<i>P</i> value	CI	
			Lower	Upper
Constant	0.27	0.00	-	-
Menopause	1.13	0.07	0.98	1.29
Marital status	0.96	0.83	0.70	1.33
Job	0.97	0.75	0.85	1.12
BMI	1.002	0.80	0.98	1.01
Age	1.003	0.38	0.99	1.01
Education level	1.012	0.40	0.98	1.03

4. Conclusion

The results of regression analysis indicated that sleep

duration was not explained by menopause. In addition, the comparison of the sleep patterns in the menopausal women with the non-menopausal women showed that sleep disorders (sleep latency, RLS, daytime naps, and use of sleeping pills) were significantly more common in the menopausal women. Since training could have a positive impact on improving sleep patterns and sleep disorders, educational interventions should be implemented based on lifestyle improvement for menopausal women by health centers.

Authors' Contributions

M.M., and H.F., conceived and developed the idea for the article; M.M., prepared numerous drafts; H.F., contributed to the statistical analysis; M.M., H.F., and M.M., revised the manuscript. All the authors read and approved the final manuscript.

Conflict of Interest

The Authors declare that there is no conflict of interest.

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