

Sleep Quality and Associated Factors in Premenopausal, Perimenopausal, and Postmenopausal Women in Korea: Findings from the K-Stori 2016

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Purpose: Poor sleep quality is a common problem among middle-aged women. Few studies, however, have assessed differences in sleep quality among premenopausal, perimenopausal, and postmenopausal women and related risk factors in Korea women. The aim of this study was to assess sleep quality and factors associated therewith according to menopausal status in Korean women.

Patients and Methods: This study was based on the 2016 Korean Study of Women's Health Related Issues (K-Stori), a cross-sectional survey employing nationally representative random sampling. In total, 3000 Korean women aged 45 to 64 years completed the Pittsburgh Sleep Quality Index (PSQI). Comparison of demographic characteristics and sleep quality among pre-, peri-, and postmenopausal women was conducted.

Results: Among the participants, 26% suffered from poor sleep quality based on the PSQI. The prevalence of poor sleep quality increased with later menopausal stage (from 18.8% in the premenopausal stage to 29.5% in the postmenopausal stage $P < 0.001$). Multivariate logistic regression analysis showed that peri- and postmenopausal women were 1.50 and 1.73 times more likely to have poor sleep quality in comparison to premenopausal women, respectively. Chronic disease, depression, at-risk drinking, taking dietary supplements, and single women were associated with a higher likelihood of having poor sleep quality. Health status, at-risk drinking, chronic illness, dietary supplementation, and depression were significantly associated with poor sleep quality.

Conclusion: Poor sleep quality appears to be prevalent in peri- and postmenopausal women in Korea. The management of sleep quality during menopause transition is important, and further research on how sleep disturbances influence the health status of women in menopausal transition is required.

Keywords: menopause, sleep quality, Pittsburgh sleep quality index

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Introduction

Menopausal transition refers to the period when the female body produces less estrogen, signaling the end of egg production. Once women start this transition naturally, it cannot be stopped. During this time, women commonly report experiencing reduced sleep quality, including trouble falling asleep and frequent nocturnal awakenings,¹⁻⁶ and numerous factors are assumed to be contributors to sleep disturbances in mid-life women, including age, social factors, perceived

stress, depression, physical activity, alcohol intake, body weight, and history of chronic diseases.^{1,7–10} Midlife women transitioning menopause and postmenopause are more likely to report sleep difficulties, with prevalence rates of self-report sleep difficulties ranging between 40% and 56%, compared to premenopausal women in the late reproductive stage, who have rates of 31%.^{1,4} Further, a systematic review and meta-analysis showed that poor sleep quality and inappropriate sleep duration pose increased risks of cardiovascular diseases, all-cause mortality, and cancer-related mortality¹¹ and that sleep disturbances are associated with psychological symptoms, such as anxiety and depression, both of which are more prevalent in women during menopause.^{5,12–14}

While several studies have indicated that menopausal status without vasomotor symptoms is independently associated with an increased risk of poor sleep quality,^{5,15} others have suggested that it is not and is multifactorial.^{13,16,17} Moreover, previous studies have indicated that there are racial differences in sleep in midlife women, suggesting that the prevalence of poor sleep quality is lower in Asian populations in comparison to other racial groups.^{4,18,19} However, most sleep-related studies have been conducted on Caucasian populations,⁴ and such evidence is largely unavailable for Korea. Although one previous study examined the prevalence of poor sleep quality and its associated factors in middle-aged Korean women, this study was conducted at a single center, and their results cannot be generalized to all menopausal women in Korea.²⁰

Therefore, this population-based study was conducted to assess associations between sleep quality and menopausal status and to investigate factors related with sleep quality among mid-life women in Korea.

Materials and Methods

Study Population

The study was based on the 2016 Korean Study of Women's Health Related Issues (K-Stori), a cross-sectional survey that utilized nationally representative random sampling to explore life-cycle specific women's health issues in Korea. A detailed description of K-Stori has been provided elsewhere.²¹ In brief, we randomly sampled 3000 women in each stage of the female life cycle (Adolescence, 14–17 years; Childbearing, 19–44 years; Pregnancy and Postpartum, 19–44 years; Menopause, 45–64 years; and Older Adulthood, 65–74

years) by multistage random sampling according to the sizes of population per region and geographic area, based on 2010 Population and Housing Census. Trained interviewers from a professional research agency conducted door-to-door surveys to assess study eligibility. Among 37,334 eligible women, 15,084 women completed in-person interview surveys (adolescents completed online surveys) between April 2016 and June 2016. The response rate of K-Stori was 40.4%. Of the 15,084 women who participated in the K-Stori, 84 women who did not answer the main questions or were over-sampled were excluded from the analysis.²² For final analysis, we excluded 12,000 women in adolescence, childbearing, pregnancy and postpartum, and older adulthood stages. Thus, a total of 3000 Korean women in menopause stages aged 45 to 64 years were included in the final analysis.

This study was approved by the Institutional Review Board (IRB) of the National Cancer Center, Korea (approval number: NCC2016-0062). An approved study description was provided to all eligible participants. The study description covered the research purpose, subject, content, duration, voluntary participation, withdrawal of consent, expected risks and benefits from participating in the research, publication of the study results, and confidentiality. If the subjects agreed to participate in the study after reading the study description, participants were asked to provide written informed consent. This study was conducted in accordance with the Declaration of Helsinki.

Measurements

The surveys collected information on sociodemographic factors, self-health status, health awareness, psychological health, stress levels, health concerns, menstrual and reproductive health, health behaviors, medical service use, health information, social support, gender role and socioeconomic status. Blood pressure and body weight and height were measured, and BMI was calculated as body weight divided by body height squared.

The menopausal transition refers to the years leading up to menopause, or final menstrual period, when endocrinological, biological, and clinical features of approaching menopause commence.²² In the current study, menopausal status was determined by menstrual history: premenopausal (women having regular menses), perimenopausal (irregularities >7 days from normal cycle),²³ and postmenopausal (no menses in the last 12 months).

Sleep quality was determined using the Pittsburgh Sleep Quality Index (PSQI),²⁴ a self-reported

questionnaire detailing sleep quality over the period of 1 month. A validated Korean version of the PSQI was used.²⁴ In total, 19 items were measured to generate seven component scores, which are subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleeping medication, and daytime dysfunction. The scores of the seven components scores were summed together to yield a global PSQI score (total score of 21), with higher scores indicating poorer sleep quality. A global PSQI score >5 was defined as poor overall sleep quality.

The Tolerance-Annoyed, Cut down, Eye-opener (T-ACE) screening tool was used to identify at-risk drinking, with a T-ACE score of 2 or higher defined as being at potential risk.²⁵ Korean Versions of the Perceived Stress Scale (PSS) were utilized to measure stress: the original PSS contains 14 items, but a 4-item version is also available for quick measurement, which was used in this study. The Korean version of the PSS was validated.²⁶ The Patient Health Question-9 (PHQ-9), a diagnostic instrument for common mental disorders, particularly depression, was used in this study to determine the severity of depression.²⁷

Statistical Analysis

All statistical analyses were performed using STATA 12.0 software (Stata Corp. L. P., College Station, Texas). Demographic and sleep quality variables among groups pre-, peri-, and postmenopausal women were compared. Categorical variables are presented as percentages and were compared using the chi-square test and Fisher's exact test. Continuous variables are expressed as means (standard deviations). *T*-tests and analysis of variance was conducted, followed by Tukey's post-hoc analysis, to identify significant differences among the women according to menopausal status. Variance inflation factor (VIF) was assessed prior to the logistic analyses to assess collinearity between independent variables, because multicollinearity may increase the variance of the regression coefficients and make them unstable. We found the VIFs were all less than 10, thus indicating no collinearity. Univariate logistic regression analysis was conducted to examine associations between poor sleep quality and different variables. Then, variables with a *P* value <0.05 from univariate analysis were selected for multivariable analysis. In the multivariable analysis, we applied age-adjusted weighting values for Korean women from the 2010 Population and Housing Census. In the analysis, a global PSQI score was

categorized as a binary outcome: Women with a PSQI score ≤ 5 were categorized as having good quality sleep, while those with a PSQI score >5 were categorized as having poor quality sleep. We estimated the odds of having poor sleep quality according to menopausal status. *P* values <0.05 were considered statistically significant.

Results

The general demographic, health, psychological health, and lifestyle variables are presented in Table 1. Of the 3000 participants, 770 (25.67%) were premenopausal, 398 (13.27%) were perimenopausal and 1832 (61.07%) were postmenopausal. All variables were significantly different among the three menopausal status groups ($P < 0.05$).

Table 2 shows score for sub-scales of PSQI according to menopausal status. There were significant differences in all sub-scales of PSQI (subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleep medication and daytime dysfunction) according to menopausal stage (All $P < 0.05$).

Table 3 comprises PSQI scores according to menopausal status. Among the participants, 26% suffered from poor sleep quality based on the PSQI. Post-hoc analysis revealed that mean PSQI scores were significantly higher in peri- and postmenopausal women than in premenopausal women ($P < 0.05$). Both total scores and scores of each item showed an increasing trend from premenopausal to postmenopausal status, except for sleep duration. In comparison to premenopausal women, postmenopausal women were significantly more likely to report poorer subjective sleep quality ($P < 0.001$), prolonged sleep latency ($P = 0.005$), lower habitual sleep efficiency ($P = 0.038$), frequent use of sleep medication ($P < 0.0001$), and daytime dysfunction ($P < 0.001$). The prevalence of poor sleep quality increased with later menopausal stage (from 18.8% in the premenopausal stage to 29.5% in the postmenopausal stage $P < 0.001$).

Table 4 presents the mean PSQI scores by sociodemographic characteristics and the results from logistic regression analysis to identify factors associated with poor quality of sleep. There were statistically significant differences in mean sleep quality scores according to menopausal stages, age, income level, marital status, dietary supplement consumption, chronic illness, risk drinking, depression, and stress level (All $P < 0.05$). Univariable logistic regression analysis indicated that menopause stage, age, income level, marital status, consumption of dietary supplements, chronic

Table I Demographic Characteristics According to Menopausal Status

	Total	Menopause Stage, n (%)			P value
		Pre	Peri	Post	
Total	3000 (100)	770 (25.67)	398 (13.27)	1832 (61.07)	
Age, mean (S.D)	54.43 (5.65)	49.37 (3.96)	49.99 (3.44)	57.51 (4.31)	<0.0001
Income level					<0.0001
< \$1990	313 (10.43)	36 (4.68)	18 (4.52)	259 (14.14)	
\$2000–\$3990	1418 (47.27)	355 (46.10)	146 (36.68)	917 (50.05)	
> \$4000	1269 (42.30)	379 (49.22)	234 (58.79)	656 (35.81)	
Marital Status					<0.0001
Married	2705 (90.17)	717 (93.12)	372 (93.47)	1616 (88.21)	
Single	295 (9.83)	53 (6.88)	26 (6.53)	216 (11.79)	
Education level					<0.0001
Middle School and lower	595 (19.83)	34 (4.42)	24 (6.03)	537 (29.31)	
High School	1703 (56.77)	446 (57.92)	228 (57.29)	1029 (56.17)	
University and higher	702 (23.40)	290 (37.66)	146 (36.68)	266 (14.52)	
Consumption of dietary supplements^a					<0.0001
No	1006 (33.53)	305 (39.61)	137 (34.42)	564 (30.79)	
Yes	1994 (66.47)	465 (60.39)	261 (65.58)	1268 (69.21)	
BMI					<0.0001
<25	2423 (80.77)	663 (86.10)	334 (83.92)	1426 (77.84)	
≥ 25	577 (19.23)	107 (13.90)	64 (16.08)	406 (22.16)	
Consumption of coffee					<0.0001
No	435 (14.50)	68 (8.83)	35 (8.79)	332 (18.12)	
Yes	2565 (85.50)	702 (91.17)	363 (91.21)	1500 (81.88)	
Regular exercise					0.022
No	1741 (58.03)	476 (61.82)	237 (59.55)	1028 (56.11)	
Yes	1259 (41.97)	294 (38.18)	161 (40.45)	804 (43.89)	
Self-reported health status					<0.0001
Moderate	2671 (89.03)	732 (95.06)	368 (92.46)	1571 (85.75)	
Bad	329 (10.97)	38 (4.94)	30 (7.54)	261 (14.25)	
Chronic illness status					<0.0001
No	2234 (74.47)	672 (87.27)	330 (82.91)	1232 (67.25)	
Yes	766 (25.53)	98 (12.73)	68 (17.09)	600 (32.75)	
At-risk drinking					<0.0001
Low	2647 (88.23)	678 (88.05)	322 (80.90)	1647 (89.90)	
High	353 (11.77)	92 (11.95)	76 (19.10)	185 (10.10)	
Depression, mean (S.D)	2.43 (2.99)	2.04 (2.56)	2.44 (2.53)	2.60 (3.23)	<0.0001
Stress level in everyday life, mean (S.D)	6.92 (2.01)	6.94 (2.06)	7.23 (2.00)	6.84 (1.99)	0.0015

Notes: ^aDietary supplements included vitamins, dietary supplements, nutritional supplements (omega-3, calcium, folic acid, beta-carotene, etc.) and functional foods (isoflavones, evening primrose oil, pomegranate extract, etc).

Abbreviation: S.D, standard deviations.

illness status, risk drinking, and depression were associated with poor sleep quality ($P < 0.05$). Multivariable logistic regression analysis showed that perimenopause (Odds ratio [OR], 1.50; 95% Confidence Interval [CI] 1.07 to 2.11) and

postmenopause states (OR, 1.73; 95% CI 1.26 to 2.39), single women (OR, 1.51; 95% CI 1.11 to 2.06), taking dietary supplements (OR, 1.72; 95% CI 1.39 to 2.13), chronic health illness (OR, 1.50; 95% CI 1.20 to 1.87), at-

Table 2 Sub-Scales of the Pittsburgh Sleep Quality Index (PSQI) According to Menopausal Status

PSQI Items	Menopause Stage			P value
	Pre (n=770)	Peri (n=398)	Post (n=1832)	
Subjective sleep quality				<0.0001
Very good	115 (14.9)	59 (14.8)	200 (10.9)	
Good	553 (71.8)	274 (68.8)	1221 (66.7)	
Bad	98 (12.7)	59 (14.8)	392 (21.4)	
Very bad	4 (0.5)	6 (1.5)	19 (1.0)	
Sleep latency (minutes)				0.001
≤15	309 (40.1)	152 (38.2)	687 (37.5)	
16~30	364 (47.3)	180 (45.2)	814 (44.4)	
31~60	86 (11.2)	60 (15.1)	254 (13.9)	
> 60	11 (1.4)	6 (1.5)	77 (4.2)	
Sleep duration (hours)				0.049
>7	236 (30.7)	102 (25.6)	603 (32.9)	
6~7	453 (58.8)	261 (65.6)	1064 (58.1)	
5~6	70 (9.1)	27 (6.8)	144 (7.9)	
<5	11 (1.4)	8 (2.0)	21 (1.2)	
Habitual sleep efficiency (%)				0.114
>85	717 (93.1)	367 (92.2)	1661 (90.7)	
75~84	46 (6.0)	26 (6.5)	131 (7.2)	
65~74	5 (0.7)	1 (0.3)	26 (1.4)	
<65	2 (0.3)	4 (1.0)	14 (0.8)	
Sleep disturbance				<0.0001 ^a
None during the last month	207 (26.9)	101 (25.4)	374 (20.4)	
< Once a week	548 (71.2)	276 (69.4)	1309 (71.5)	
1~2 times per week	15 (2.0)	21 (5.3)	147 (8.0)	
≥3 times per week	0 (0.0)	0 (0.0)	2 (0.1)	
Use of sleep medication				0.001
None the last month	737 (95.7)	371 (93.2)	1690 (92.3)	
< Once a week	29 (3.8)	20 (5.0)	75 (4.1)	
1~2 times per week	3 (0.4)	6 (1.5)	46 (2.5)	
≥3 times per week	1 (0.1)	1 (0.3)	21 (1.2)	
Daytime dysfunction				<0.0001
None the last month	434 (56.4)	204 (51.3)	826 (45.1)	
< Once a week	241 (31.3)	115 (28.9)	636 (34.7)	
1~2 times per week	85 (11.0)	70 (17.6)	334 (18.2)	
≥3 times per week	10 (1.3)	9 (2.3)	36 (2.0)	

Notes: Differences were considered significant at $P < 0.05$. Unadjusted data are presented as a frequency and percent. ^a P-value from Fisher's exact test.

risk drinking (OR, 1.53; 95% CI 1.17 to 2.02), and depression (OR, 4.16; 95% CI 3.32–5.22) posed an increased risk of poor sleep quality in women.

Discussion

In this study, we aimed to assess associations between sleep quality and menopausal status, as well as demographic and health-related factors associated with sleep quality among Korean women. We discovered that about

26% of surveyed women aged 45–64 years were having poor sleep quality during mid-life (global PSQI scores >5). One previous study conducted in the United States reported that the overall prevalence of poor sleep quality complaints (PSQI >5) was 66%, and the prevalence thereof was significantly higher among African Americans than Caucasians.¹⁸ In Asia, one study conducted in Hong Kong reported that the prevalence of poor sleep quality in mid-life women aged 45–55 years

Table 3 Analysis of PSQI Scores According to Menopausal Status

PSQI Items	Menopause Stage			P value
	Pre	Peri	Post	
Subjective sleep quality	0.99±0.55 ^c	1.03±0.60 ^c	1.13±0.59 ^{a,b}	<0.001
Sleep latency	0.74±0.71 ^c	0.80±0.74	0.85±0.81 ^a	0.005
Sleep duration	0.81±0.65	0.85±0.62	0.77±0.63	0.048
Habitual sleep efficiency	0.08±0.32 ^c	0.10±0.40	0.12±0.43 ^a	0.038
Sleep disturbance	0.75±0.48 ^c	0.80±0.52 ^c	0.88±0.52 ^a	<0.001
Use of sleep medication	0.05±0.25 ^c	0.09±0.35	0.13±0.48 ^a	<0.001
Daytime dysfunction	0.57±0.73 ^{b,c}	0.71±0.83 ^a	0.77±0.81 ^a	<0.001
Total score (21 items)	3.99±1.92 ^{b,c}	4.37±2.31 ^a	4.64±2.53 ^a	<0.001
Good (total score of ≤5), n (%)	625 (81.2)	289 (72.6)	1292 (70.5)	<0.001
Bad (total score >5), n (%)	145 (18.8)	109 (27.4)	540 (29.5)	<0.001

Notes: Differences were considered significant at $P < 0.05$. Data are presented as means ± standard deviations. ^aSignificantly different from premenopause. ^bSignificantly different from perimenopause. ^cSignificantly different from postmenopause.

was about 26%, similar to the results of our study.¹³ One Korean study also found that the overall prevalence of poor sleep quality was 19.4%.²⁰ Several studies have shown that there are strong associations between sleep problems and the severity of menopausal symptoms.^{8,10,28} The Study of Women's Health Across the Nation, which is the largest cross-racial/multiethnic study of menopausal symptoms, found that in comparison to Caucasian women, Chinese, Japanese, African American, and Hispanic women reported significantly fewer menopausal symptoms, even after controlling for health and lifestyle factors.^{19,29} We suspect that variations in symptom reporting across race/ethnicity may contribute to the lower prevalence of poor sleep quality among Asian women.

In the current study, we noted that the prevalence of poor sleep quality increased significantly with transition from a premenopause to perimenopause (1.50 times) state and that postmenopausal women faced a 1.73 times higher risk of having poor sleep quality than premenopausal women. This was similar to results in the majority of previous studies.^{13,16,30} In a recent meta-analysis of cross-sectional data from 24 studies reported that women in perimenopause (OR, 1.60; 95% CI, 1.40–1.82), postmenopause (OR, 1.67; 95% CI, 1.46–1.91), and surgical menopause (OR, 2.17; 95% CI, 1.80–2.61) had higher odds of experiencing sleep disturbance, relative to premenopause.³¹

According to previous studies, menopausal status alone could account for the increased risk of poor sleep quality in middle-aged women, and our results are consistent therewith. Meanwhile, however, a few studies have

suggested that vasomotor symptoms, as well as depressive symptoms, may be the primary contributors to sleep problems and that menopausal status might be insignificant when these factors are taken into consideration.^{13,16,17} Multivariable logistic regression analysis in the present study indicated that the consumption of a dietary supplement, at-risk drinking, chronic illness, and depression are independent risk factors for poor sleep quality, in addition to menopausal status. At-risk drinking is a known risk factor for poor sleep quality,¹⁶ and good sleep quality is required for good physical and psychological health. In general, depression is more common in women during menopausal transition, and in parallel with previous results, we found that depression was associated with a 4.16 folds increase in the risk of having poor sleep quality in middle-aged women, consistent with previous research. Interestingly, although prior studies have reported that increased stress leads to poor sleep quality,¹³ our analyses indicated that stress was not significantly associated with quality of sleep. The consumption of a dietary supplement, however, was significantly associated with poor sleep quality. We assume that women with poor sleep quality may have sought dietary supplements in an effort to improve their overall health status or sleep quality.³²

There are limitations to this study. Because this study was conducted as a cross-sectional study, our results are unable to definitively support causal relationships between menopausal status and PSQI scores. As another limitation, all of the results of our study were based on subjective assessments, such as self-reported instruments, and thus, objective assessments, such as polysomnography, would

Table 4 Results from Logistic Regression Analysis to Identify Factors Associated with Poor Sleep Quality

	PSQI Score	Tukey's HSD/P value	Univariate Analysis	Multivariate Analysis
	Mean (S.D)		OR (95% CI)	OR ^e (95% CI)
Menopause Stages		b*,c***>a		
Premenopause ^a	3.99 (1.92)		1.00	1.00
Perimenopause ^b	4.38 (2.30)		1.78 (1.29–2.45)	1.50 (1.07–2.11)
Postmenopause ^c	4.64 (2.53)		1.83 (1.46–2.31)	1.73 (1.26–2.39)
Age		c,d**>a		
45–49 ^a	4.15 (2.17)		1.00	1.00
50–54 ^b	4.44 (2.29)		1.38 (1.06–1.80)	1.12 (0.83–1.52)
55–59 ^c	4.56 (2.50)		1.30 (1.00–1.69)	0.76 (0.54–1.09)
59–64 ^d	4.60 (2.49)		1.29 (0.99–1.67)	0.71 (0.49–1.03)
Income level		a>b,c***		
< \$1990 ^a	5.02 (3.02)		1.00	1.00
\$2000–\$3990 ^b	4.44 (2.28)		0.72 (0.54–0.96)	0.91 (0.66–1.26)
> \$4000 ^c	4.29 (2.28)		0.61 (0.45–0.82)	0.81 (0.58–1.15)
Marital Status		<0.001		
Married	4.38 (2.33)		1.00	1.00
Single	4.91 (2.68)		1.66 (1.24–2.20)	1.51 (1.11–2.06)
Consumption of Dietary Supplement		<0.001		
No	4.02 (2.35)		1.00	1.00
Yes	4.65 (2.36)		1.66 (1.35–2.03)	1.72 (1.39–2.13)
Chronic illness status		<0.001		
No	4.18 (2.16)		1.00	1.00
Yes	5.18 (2.78)		1.97 (1.62–2.40)	1.50 (1.20–1.87)
Risk Drinking		<0.001		
Low	4.31 (2.24)		1.00	1.00
High	5.41 (3.05)		1.92 (1.48–2.49)	1.53 (1.17–2.02)
Depression		<0.001		
No Depression	4.05 (2.04)		1.00	1.00
Depression	6.31 (2.92)		4.64 (3.73–5.78)	4.16 (3.32–5.22)
Stress level in everyday life		b,c*>a		
Almost none ^a	4.17 (2.15)		1.00	1.00
Feel slight stress ^b	4.49 (2.42)		1.21 (0.96–1.52)	1.09 (0.86–1.38)
Feel a lot of stress ^c	5.04 (2.22)		1.38 (0.68–2.80)	1.22 (0.58–2.54)

Notes: a, b, c, dComparing mean PSQI values by conducting Tukey's HSD test. Differences were considered significant at *P<0.05, **P<0.01, ***P<0.001. ^eAdjusted for menopause stage, age, income level, marital status, consumption of dietary supplement, chronic illness status, risk drinking, depression, and stress level in everyday life.

Abbreviations: OR, Odds ratio; CI, Confidence Interval; HSD, Honestly Significant Difference.

be required for more accurate results. Previous studies have emphasized that the severity of vasomotor symptoms might be influenced by the association between menopausal status and sleep problems, not just menopausal status.^{13,16,33} Vasomotor symptoms, however, could not be considered in our investigation due to a lack of data. Notwithstanding, mean PSQI global scores in postmenopausal women who had visited a hospital due to vasomotor symptoms, such as hot flashes, sweating, and palpitation,

were higher than those in women who had not experienced vasomotor symptoms. The strengths are that we utilized nationwide data collected via a stratified, multistage, random sampling strategy, making the data representative of the general Korean population.

Conclusions

Our study findings suggest that the prevalence of poor sleep quality is relatively lower among midlife Korean women in

comparison to other countries. Similar to previous studies, we found that poor sleep quality was more prevalent in peri- and postmenopausal women than premenopausal women. We also discovered that menopausal status, the consumption of a dietary supplement, chronic illness, at-risk drinking, and depression show statistically significant associations with poor sleep quality. Future studies on how sleep disturbances influence the health status of women in menopausal transition would be beneficial to the management of women in menopausal transition.

Author Contributions

All authors contributed to data analysis and drafting or revising the article, have agreed on the journal to which the article will be submitted, gave final approval of the version to be published, and agreed to be accountable for all aspects of the work.

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Disclosure

The authors report no conflicts of interest related with this work.

References

- Guidozzi F. Sleep and sleep disorders in menopausal women. *Climacteric*. 2013;16(2):214–219. doi:10.3109/13697137.2012.753873
- Young T, Rabago D, Zgierska A, Austin D, Finn L. Objective and subjective sleep quality in premenopausal, perimenopausal, and postmenopausal women in the Wisconsin Sleep Cohort Study. *Sleep*. 2003;26(6):667–672. doi:10.1093/sleep/26.6.667
- Kuh DL, Hardy R, Wadsworth M. Women's health in midlife: the influence of the menopause, social factors and health in earlier life. *Br J Obstet Gynaecol*. 1997;104(12):1419. doi:10.1111/j.1471-0528.1997.tb11016.x
- Kravitz HM, Ganz PA, Bromberger J, Powell LH, Sutton-Tyrrell K, Meyer PM. Sleep difficulty in women at midlife: a community survey of sleep and the menopausal transition. *Menopause*. 2003;10(1):19–28. doi:10.1097/00042192-200310010-00005
- Cheng M-H, Hsu C-Y, Wang S-J, Lee S-J, Wang P-H, Fu J-L. The relationship of self-reported sleep disturbance, mood, and menopause in a community study. *Menopause*. 2008;15(5):958–962. doi:10.1097/gme.0b013e318160dafa
- Baker A, Simpson S, Dawson D. Sleep disruption and mood changes associated with menopause. *J Psychosom Res*. 1997;43(4):359–369. doi:10.1016/S0022-3999(97)00126-8
- Taavoni S, Ekbatali NN, Haghani H. Postmenopausal women's quality of sleep and its related factors. *J Midlife Health*. 2015;6(1):21. doi:10.4103/0976-7800.153611
- Polo-Kantola P, Erkkola R, Irjala K, Helenius H, Pullinen S, Polo O. Climacteric symptoms and sleep quality. *Obstet Gynecol*. 1999;94(2):219–224. doi:10.1016/s0029-7844(99)00284-7
- Seib C, Anderson D, Lee K. Prevalence and correlates of sleep disturbance in postmenopausal women: the Australian Healthy Aging of Women (HOW) Study. *J Womens Health (Larchmt)*. 2014;23(2):151–158. doi:10.1089/jwh.2013.4472
- Sun D, Shao H, Li C, Tao M. Sleep disturbance and correlates in menopausal women in Shanghai. *J Psychosom Res*. 2014;76(3):237–241. doi:10.1016/j.jpsychores.2013.12.002
- Gallicchio L, Kalesan B. Sleep duration and mortality: a systematic review and meta-analysis. *J Sleep Res*. 2009;18(2):148–158. doi:10.1111/j.1365-2869.2008.00732.x
- Owens JF, Matthews KA. Sleep disturbance in healthy middle-aged women. *Maturitas*. 1998;30(1):41–50. doi:10.1016/S0378-5122(98)00039-5
- Chung KF, Tang MK. Subjective sleep disturbance and its correlates in middle-aged Hong Kong Chinese women. *Maturitas*. 2006;53(4):396–404. doi:10.1016/j.maturitas.2005.07.001
- Freedman RR, Roehrs TA. Sleep disturbance in menopause. *Menopause*. 2007;14(5):826–829. doi:10.1097/gme.0b013e3180321a22
- Hung H-C, Lu F-H, Ou H-Y, Wu J-S, Yang Y-C, Chang C-J. Menopause is associated with self-reported poor sleep quality in women without vasomotor symptoms. *Menopause*. 2014;21(8):834–839. doi:10.1097/GME.0000000000000183
- Blümel JE, Cano A, Mezones-Holguín E, et al. A multinational study of sleep disorders during female mid-life. *Maturitas*. 2012;72(4):359–366. doi:10.1016/j.maturitas.2012.05.011
- Pien GW, Sammel MD, Freeman EW, Lin H, DeBlasis TL. Predictors of sleep quality in women in the menopausal transition. *Sleep*. 2008;31(7):991–999.
- Hall MH, Matthews KA, Kravitz HM, et al. Race and financial strain are independent correlates of sleep in midlife women: the SWAN Sleep Study. *Sleep*. 2009;32(1):73–82.
- Gold EB, Sternfeld B, Kelsey JL, et al. Relation of demographic and lifestyle factors to symptoms in a multi-racial/ethnic population of women 40–55 years of age. *Am J Epidemiol*. 2000;152(5):463–473. doi:10.1093/aje/152.5.463
- Kim M-J, Yim G, Park H-Y, Hachul H. Vasomotor and physical menopausal symptoms are associated with sleep quality. *PLoS One*. 2018;13(2):e0192934. doi:10.1371/journal.pone.0192934
- Cho HN, Choi E, Seo DH, et al. The Korean Study of women's health-related issues (K-Stori): rationale and study design. *BMC Public Health*. 2017;17(1):609. doi:10.1186/s12889-017-4531-1
- Burger HG, Hale GE, Dennerstein L, Robertson DM. Cycle and hormone changes during perimenopause: the key role of ovarian function. *Menopause*. 2008;15(4 Pt 1):603–612. doi:10.1097/gme.0b013e318174ea4d
- Harlow SD, Gass M, Hall JE, et al. Executive summary of the stages of reproductive aging workshop + 10: addressing the unfinished agenda of staging reproductive aging. *J Clin Endocrinol Metab*. 2012;97(4):1159–1168. doi:10.1210/jc.2011-3362
- Buyse DJ, Reynolds CF, 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. doi:10.1016/0165-1781(89)90047-4
- Sokol RJ, Martier SS, Ager JW. The T-ACE questions: practical prenatal detection of risk-drinking. *Am J Obstet Gynecol*. 1989;160(4):863–870. doi:10.1016/0002-9378(89)90302-5
- Lee EH, Chung BY, Suh CH, Jung JY. Korean versions of the perceived stress scale (PSS-14, 10 and 4): psychometric evaluation in patients with chronic disease. *Scand J Caring Sci*. 2015;29(1):183–192. doi:10.1111/scs.12131
- Kroenke K, Spitzer RL, Williams JB, Löwe B. The patient health questionnaire somatic, anxiety, and depressive symptom scales: a systematic review. *Gen Hosp Psychiatry*. 2010;32(4):345–359. doi:10.1016/j.genhosppsych.2010.03.006

28. Monterrosa-Castro A, Marrugo-Flórez M, Romero-Pérez I, Fernández-Alonso AM, Chedraui P, Pérez-López FR. Assessment of sleep quality and correlates in a large cohort of Colombian women around menopause. *Menopause*. 2013;20(4):464–469. doi:10.1097/gme.0b013e31826e7649
29. Avis NE, Stellato R, Crawford S, et al. Is there a menopausal syndrome? Menopausal status and symptoms across racial/ethnic groups. *Soc Sci Med*. 2001;52(3):345–356. doi:10.1016/S0277-9536(00)00147-7
30. Zhang JP, Wang YQ, Yan MQ, Li ZA, Du XP, Wu XQ. Menopausal symptoms and sleep quality during menopausal transition and postmenopause. *Chin Med J (Engl)*. 2016;129(7):771–777. doi:10.4103/0366-6999.178961
31. Xu Q, Lang CP. Examining the relationship between subjective sleep disturbance and menopause: a systematic review and meta-analysis. *Menopause*. 2014;21(12):1301–1318. doi:10.1097/GME.0000000000000240
32. Bailey RL, Gahche JJ, Miller PE, Thomas PR, Dwyer JT. Why US adults use dietary supplements. *JAMA Intern Med*. 2013;173(5):355–361. doi:10.1001/jamainternmed.2013.2299
33. Dennerstein L, Dudley E, Hopper J, Guthrie J, Burger H. A prospective population-based study of menopausal symptoms. *Obstet Gynecol*. 2000;96(3):351–358. doi:10.1016/s0029-7844(00)00930-3

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