ORIGINAL ARTICLE

COMPARATIVE ANALYSIS OF SLEEP DISORDER RISK ACROSS REPRODUCTIVE AGING STAGES IN WOMEN

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Abstract

Introduction: To evaluate the risk of obstructive sleep apnea syndrome, insomnia, and restless legs syndrome across reproductive aging stages and assess associations with key menopausal symptoms, age, parity, multimorbidity, anxiety, and depression.

Materials and Method: A total of 900 women aged >18 years were included. The risks of sleep disorders were assessed using validated screening tools. Multimorbidity was defined as the presence of two or more chronic conditions based on the Charlson comorbidity index. Logistic regression analyses were conducted to calculate the crude and adjusted odds ratios for each disorder.

Results: The prevalence of risk for obstructive sleep apnea syndrome, restless legs syndrome, and insomnia was 19.4%, 16.6%, and 21.4%, respectively; 42% of participants were at risk for at least one of these disorders. In adjusted models, the risk of obstructive sleep apnea syndrome was associated with older age, night sweats, and depression. Insomnia was predicted by frequent urination, anxiety, depression, and parity ≥3. Restless legs syndrome was associated with urinary incontinence, anxiety, and parity ≥3. Insomnia symptoms were more common in postmenopausal women, whereas daytime symptoms were less frequent. Sleep disorder risk was elevated in the menopausal transition and postmenopausal groups.

Conclusion: The risk of sleep disorders is high during menopause and menopausal transition and is likely multifaceted. Multimorbidity, parity, depression, and anxiety can lead to complications. Menopausal symptoms, a common reason for gynecology visits, may be linked to these disorders, offering key opportunities to identify and support at-risk individuals.

Keywords: Sleep Initiation and Maintenance Disorders; Menopause; Sleep Apnea, Obstructive; Restless Legs Syndrome; Aging.

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INTRODUCTION

Sleep, a crucial contributor to the homeostasis of the brain and body (1), is often compromised by the high prevalence of sleep disorders in society. These conditions are associated with significant morbidity and mortality, emphasizing the need for effective interventions (2). Sleep disturbances in women are often perceived as a normal part of the menopausal transition, which may contribute to underdiagnosis in clinical practice (3).

In women, reproductive aging introduces distinct physiological challenges that affect sleep. The ovary is the first organ to show functional decline with age (4), and chronological and ovarian aging are intertwined processes that jointly shape the timing and experience of reproductive transitions (5). Based on menstrual bleeding patterns, the Staging Reproductive Aging Workshop (STRAW) criteria divides adult female life into three broad stages: reproductive (RS), menopausal transition (MTS), and postmenopausal (PMS). Two key symptoms—vasomotor symptoms (VMS) and urogenital atrophy—are incorporated as additional descriptive markers (6).

Women may experience the menopausal transition and menopause differently. The presence of some menopausal symptoms may predict an increased risk of developing other disorders. The signs and symptoms of menopause include central nervous system-related disorders (hot flashes, mood and sleep disturbances), metabolic dysfunction, cardiovascular changes, and urogenital atrophy. These changes are primarily related to estrogen deprivation but may also reflect broader neuroendocrine dysregulation (7). The menopausal transition, a human physiological transition state, involves a restructuring of regulatory systems; during this period, even minor internal or external perturbations can directly induce vulnerabilities or unmask existing ones (8). This may partly explain the variability in symptom expression and the increased risk for comorbid conditions.

The relationship between mood symptoms and sleep disturbances is bidirectional (9), and menopausal symptoms often overlap with or complicate the clinical presentation of depression (10). Multimorbidity has also been associated with sleep problems (11). Additionally, parity may play a long-term role in sleep and mood regulation. Gestation has been suggested to represent a period of significant neuroplasticity and brain remodeling in adulthood, which may have lasting implications for emotional and physiological regulation (12). This possibility underscores the importance of considering parity in evaluating sleep disorders.

Although the relationship between menopause and sleep has been widely studied, most studies have focused on general sleep complaints or sleep quality rather than disorder-specific risks. Multimorbidity, parity, and urinary symptoms have received limited attention, and night sweats are generally examined together with hot flashes as a single vasomotor symptom, rather than being considered separately. These factors may influence sleep disorders in distinct ways, and overlooking them could limit the clarity of observed associations.

Changes in hormone levels, physical health, and psychosocial status may influence the likelihood of developing sleep disorders throughout reproductive aging. As life expectancy increases globally, gaining a better understanding of potentially modifiable factors may contribute to efforts aimed at promoting healthy aging in women. This study aimed to assess the risk of common sleep disorders by examining their associations with reproductive aging stage, key menopausal symptoms, multimorbidity, depression, anxiety, and parity using validated screening tools.

MATERIALS AND METHOD

This cross-sectional study was conducted at a gynecology clinic between 2022 and 2023

to examine the risk of sleep disorders across reproductive aging stages. Women over 18 years old and their acquaintances who voluntarily agreed to participate were included. Participants completed either a face-to-face assessment or an online survey, depending on their preference. A total of 900 volunteers participated.

Participants who did not speak Turkish or who were not eligible for STRAW classification (e.g., due to primary amenorrhea, history of hysterectomy, use of reproductive hormones within the preceding three months, current pregnancy or breastfeeding, or diagnosis of polycystic ovary syndrome) were excluded. Those who completed the sleep disorder questionnaire and provided complete information on age and reproductive aging stage were included in the analysis (Figure 1). Ultimately, 646 women met the inclusion criteria. For the risk of obstructive sleep apnea syndrome (rOSAS) analysis, participants lacking information on hypertension or body mass index (BMI) were excluded.

The study was approved by the Research Ethics Committee of my institution (Approval No: 2022/29) and conducted following the ethical principles outlined in the Declaration of Helsinki. Written informed consent was obtained from all participants, with online participants providing digital confirmation codes.

Questions on sleep disorders were adapted from the Turkish Adult Population Epidemiology of Sleep Disorders (TAPES) study, in which the scales demonstrated acceptable reliability and content validity (Cronbach's alpha > 0.70) (13).

Sleep Disorder Assessment

Insomnia was evaluated based on the International Classification of Sleep Disorders, 3rd Edition (ICSD-3) (14). Participants were asked about difficulty initiating or maintaining sleep that occurred at least three times per week for at least three months and resulted in daytime impairment (e.g., unrefreshing sleep, fatigue, or reduced functioning).

Restless legs syndrome (RLS) was assessed using the criteria established by the International Restless Legs Syndrome Study Group (15). Participants reported unpleasant sensations (e.g., tingling, restlessness, throbbing) in their legs that occurred at rest, improved with movement, and worsened in the evening or at night. RLS was considered present if all four diagnostic criteria were met and symptoms occurred five times or more monthly. The fifth criterion—excluding other medical or behavioral causes—was not applied.

The Berlin Questionnaire was used to determine the rOSAS. This tool comprises three categories: Category 1 (snoring and witnessed apnea), Category 2 (daytime sleepiness), and Category 3 (hypertension and BMI). Participants with positive responses in at least two categories were classified as having rOSAS (16).

Other Measures

Depression was assessed using the Beck Depression Inventory–FastScreen, a brief seven-item self-report tool designed to measure depressive symptoms without confounding with medical conditions (17). Anxiety was evaluated using the 21-item Beck Anxiety Inventory, which focuses on somatic symptoms of anxiety. The validity and reliability of the Turkish version have been previously established (18). Multimorbidity was assessed using the Charlson Comorbidity Index, which captures physician-diagnosed chronic diseases across multiple systems (e.g., cardiovascular, respiratory, endocrine, renal, and psychiatric) (19). Multimorbidity was defined as the presence of two or more chronic conditions. BMI was calculated from self-reported height and weight, with BMI ≥30 kg/m² classified as obese.

Sociodemographic variables (age, marital status, education, and employment status) were obtained

via self-report. Participants provided information on menstrual cycle characteristics, hormone use (past/current), contraceptive methods, reasons for amenorrhea, last menstrual period (natural or hormone-induced), and obstetric history.

Reproductive aging stage classification followed the STRAW+10 criteria. Based on menstrual patterns, participants selected one of the following categories: regular cycles, subtle changes in flow/length, variable cycle length with persistent ≥7-day difference, ≥60 days of amenorrhea, amenorrhea for 1–2 years, >2–3 years, >3–6 years, or >6 years. These responses were used to classify participants into RS, MTS, or PMS groups (6). Additionally, participants were asked about hot flashes, night sweats, frequent urination, and urinary incontinence.

The minimum required sample size was calculated based on the prevalence of sleep disorders in women from the TAPES study (16). A sample size of at least 248 participants is necessary to achieve a 95% confidence level and a 5% margin of error.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 21.0 (IBM Corp., Armonk, NY, USA). Continuous variables are presented as medians and interquartile ranges (Q1–Q3), and categorical variables as frequencies and percentages.

Associations between reproductive aging stages and sleep disorders, menopausal symptoms, multimorbidity, depression, anxiety, and parity were evaluated using the Chi-square test. Binary logistic regression analyses were conducted to examine the associations between sleep disorders and the variables of interest and to estimate crude odds ratios (ORs). Variables with p-values <0.20 in the univariate analysis were included in a multivariable logistic regression using backward stepwise selection based on the likelihood ratio test.

Because BMI is a component of the rOSAS screening algorithm, obesity was excluded from the regression model for rOSAS. The Hosmer–Lemeshow goodness-of-fit test was used to assess model fit. All logistic regression analyses were performed without imputation of missing data. The constant term was included in all models. A two-tailed p-value <0.05 was considered statistically significant.

RESULTS

This study included 900 volunteers. After applying the exclusion criteria, 545 participants were identified for rOSAS, 644 for risk of insomnia, and 566 for RLS. Figure 1 depicts a flowchart of the study. Table 1 summarizes the characteristics of the study population. The distribution of sleep disorder risk in the study population was as follows: rOSAS was 19.4%, RLS was 16.6%, and insomnia was 21.4%. Overall, 42% of participants were at risk of at least one sleep disorder. Among participants without a known diagnosis of a sleep disorder, 18.3% had rOSAS, 16.4% had RLS, and 18.6% had insomnia.

The median age of the participants was 42 (32–49) years. According to the STRAW criteria, 64.6% (n=417), 12.8% (n=83), and 22.6% (n=146) of participants were classified into the RS, MTS, and PMS groups, respectively. Among postmenopausal women, 8.8% reported experiencing surgical menopause. Compared to the reference age group (18–34 years), all older age groups exhibited a statistically significant increase in crude ORs for the risk of rOSAS. Similarly, women in the MTS and PMS groups had significantly higher crude ORs for rOSAS compared with those in the RS group. The presence of hot flashes, night sweats, frequent urination, urinary incontinence, multimorbidity, anxiety, and depression was significantly associated with an increased risk of rOSAS in the univariate analysis. Having two or more children (parity 2 or ≥3) was also associated

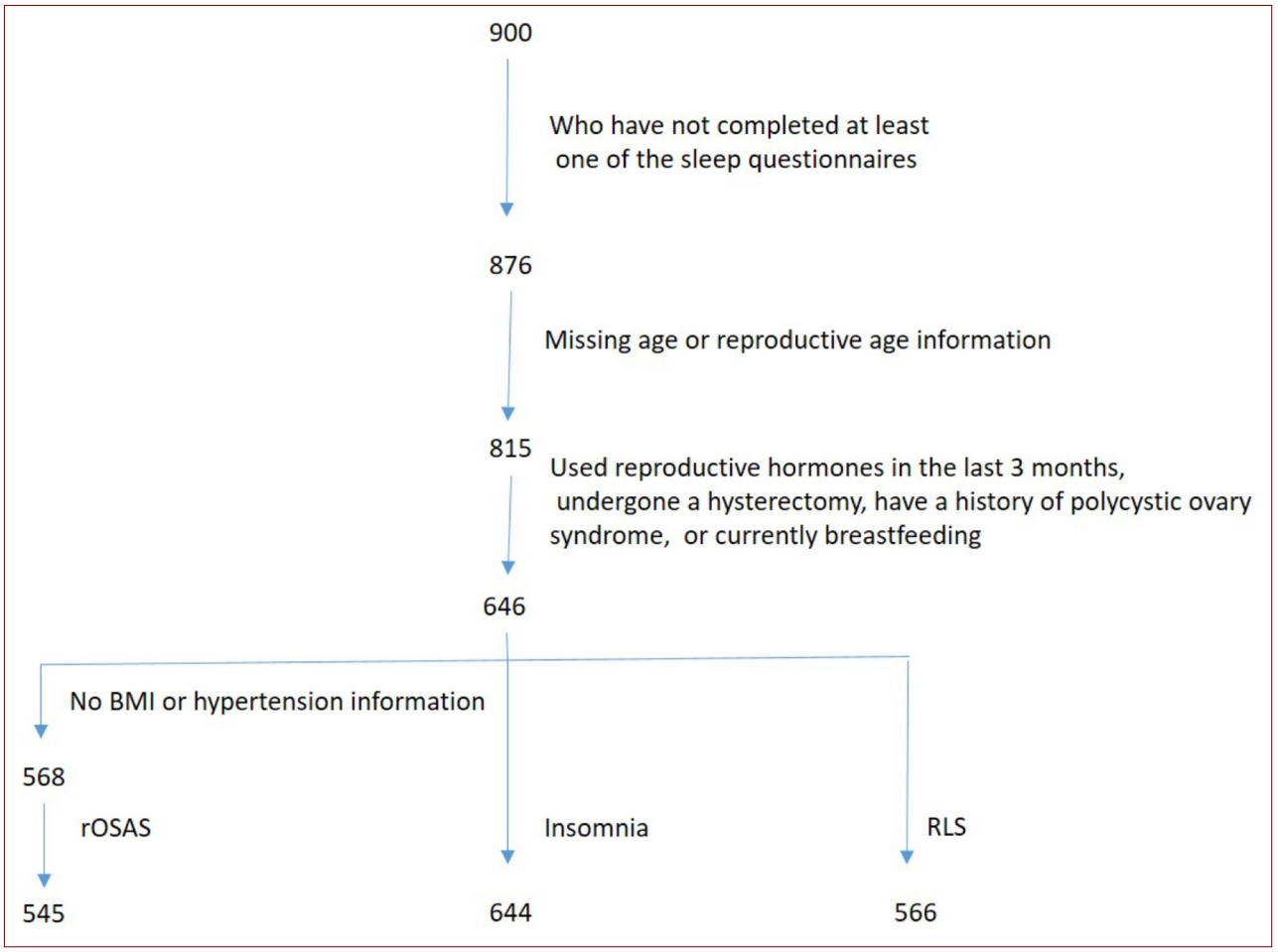

Figure 1. Flow diagram of the study

Abbreviations: rOSAS, risk of obstructive sleep apnea; RLS, restless legs syndrome; BMI, body mass index

with a statistically significant increase in risk. In the multivariable logistic regression analysis, older age groups, night sweats, and depression remained independently associated with a significantly increased risk of rOSAS. Although multimorbidity (p=0.051) and urinary incontinence (p=0.056) did not reach statistical significance, they were retained in the final model (Table 2).

Compared with the reference age group (18–34 years), all older age groups had significantly higher crude ORs for the risk of insomnia. In the univariate analysis, the presence of hot flashes, frequent urination, urinary incontinence, multimorbidity, anxiety, and depression was also significantly associated with increased risk of insomnia. Participants with a parity of ≥3 had a significantly increased risk compared with nulliparous women. In the multivariable logistic regression model, frequent urination, anxiety, depression, and having three or more children remained independently associated with a significantly increased risk of insomnia. Although multimorbidity did not reach statistical significance (p=0.081), it was retained in the final model step (Table 2).

Table 1. Characteristics of the study population

		n(%)
Age	18-34	196(30.3)
	35-44	189(29.3)
	45-54	172(26.6)
	≥55	89(13.8)
Reproductive aging stage	Reproductive	417(64.6)
	Menopausal transition	83(12.8)
	Postmenopause	146(22.6)
Education	High school or less	237(36.9)
	Above high school	406(63.1)
Working status	Not working	295(45.7)
	Working	347(53.7)
Marital status	Single	191(29.7)
	Married	452(70.3)
rOSAS	absent	439(80.6)
	present	106(19.4)
Insomnia	absent	506(78.6)
	present	138(21.4)
RLS	absent	472(83.4)
	present	94(16.6)
Any sleep disorder	absent	308(58.0)
	present	223(42.0)

rOSAS, risk of obstructive sleep apnea; RLS, restless legs syndrome; BMI, body mass index

When individual insomnia symptoms were analyzed separately according to the ICSD-3 criteria, difficulty initiating sleep was significantly more prevalent in the PMS group compared with the RS group (p=0.009; OR=1.8, 95% CI=1.2–2.9). Similarly, difficulty maintaining sleep was approximately twice as common in the PMS group (p=0.005; OR=2.0, 95% CI=1.2–3.2). In contrast, daytime insomnia-related symptoms were significantly less frequent in the PMS group compared with the RS group (p<0.001; OR=0.5, 95% CI=0.3–0.7).

Compared with the reference age group (18–34 years), participants aged 45–54 and ≥55 years had significantly higher crude ORs for the risk of RLS. In the univariate analysis, the presence of hot flashes, night sweats, urinary incontinence, anxiety, obesity, and parity of ≥3 was also significantly associated with increased RLS risk. In the multivariable logistic regression model, urinary incontinence, anxiety, and parity of ≥3 were independently associated with a significantly increased risk of RLS (Table 2).

Table 3 presents the associations between reproductive aging stages and the parameters

Table 2. Crude and Adjusted Odds Ratios for Sleep Disorders

	rOSAS				Insomnia				RLS			
	p	Crude OR (95% CI)	p	Adjusted OR (95% CI)	p	Crude OR (95% CI)	p	Adjusted OR (95% CI)	p	Crude OR (95% CI)	p	Adjusted OR (95% CI)
Age	<0.001		0.003		0.013				0.012			
18-34		ref		ref		ref		ref		ref		ref
35-44	0.001	3.5(1.7-7.2)	0.004	4.6(1.6-12.9)	.003	2.2(1.3-3.8)			0.055	1.9(1.0-3.7)		
45-54	<0.001	4.5(2.2-9.3)	0.016	3.8(1.3-11.0)	0.006	2.1(1.2-3.7)			0.003	2.7(1.4-5.1)		
≥55	<0.001	7.2(3.3-15.4)	<0.001	8.9(2.9-28.3)	0.018	2.1(1.1-4.0)			0.005	2.9(1.4-6.0)		
Reproductive aging stage	<0.001				0.127				0.143			
Reproductive		ref		ref		ref		ref		ref		ref
Menopausal transition	0.001	2.7(1.5-5.0)			0.173	1.5(0.8-2.6)			0.272	1.4(0.8-2.7)		
Postmenopausa	0.001	2.2(1.4-3.6)			0.073	1.5(1.0-2.3)			0.061	1.6(1.0-2.7)		
Hot flushes	0.001	2.2(1.4-3.5)			0.001	2.0(1.3-3.0)			<0.001	2.5(1.5-4.0)		
Night sweats	<0.001	2.6(1.6-4.3)	0.025	2.2(1.1-4.5)	0.115	1.5(0.9-2.3)			0.008	2.0(1.2-3.4)		
Frequent urination	0.002	2.3(1.4-3.8)			<0.001	2.5(1.5-3.9)	0.019	2.3(1.2-4.7)	0.177	1.5(0.8-2.6)		
Urinary incontinence	<0.001	4.5(2.5-8.1)	0.056	2.4(1.0-4.5)	<0.001	2.7(1.6-4.7)			0.009	2.3(1.2-4.2)	0.043	2.5(1.0-6.0)
Multimorbidity	<0.001	4.3(2.7-6.8)	0.051	2.0(1.0-3.9)	0.001	2.1(1.3-3.2)	0.081	1.8(0.9-3.4)	0.053	1.7(1.0-2.8)		
Anxiety	0.005	2.1(1.2-3.5)			<0.001	3.6(2.2-5.8)	0.003	2.5(1.4-4.3)	<0.001	3.5(2.0-5.9)	0.001	2.8(1.5-5.2)
Depression	<0.001	4.1(2.3-7.2)	<0.001	5.9(2.9-12.3)	<0.001	2.8(1.6-4.8)	0.008	2.5(1.3-4.8)	0.089	1.7(0.9-3.0)		
Parity	0.068				0.060		0.081		<0.001		0.002	
.0	ref	ref				ref		ref		ref		ref
1	0.063	2.0(1.0-4.3)			0.939	1.0(0.5-2.1)	0.591	0.8(0.3-1.9)	0.268	1.6(0.7-3.6)	0.132	2.1(0.8-5.7)
2	0.011	2.4(1.2-4.8)			0.163	1.5(0.8-2.8)	0.344	1.4(0.7-3.0)	0.062	2.0(1.0-4.1)	0.115	2.1(0.8-5.0)
≥ 3	0.038	2.4(1.0-5.3)			0.018	2.3(1.2-4.5)	0.047	2.3(1.0-5.3)	<0.001	5.1(2.4-10.8)	<0.001	6.3(2.4-16.4)
Obesity					0.287	1.3(0.8-2.2)			0.028	1.9(1.1-3.3)		
Nagelkerke R Square				0.269				0.191				0.162

rOSAS, risk of obstructive sleep apnea; RLS, restless legs syndrome; ref, reference;OR, odds ratio; CI confidence interval.*p* values indicate the significance level of each variable in the regression models. Variables with a *p* value < 0.20 in univariable analyses were included in the multivariable logistic regression models using backward stepwise selection (likelihood ratio).

Table 3. Distribution of Parameters by Reproductive Aging Stage

		Reproductive n(%)	Menopausal transition n(%)	Postmenopausal n(%)	p
rOSAS	absent	299(85.7)	44(68.8)	96(72.7)	< 0.001
	present	50(14.3)	20(31.3)	36(27.3)	
Insomnia	absent	337(81.0)	61(74.4)	108(74.0)	0.125
	present	79(19.0)	21(25.6)	38(26.0)	
Sleep initiation difficulty	absent	349(83.9)	63(76.8)	108(74.0)	0.021
	present	67(16.1)	19(23.2)	38(26.0)	
Sleep maintenance difficulty	absent	361(86.8)	65(79.3)	112(76.7)	0.010
	present	55(13.2)	17(20.7)	34(23.3)	
Insomnia daytime symptoms	absent	166(39.9)	34(41.0)	84(57.5)	0.001
	present	250(60.1)	49(59.0)	62(42.5)	
RLS	absent	306(85.7)	63(80.8)	103(78.6)	0.140
	present	51(14.3)	15(19.2)	28(21.4)	
Any sleep disorder	absent	212(64.0%)	33(49.3%)	63(47.4%)	0.001
	present	119(36.0%)	34(50.7%)	70(52.6%)	
Age	18-34	190(45.6)	6(7.2)	0(0.0)	< 0.001
	34-44	156(37.4)	30(36.1)	3(2.1)	
	45-54	70(16.8)	44(53.0)	58(39.7)	
	≥55	1(0.2)	3(3.6)	85(58.2)	
Hot flushes	absent	326(83.2)	41(53.2)	81(58.3)	< 0.001
	present	66(16.8)	36(46.8)	58(41.7)	
Night sweats	absent	346(88.3)	57(74.0)	94(67.6)	< 0.001
	present	46(11.7)	20(26.0)	45(32.4%)	
Urinary incontinence	absent	363(92.6)	66(85.7)	116(83.5)	0.005
	present	29(7.4)	11(14.3)	23(16.5)	
Frequent urination	absent	341(87.0)	66(85.7)	101(72.7)	< 0.001
	present	51(13.0)	11(14.3)	38(27.3)	
Obesity	absent	340(86.7)	49(74.2)	114(81.4)	0.023
	present	52(13.3)	17(25.8)	26(18.6)	
Anxiety	absent	170(65.9)	39(68.4)	63(64.3)	0.872
	present	88(34.1)	18(31.6)	35(35.7)	
Depression	absent	214(79.0)	53(80.3)	97(91.5)	0.015
	present	57(21.0)	13(19.7)	9(8.5)	
Parity	0	94(33.9)	10(14.3)	20(17.5)	< 0.001
	1	67(24.2)	9(12.9)	28(24.6)	
	2	77(27.8)	32(45.7)	45(39.5)	
	≥3	39(14.1)	19(27.1)	21(18.4)	
Multimorbidity	absent	325(82.7)	60(75.0)	95(67.9)	0.001
	present	68(17.3)	20(25.0)	45(32.1)	

rOSAS, risk of obstructive sleep apnea; RLS, restless legs syndrome.*p* values were obtained using the Chi-square test to compare distributions across reproductive aging stages.

examined. Statistically significant associations were identified for rOSAS, age group, hot flashes, night sweats, frequent urination, urinary incontinence, obesity, depression, multimorbidity, and parity.

DISCUSSION

In the study population, the risk of sleep disorders was as follows: rOSAS 19.4%, RLS 16.6%, insomnia 21.4%. The overall incidence of any sleep disorders was 42%. The rOSAS and risk of any sleep disorders were higher in the MTS group than in the RS group. The PMS group exhibited higher rOSAS, difficulty initiating and maintaining sleep, and risk of any sleep disorder compared with the RS group. In the TAPES study (13), the prevalence rates of sleep disorders in women were 16.1% for OSAS, 7.3% for RLS, and 20.2% for insomnia. The observed rate differences may be attributed to a higher likelihood of women with sleep and gynecological complaints volunteering for the study.

Although studies vary in their findings, most report an increase in insomnia symptoms during the menopausal transition period, with some noting an increase during menopause itself (20,21). The lower risk of daytime insomnia symptoms during MTS and PMS compared with that during RS may explain the lack of a statistically significant difference in the risk of insomnia between the stages. Differences in reproductive aging classification and the failure of some studies to assess daytime symptoms may also account for the inconsistencies in previous findings. Menopause is a risk factor for OSAS in women, and an exposure–response relationship between advancing menopause and OSAS has been suggested. Depression is commonly reported among those affected (14,22). Although the relationship between OSAS and urinary incontinence in women has not been widely studied, evidence of an association has been observed in the urogynecology population (23). The relationship between OSAS and multimorbidity remains inconclusive (24). Further research is needed to clarify the relationships between OSAS, multimorbidity, and urinary incontinence.

In a previous study conducted among women aged 18–64 years, the prevalence of RLS was 15.7%, with a positive association with age, no significant relationship with menopausal status, and a higher prevalence among women experiencing VMS compared with those without VMS (25). In the present study, however, the effect of VMS on RLS was not statistically significant after adjusting for other variables. Similarly, although age was associated with RLS in univariable analysis, this association did not persist in the multivariable model, suggesting potential confounding by other factors. Only 5.2% of individuals report having a sleep disorder, whereas the risk of any sleep disorder was identified in 42% of participants. Considering the significant impact of sleep on physical and mental health, our findings underscore the need for measures to improve accessibility and support for affected individuals.

Poor sleep quality at baseline is independently and collectively associated with a higher risk of progression of multimorbidity during the follow-up period, particularly among individuals younger than 65 years and female participants (24). The relationship between sleep disorders, multimorbidity, and MT underscores the critical importance of this period for early prevention and intervention.

Sleep disorders are associated with depression and anxiety. Given the multiple effects that estrogens and progesterone exert on the central nervous system, their influence on mood and sleep and the consequent reciprocal relationship between mood and sleep across female reproductive stages is not surprising (9). Parity has been found to be associated with sleep disorders; its relationship with RLS and insomnia remained significant even when adjusted for other factors. This finding warrants further investigation.

The frequency of parameters in different reproductive aging stages suggests that various interactions may play a role during different stages.

Strengths

This study includes a detailed assessment of reproductive history. Insomnia was diagnosed using the ICSD-3 criteria, and accepted screening tests for OSA and RLS were used. The study also analyzed common symptoms of menopause and parity and considered multimorbidity, depression, and anxiety as covariates.

Limitations

This study employed screening rather than diagnostic methods. The cross-sectional design prevents conclusions about causality. Self-reported questionnaires were used to assess sleep disorders and other variables, which may be subject to recall or reporting bias. The reliance on voluntary participation may have resulted in an overrepresentation of women with sleep issues, potentially skewing the results. The participants' high level of education may have also impacted the outcomes. Although hormonal markers were not included in the classification of menopausal stages, reproductive aging was determined using the STRAW+10 criteria, which emphasize menstrual patterns as the primary basis for staging and consider hormonal values as optional due to their intra-individual variability. Comorbid conditions were not confirmed with biological markers or clinical records, which may have introduced classification bias in the multimorbidity assessment. The final regression models did not include lifestyle-related factors such as medication use, physical activity, marital status, and working status. This limited the ability to control for potential confounding effects. The wide age range of participants may have introduced heterogeneity that could affect the interpretation of the findings. The presence of hypertension in the multimorbidity and OSAS screenings may have confounded the relationship between multimorbidity and rOSAS. Only a few menopausal participants underwent surgical menopause; this was not distinguished from natural menopause. Missing data resulted in a reduced sample size for the regression analysis. The study is prone to overfitting the models to the study population, thus requiring replication in another group. Additionally, the lack of longitudinal follow-up limits the ability to observe temporal relationships. Moreover, these results cannot be generalized beyond the study population. The findings indicate associations rather than causation.

Conclusion

Considering the impact of sleep on physical and mental health, the high detection rate of sleep disorders emphasizes the importance of measures that will make it easier to reach individuals. The risk of sleep disorders is particularly elevated in women during the menopausal transition and menopause. This risk is complex and multifaceted, with continuous interactions among various factors contributing to its complexity. Menopausal symptoms, which are common reasons for frequent visits to gynecology clinics, as well as multimorbidity, depression, and anxiety, may be associated with sleep disorders. As the human ovary is the first organ to decline in function with age, the menopausal transition may be a critical period for healthy aging.

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