

Sleep Health and Disorders in Women with Polycystic Ovary Syndrome: A Cross-Sectional Study

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ABSTRACT

Background & Objective: Polycystic ovary syndrome (PCOS) is a common endocrine disorder affecting women of reproductive age which is characterized by hormonal imbalance and ovarian dysfunction. New evidence indicates the existence of a potential two-way relationship between PCOS and sleep disorders. Therefore, due to the necessity for a comprehensive assessment, the present study was conducted with aim of investigating the relationship between sleep health and disorders in PCOS patients.

Materials & Methods: This cross-sectional study was conducted on 120 women diagnosed with PCOS. The patients were asked to fill out PSQI questionnaire to examine people's attitudes regarding sleep quality within 4 weeks. Demographic and anthropometric data were collected, and PSQI scores were statistically analyzed. $P < 0.05$ was considered significant.

Results: Sleep problems generally increased with age, except for the fifth component (sleep disturbance) and the sixth component (need to take sleeping pills), where this increase was not statistically significant ($p > 0.05$). Severe sleep problems were observed in the second (delay in falling asleep), third (duration), and seventh (daily functional disturbances) components, especially in participants over 35 years old. However, moderate problems were common in patients over 35 years old in the first (subjective quality of sleep), third, and fourth (efficiency level) components. Also, sleep problems increased in all components with increasing BMI, which was significant (P value < 0.006) except in the fifth and sixth components.

Conclusion: PCOS is associated with sleep disorders and sleep problems generally increase with age in PCOS patients.

Keywords: Polycystic ovary syndrome, Sleep disorders, Sleep quality, Age, BMI



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1. Introduction

Polycystic Ovary Syndrome (PCOS) is the most prevalent endocrine and metabolic disorder affecting women, impacting up to 10% of female population that is primarily characterized by hyperandrogenism and irregular menstrual cycles. The presentation of PCOS varies significantly among individuals, yet it is strongly linked to obesity, hirsutism, and infertility (1-3). Beyond its reproductive implications, PCOS is closely associated with a wide array of metabolic disorders, including hepatic steatosis, glucose intolerance, dyslipidemia, Type 2 Diabetes Mellitus (T2DM), and hypertension (4). The metabolic and reproductive consequences of PCOS have been extensively documented across all life stages (5), underscoring its profound long-term impact on women's health (6).

The adverse effects of PCOS often lead to psychological issues such as low self-esteem, frequent stress, and mood disorders. It is well-established that depression and anxiety can precipitate sleep disorders. Since PCOS involves metabolic disturbances and the endocrine system-particularly the functions of melatonin and cortisol-plays a vital role in regulating the sleep-wake cycle, PCOS may disrupt normal sleep patterns (7-9). Recent research has highlighted a strong connection between PCOS and sleep disorders, including obstructive sleep apnea and excessive daytime sleepiness (1,10-14). PCOS women frequently experience difficulty in falling asleep, restless sleep, and severe fatigue during short or medium sleep durations, largely due to reduced REM sleep time (15-18). These

sleep issues are more pronounced in patients with high BMI and depression symptoms, although both factors independently contribute to sleep disorders, illustrating the complexity of PCOS. While many PCOS patients are overweight or obese, sleep problems also occur in those with average weight (19, 20).

Cohort studies demonstrated that short sleep duration can lead to various metabolic disorders, including elevated reactive protein levels, decreased insulin sensitivity (a critical feature of PCOS), increased blood pressure, high cholesterol, elevated nighttime cortisol levels, and decreased leptin, all of which may increase the risk of obesity (19). In this context, sleep disorders and short sleep duration can mediate both the symptoms and metabolic effects of PCOS. Other studies have found that poor sleep is associated with high triglyceride levels in PCOS patients. Insulin resistance reduces the inhibition of fat lipolysis, resulting in increased serum-free fatty acids and triglycerides (21). Reduced sleep duration can increase cortisol levels, making cells more resistant to insulin and contributing to PCOS development (22). Poor sleep also decreases leptin levels while increasing ghrelin, which stimulates appetite and disrupts energy balance, potentially contributing to obesity in PCOS patients (23,24). Consequently, sleep disorders can be both a complication and a contributing factor to PCOS.

It is crucial to determine the relationship between PCOS and sleep, as sleep disturbances can exacerbate metabolic symptoms associated with PCOS, such as insulin resistance and obesity (25,26). Poor sleep quality can lead to increased cortisol levels, reduced insulin sensitivity, and altered appetite hormones, further complicating the condition. Therefore, investigating sleep in PCOS patients is essential to address both the psychological and metabolic impacts of this syndrome; therefore, the present study was conducted with aim to investigate the relationship between sleep health and disorders in women with polycystic ovary syndrome.

2. Materials and Methods

This cross-sectional study was conducted on all women diagnosed with polycystic ovary syndrome referred to Shariati hospital clinic, BandarAbbas, Iran, in February 2023-2024. The patients with chronic diseases, psychiatric disorders, and the use of drugs affecting the hypothalamic-pituitary-gonadal axis (such as GnRH agonists, antipsychotic drugs, antidepressants, and chemotherapy agents) due to the inhibition of ovarian hormone secretion were excluded. The census method was used to prepare the sample size (n=120), and all eligible patients were invited to participate in this study.

The patients were invited to complete the questionnaire. Patients' demographics (age) and anthropometric variables (height, weight, BMI) were recorded. Then, Pittsburgh Sleep Quality Index (PSQI)

questionnaire was completed by the patients, which examines people's attitudes regarding sleep quality in the last four weeks. This questionnaire has seven components (subjective sleep quality, sleep latency, proper sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication and daytime dysfunction) and each scale of the questionnaire gets a score of 0 (no problem) to 3 (severe problem) (27). At the end, the scores of each component are added together and a total score of 0 to 21 is obtained. A high score in each component or the overall score indicates poor sleep quality. Scores of 0, 1, 2, and 3 on each scale indicate a normal condition, the existence of a mild, moderate, and severe problem, respectively. A total score of 5 or more means poor sleep quality. Each of the overall description scales of a person's sleep quality includes, sleep latency, proper sleep duration, habitual sleep efficiency (based on the ratio of helpful sleep duration to the total time spent in bed), sleep disturbances (waking up at night), use of sleeping medication and daytime dysfunction (problems caused by poor sleep experienced by the person during the day) (26,28). The score for each of the seven components, as well as the total score, was recorded.

Data analysis

Descriptive and analytical statistical analysis was done using IBM-SPSS software (version 23). Quantitative variables were reported as mean±SD and qualitative variables as percentages. Chi-square, Student t, ANOVA, and correlation coefficient tests were also used. P<0.05 was regarded as statistically significant.

3. Results

A total of 120 patients participated in this study; the minimum and maximum ages of the participants were 17 and 45 years (Table 1).

The PSQI questionnaire has seven components, which include subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. The participants' lowest and highest total PSQI scores were 1 and 12, respectively. The mean PSQI score, a reflection of the average sleep quality of the participants, was 6.30±2.41.

The mean scores of the first component of the questionnaire increased with age, which was statically significant (P<0.05), providing clear and confident results. In the second, third, fourth, and seventh components, as in the first component, sleep problems significantly increased with increasing age (P<0.05). In the fifth component, as in the first component, sleep problems increased with age, but this increase was insignificant (P>0.05). In the sixth component, there was no statistical difference between the least sleep problems and the most sleep problems (P>0.05) (Table 2).

The analysis revealed a significant correlation between age and the severity of sleep problems among women with PCOS (Table 3). Specifically, individuals over 35 years were more likely to experience moderate to severe sleep issues. In contrast, those 25 to 35 years predominantly reported mild sleep problems. Notably, younger individuals under 25 years were more likely to have no sleep problems at all.

The statistical analysis confirmed the significant relationship between age groups and sleep problems in several components ($P < 0.05$). This suggests that age plays a crucial role in determining the severity of sleep disturbances in PCOS women.

Components 1, 2, 3, 4, and 7 showed a significant relationship between age and sleep problems. In these groups, the majority of individuals with severe sleep problems were over 35 years, while those with

moderate sleep issues were mostly 25 to 35 years. Individuals with mild sleep problems or no sleep problems were also predominantly in the younger age groups. In contrast, components 5 and 6 did not show a significant relationship between age and sleep problems. Most individuals in these groups experienced mild sleep issues and were between 25 and 35 years. Additionally, in component 6, most individuals had no sleep problems and were also within the 25 to 35 age range.

In all components, with increasing BMI, sleep problems increased, and this increase was significant ($P < 0.05$), except for the fifth and sixth components, where this increase was not significant ($P > 0.05$) (Table 4).

Table 1. Demographic and anthropometric information of participants

	Minimum	Maximum	Mean±SD
Age (years)	170	45	6.58±30.50
Weight (kg)	45	85	9.54±66.02
Height (cm)	155	172	4.02±161.25
BMI (kg/m ²)	17.5	31.4	3.48±25.52

Table 2. Examining the relationship between age and components of the questionnaire

	Age	Number	Mean±SD	P-value
The first component (subjective sleep quality)	25≥	31	0.64±0.55	0.000
	25< <35	52	1.03±0.55	
	35≤	37	1.32±0.47	
The second component (sleep latency)	25≥	31	0.77±0.84	0.000
	25< <35	52	1.69±0.61	
	35≤	37	2.08±0.43	
The third component (sleep duration)	25≥	31	0.71±0.46	0.001
	25< <35	52	0.71±0.53	
	35≤	37	1.16±0.60	
The fourth component (habitual sleep efficiency)	25≥	31	0.38±0.49	0.000
	25< <35	52	0.59±0.49	
	35≤	37	0.94±0.32	
The fifth component (sleep disturbances)	25≥	31	1.00±0.25	0.92
	25< <35	52	1.01±0.37	
	35≤	37	1.02±0.16	
The sixth component (use of sleeping medication)	25≥	31	0.09 ± 0.30	0.15
	25< <35	52	0.25 ± 0.43	
	35≤	37	0.13 ± 0.34	
The seventh component (daytime dysfunction)	25≥	31	0.67 ± 0.65	0.007
	25< <35	52	1.13 ± 0.74	
	35≤	37	1.13 ± 0.58	

Table 3. The correlation of responses to questionnaire components with different age groups

Age Group		≤25	25< <35	≥35	P-value
	score				
The first component (subjective sleep quality)	0	12(10.0)	7(5.8)	0(0.00)	0.000
	1	18(15.0)	36(30.0)	25(20.8)	
	2	1(0.8)	9(7.5)	22(18.3)	
The second component (sleep latency)	0	15(1.25)	3(2.5)	0(0.00)	0.000
	1	8(6.7)	11(9.2)	2(1.7)	
	2	8(6.7)	37(30.8)	30(25.00)	
	3	0(0.00)	1(0.8)	5(4.2)	
The third component (sleep duration)	0	9(7.5)	17(14.2)	3(2.5)	0.006
	1	22(18.3)	33(27.5)	26(21.7)	
	2	0(0.00)	2(1.7)	7(5.8)	
The fourth component (habitual sleep efficiency)	0	19(15.8)	21(17.5)	3(2.5)	0.000
	1	12(10.0)	31(25.8)	33(27.5)	
	2	0(0.00)	0(0.00)	1(0.8)	
The fifth component (sleep disturbances)	0	1(0.8)	3(2.5)	1(0.8)	0.43
	1	29(24.2)	45(37.5)	29(24.2)	
	2	1(0.8)	4(3.3)	1(0.8)	
The sixth component (use of sleeping medication)	0	28(23.3)	39(32.5)	32(26.7)	0.15
	1	3(2.5)	13(10.8)	5(4.2)	
The seventh component (daytime dysfunction)	0	1(0.8)	3(2.5)	1(0.8)	0.03
	1	29(24.2)	45(37.5)	29(24.2)	
	2	1(0.8)	4(3.3)	1(0.8)	
	3	1(0.8)	4(3.3)	1(0.8)	

Table 4. The relationship between BMI and the questionnaire components

	score	BMI Mean±SD	P-value
The first component (subjective sleep quality)	0	22.16±0.43	0.000
	1	25.71±0.38	
	2	27.74±0.53	
The second component (sleep latency)	0	21.73±0.43	0.000
	1	22.9±0.49	
	2	27.09±0.30	
The third component (sleep duration)	0	23.55±0.56	0.000
	1	25.85±0.38	
	2	28.91±0.57	
The fourth component (habitual sleep efficiency)	0	22.82±0.38	0.000
	1	26.98±0.34	
The fifth component (sleep disturbances)	0	25.25±0.98	0.14
	1	25.38±0.33	
	2	28.26±0.78	
The sixth component (use of sleeping medication)	0	25.32±0.35	0.18
	1	26.48±0.68	
The seventh component (daytime dysfunction)	0	23.23±0.69	0.000
	1	25.78±0.39	
	2	27.11±0.59	

4. Discussion

Studies link PCOS with sleep problems and daytime sleepiness that may affect the sleep-wake cycle, which is a complex and potentially bidirectional relationship. The purpose of the present study was to investigate the quality of sleep in PCOS patients using the PSQI questionnaire.

Our results suggests that age may play a role in the prevalence of sleep problems in PCOS patients, with a notable increase in sleep problems in patients over 35 years of age. This finding underscores the need for age-specific interventions in the management of PCOS-related sleep problems. Our study also found that sleep problems increased with increasing BMI in all

components, with a significant increase in all but the fifth and sixth components. This suggests that BMI may play a role in the development of sleep problems, highlighting the potential for targeted interventions.

Hung et al., also studied the association between PCOS and psychiatric disorders, including schizophrenia, bipolar, depression, anxiety, and sleep disorders. They compared 5,431 PCOS patients with 21,724 age- and sex-matched individuals without PCOS. Their results showed that PCOS patients had more incidences of depression, anxiety, and sleep disorders compared to the other group. However, there was no significant increase in the risk of bipolar disorder in PCOS people (10). Their study was aligned with our study that the average total PSQ score of the participants was 6.30, and since a total score of 5 or more means inadequate sleep quality, it can be concluded that PCOS is related to sleep disorders in these patients.

In 2019, Hachul et al., studied sleep quality in women with PCOS and compared them to a healthy control group, once without and once with consideration of hyperandrogenism. They found that women with polycystic ovary syndrome had poor subjective sleep quality, increased snoring, and higher rates of obstructive sleep apnea. After adjusting for body mass index, people with polycystic ovary syndrome had less REM sleep than the control group. They found that obesity affects sleep, but hyperandrogenism does not (26). Our study's results also indicated that women with PCOS have sleep disorders as BMI and age increases.

Moran et al., conducted a study in South Australia to investigate sleep disorders in women with PCOS in a community-based sample. They compared 87 women with PCOS diagnosed using the Rotterdam criteria, a widely accepted diagnostic tool for PCOS, and 637 women without this diagnosis. Sleep disorders were twice as common in women with polycystic ovary syndrome than women without it. Increased incidence of difficulty in maintaining sleep was associated with obesity and depressive symptoms (12). In our study, sleep problems increased in all components with increasing BMI. Therefore, these studies are also in line with our study, which showed a significant relationship between PCOS and sleep disorders.

Turan et al., In 2021 examined sleep quality in patients with PCOS and its relationship with metabolic parameters. This study included 50 PCOS patients and 51 healthy volunteers. Using the PSQI, they found that PCOS patients had lower sleep quality, although it was not statistically significant (21). Our study significantly concluded the relationship between PCOS and low quality of sleep. This significant difference may be due to the difference in sample size or individual differences between the subjects studied.

Azizi et al., reported lower sleep quality in women with PCOS in all fields, especially subjective sleep quality ($P < 0.05$), daytime function ($P = 0.001$), and use

of sleep medication ($P = 0.003$) and that the strongest effect from a psychological variable on sleep quality is body image which has a negative impact on sleep quality of patients with PCOS (29). Our study also showed a lower sleep quality in women with PCOS in subjective sleep quality, daytime function, and use of sleep medication based on age groups (29).

Karasu et al., in their study, they used PSQI questionnaire to assess chronotype and sleep quality in patients with PCOS and the results showed subjective sleep quality, sleep latency, habitual sleep efficiency, utilization of sleep medication and daytime dysfunction scores were significantly different between the two groups of PCOS and control which were similar in age and body mass index. But our study considered age and BMI as variables. Nevertheless, the overall conclusion of both studies was that PCOS patients have worse sleep quality compared to others (30).

The present study had limitations in terms of sample size and participant diversity, which could affect the findings' generalizability. The sample size was relatively small, and the participants were predominantly from a single ethnic group and socioeconomic status. This limits the applicability of the findings to a more diverse PCOS population. Therefore, it is suggested that a diverse and representative sample of people with PCOS be targeted, considering factors such as ethnicity and socioeconomic status, as this will increase the study's external validity and improve the generalizability of the findings. Also, in future studies, it is better to match the data reported by people with objective measures of sleep, such as polysomnography or actigraphy, to provide a more comprehensive and accurate assessment of sleep health and disorders in people with PCOS. Importantly, collaboration with sleep medicine specialists is essential to ensure a comprehensive evaluation of sleep health and disorders in PCOS women.

5. Conclusion

Based on the findings of the present study, PCOS is significantly associated with sleep disorders, and sleep problems generally increase with age in PCOS women. These findings are crucial for understanding the complex relationship between PCOS and sleep, and they provide valuable insights for future research and clinical practice.

6. Declarations

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Ethical Considerations

The study was approved by the Ethics Committee of Hormozgan University of Medical Sciences (ethical code IR.HUMS.REC.1401.074).

Consent for publication

Consent for publication was obtained from all participants.

Authors' Contributions

Conceptualization: RS, AM, MNM, Methodology: SSS, NA, ZHF, Investigation: MNM, NA, AM,

Writing-Original Draft Preparation: SSS, RS, ZHF, Writing-Review and Editing: ZHF, NA, MNM.

Conflict of Interest

The authors declare no conflict of interest.

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