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Factors Related to Sleep Quality in Women Undergoing Infertility Treatment: A Systematic Review

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ABSTRACT

Background & aim: Considering the importance of sleep in fertility outcomes, the present study aimed to investigate the factors related to sleep quality in women undergoing infertility treatment.

Methods: This systematic review was conducted by performing a comprehensive search in English databases including PubMed, Scopus, ScienceDirect, and Google Scholar, as well as Persian databases including SID, Magiran, and IranDoc, using the keywords of "assisted reproductive technology," "psychological factors," "infertility factors," "sleep quality," and "female." Relevant studies published between 2013 and 2024 were identified. After removing duplicates and screening the titles and abstracts, full texts that met the inclusion criteria were included in this review. The methodological quality of the included studies was assessed using Newcastle–Ottawa Scale. A qualitative synthesis approach was used for data analysis.

Results: Out of 544 retrieved articles, a total of 12 articles were included in this systematic review. The findings were classified into two main categories, of "psychological factors" and "infertility-related factors". In the category of psychological factors, an inverse relationship was found between levels of stress, anxiety, and depression with sleep quality. Regarding infertility-related factors, five studies reported that variables such as type of infertility (primary), cause of infertility (female factor), longer duration of infertility (more than three years), type of treatment (invasive), and specific conditions such as polycystic ovary syndrome and irregular and abnormal menstruation are associated with poor sleep quality in women.

Conclusion: The results indicate that both psychological and infertility-related factors can significantly influence the sleep quality of infertile women.

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Introduction

Sleep is one of the fundamental requirements of life, with humans spending approximately one-third of their lives asleep (1) and it plays a significant role in all aspects of health (2-3). Sleep disorders manifest in different forms including insomnia, sleep apnea, parasomnias, restless leg syndrome, and narcolepsy (4-5). Sleep disorders usually occur following changes in living conditions (6).

Anxiety, depression, stress and mental disorders, and/or changes in a person's life such as job transitions, academic examinations, migration, disrupted daily routines, as well as physical health problems including various diseases and infertility are among the factors affecting sleep quality (6-7). Overall, in five Asian countries, the prevalence of chronic insomnia is about 10%, while mild insomnia affects up to 40% of the population (7). According to the results of some studies, sleep quality disorders are more common in women

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than in men (8–10). In addition, the prevalence of poor sleep quality among individuals with infertility has been reported to range from 12% to 18% (11).

Insufficient sleep or disturbances in sleep quality can affect homeostasis, nervous system function, mood and immune system (4). In certain conditions, individuals may experience poor sleep quality, experience increased daytime sleepiness or abnormal movements, moods and emotions (5-6). Sleep disruption can lead to insomnia, which is a significant health risk associated with impaired physical performance, mental fatigue, memory problems, altered perception, reduced emotional regulation, impaired judgment, and ultimately weakened immune function (10). The relationship between sleep and other bodily disorders is well established through molecular-genetic and hormonal pathways (12-13). These pathways play essential roles in hormone secretion, folliculogenesis, ovulation, fertilization, implantation, and menstruation (13). Also, pathological sleep patterns are strongly associated with menstrual irregularities, polycystic ovary syndrome (PCOS), premature ovarian failure (POF), infertility, and premature loss of fertility (14).

The success rate of pregnancy achieved through reproductive technology is lower in women with sleep quality disorders (13-14), since disturbances in the circadian rhythm may impair the functon of the hypothalamus-pituitary-gonadal (HPG) axis, resulting in reproductive disorders (14,15). The level and secretion patterns of prolactin, thyroid-stimulating hormone (TSH), glucocorticoids and melatonin are also related to sleep parameters (14). For example, glucocorticoids released in response to stress can influence the hormonal cycle related to fertility (16). Additionally, a reduction in serum melatonin level can affect the quantity and quality of eggs, implantation, abortion, and premature birth (15-16).

Sleep quality is influenced by various factors, such as age, gender, occupation, working hours, education level, mental and physical diseases, and in certain populations, income status (5-6). Studies on factors affecting sleep quality in infertile women have shown that treatment methods and the cause of infertility can be associated with sleep quality (5,7).

Since sleep quality is related to women's fertility, and optimal sleep is particularly important for the success of infertility treatment and/or prevention of infertility (14-16), attention to factors associated with sleep quality can help improve it. A comprehensive systematic review of the factors influencing sleep quality in infertile women can provide a valuable basis for designing intervention programs for researchers, healthcare managers, and policymakers. Therefore, considering the knowledge gap in this field, the present study was conducted as a systematic review to investigate the factors related to sleep quality in women undergoing infertility treatment.

Methods

This systematic review was conducted in five stages: 1) formulating the research question, 2) searching for and extracting relevant studies, 3) selecting eligible studies, 4) tabulating and summarizing the information and data, and 5) reporting the results (17). This study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (29-30).

Stage 1: Formulating the Research Question

In the first stage, the research question was formulated based on the PICOS framework. The population (P) consisted of infertile women. The exposure (I) included factors related to sleep quality such as stress, anxiety, depression, hormonal changes, body image concerns, and sleep disorders. There was no comparison group (C). The outcome (O) was sleep quality, and the study design (S) included observational studies such as cross-sectional, case–control, and cohort studies. Accordingly, the research question was: What factors are associated with sleep quality among infertile women?

Stage 2: Searching for and Identifying Relevant Studies

In the second stage, a comprehensive search was conducted to identify relevant studies using keywords derived from the study objective and the PICOS framework. The search strategy was developed based on Medical Subject Headings (MeSH) and related keywords. The researchers

used the following keywords and their Persian equivalents in the search strategy:

["Female" OR "Women" OR "Infertile women"] AND ["psychological factors" OR "anxiety" OR "stress" OR "depression" OR "bipolar disorder" OR "paranoid" OR "delusional disorder"] AND ["social factors"] AND ["economic factors"] AND ["physical factors"] AND ["medical factors"] AND ["sleep disorders" OR "sleep quality"] AND ["treatment of infertility" OR "ART" OR "assisted reproductive technology"].

These keywords and their Persian equivalents were combined using Boolean operators (AND, OR). A comprehensive search was conducted in the following international databases: PubMed, Scopus, ScienceDirect, and Google Scholar, as well as Persian databases including Scientific Information Database (SID), Magiran, and IranDoc. The search included studies published up to January 30, 2024. In addition, the reference lists of relevant articles were manually reviewed to identify further potentially eligible studies.

Stage 3: Study Selection and Eligibility Assessment

In the third stage, all retrieved records were imported into EndNote reference management software for organization and duplicate removal. After removing duplicate records, the titles and abstracts of the remaining studies were screened according to the predefined inclusion criteria. Studies that were not relevant to the objectives of the review were excluded.

Subsequently, the full texts of potentially eligible studies were retrieved and assessed for eligibility. The study selection process was performed independently by two researchers (FH and SE) to ensure accuracy and minimize bias. Any disagreements were resolved through discussion.

A total of 384 records were identified through database searching (n=381), and manual search of references (n=3). After removing duplicates and screening titles and abstracts, 19 studies remained for full-text assessment. One full text was not accessible. After reviewing the full texts, six studies were excluded due to the following reasons: letters or review articles (n = 2), irrelevant outcomes (n = 1), and inability to contact the study authors to obtain missing information (n = 3). Finally, 12 studies met the eligibility criteria and were included in this systematic review. The study selection process is illustrated in Figure 1.

Stage 4: Inclusion Criteria and Data Extraction

Eligible studies included observational studies (descriptive, analytical, cross-sectional, cohort, and case–control) that investigated sleep quality among infertile women undergoing infertility treatment and examined factors related to sleep quality. These factors included psychological variables such as stress, anxiety, depression, body image concerns, and sleep disorders, as well as social, economic, physical, and medical factors potentially influencing sleep quality.

Based on the PICOS framework, the population (P) consisted of infertile women undergoing infertility treatment, the exposure (I) included factors potentially affecting sleep quality, there was no comparison group ©, the outcome (O) was sleep quality, and the study design (S) included observational studies.

Studies were included if they used validated measurement tools and reported sufficient data relevant to the objectives of the study.

Studies were excluded if the full text was unavailable, if they were conference abstracts, letters to the editor, or short communications, or if they were published in languages other than English or Persian.

After confirming eligibility, relevant data were extracted from the included studies using a structured data extraction form. Extracted data included the author's name and year of publication, study location, research objective, sample size, measurement instruments, investigated variables, and the main findings related to sleep quality. The extracted data were categorized and summarized in Table 1.

Table 1. Characteristics of included studies

No.	Author/ Year	Country	Study design	Sample size	Outcome	Tool	Results	Quality Assessment Score
1	Marie Tholstrup Philipsen et al., 2013 (19)	Denmark	Cross-sectional	163 women and 132 partners	Problems and quality of sleep and related psychological factors	Pittsburgh Sleep Quality Index (PSQI)	The mean pretreatment PSQI global score was 8.1 (SD = 2.3), and 91% of participants scored above 5, indicating poor sleep quality. Sleep quality was associated with psychological disorders such as anxiety and depression, with individuals experiencing these conditions showing higher odds of poor sleep quality (OR = 1.8, p = 0.03).	7
2	Ceren Özçelik et al., 2023 (20)	Turkey	Cohort	227 women	Investigation of sleep quality and related factors	Morningness-Eveningness Questionnaire (MEQ) and Pittsburg Sleep Quality Index (PSQI)	Sleep-disorder score was higher in infertile group, compared to non-infetile group (p = 0.001; OR = ½). Sleep quality was associated with infertility duration, causes of infertility, type of infertility, and type of treatment.	8
3	Li-Hua Huang et al., 2019 (21)	Taiwan	Cross-sectional	97 women	Sleep quality and related psychological factors	Pittsburgh Sleep Quality Index (PSQI) and Beck depression and anxiety scales.	18.8% of participants required more than 30 minutes to fall asleep, 56.2% slept less than 7 hours, 43.6% had sleep efficiency below 85%, and 43.3% experienced daytime sleepiness. Sleep quality was associated with Beck Anxiety Inventory scores (adjusted F = 44.85, P = 0.000, R^2 = 49.4%).	8
4	Ya-Hui Lin MSN et al., 2016 (22)	Taiwan	Cross-sectional	100 women	Investigating the quality of sleep and its related factors in the field of infertility	Pittsburgh Sleep Quality Index and a five-item brief symptom rating scale	Very low sleep quality was observed among women undergoing infertility treatment (sleep quality score = 11.71 ± 2.37). Sleep quality was associated with treatment type and treatment stage, with the poorest sleep during egg retrieval and IVF embryo transfer stages.	6

No.	Author/ Year	Country	Study design	Sample size	Outcome	Tool	Results	Quality Assessment Score
5	Neslihan Kırca et al., 2022 (23)	Turkey	Case-control	65 women	Sleep problems and quality and related psychological factors	Pittsburgh Sleep Quality Index, the Beck's Depression Inventory, and the Multidimensional Perceived Social Support Scale	Low mean sleep quality scores were observed among infertile women. Sleep quality was associated with low social support or high depression (p = 0.021; OR = 1.7).	7
6	Maryam Azizi Kutenaee et al., 2019 (24)	Iran	Cross-sectional	199 women	Investigating the quality of sleep and its related factors in infertile women with pcos	Hospital Anxiety and Depression Scale, the Body Image Concern Investigation, the Rosenberg Self-esteem Scale	A poorer sleep quality was observed in women with PCOS, particularly in subjective sleep quality (P < 0.05), daytime functioning (P = 0.001), and use of sleep medication (P = 0.003).	7
7	Cathy Ann Goldstein et al., 2016 (25)	USA	Cross-sectional	22 women	Investigating sleep quality and its related factors in infertility	Researcher-made sleep quality instrument and laboratory sample	A sleeping time <7 hours in 46%, 57%, 69%, and 42% of participants at baseline, stimulation, post-oocyte retrieval, and post-embryo transfer stages, was observed respectively. Lowest sleep quality was reported during the egg retrieval stage and one week before embryo implantation.	7
8	Fatma Yanık et al., 2021 (26)	Turkey	Cross-sectional	158 women	Investigating the quality of sleep and its related factors in the field of infertility and psychological	Pittsburgh Sleep Quality Index", "Visual Analog Stress Scale" and "Treatment Related Physical Symptoms List"	The mean sleep quality scores were 6.96 in the pre-treatment period, 8.03 during oocyte retrieval induction, and 8.87 after embryo transfer (p < 0.001), indicating poor sleep quality. Sleep quality before and during treatment had a strong positive correlation with stress scores (r = 0.638, p < 0.001; r = 0.672, p < 0.001; r = 0.694, p < 0.001).	6
9	Esther Eisenberg	USA	Case control	1603 women	Investigating sleep quality	Pittsburgh Sleep Quality Index	A poorer sleep quality was observed among infertile women with polycystic	8

No.	Author/ Year	Country	Study design	Sample size	Outcome	Tool	Results	Quality Assessment Score
	et al., 2021 (27)				and its related factors in infertility		ovary syndrome (PCOS) and unexplained infertility. Sleep quality was lower in women with PCOS compared to women without a clinical cause of infertility (P = 0.031; OR = 1.6).	
10	Nurcan Kirca et al., 2021 (28)	Turkey	Cross-sectional	65 women	Investigation of sleep quality and related psychological factors	Perceived Stress Scale (PSS), and the Pittsburgh Sleep Quality Index (PSQI)	Pittsburgh Sleep Quality Index scores across all stages of infertility treatment had a significant positive correlation with Perceived Stress Scale scores (P = 0.001).	6
11	Lingyan Wang et al., 2023 (29)	China	Cross-sectional	1712 women	Anxiety and sleep quality	Generalized Anxiety Disorder-7 (GAD-7) and Patient Health Questionaire-9 (PHQ-9)	Poor sleep quality was associated with anxiety (OR = 9.3; 95% CI: 4.7–18.4; P < 0.001).	7
12	Sally Ibrahim et al., 2023 (30)	USA	Cross-sectional	258 women	Sleep quality and individual characteristics related to infertility	Pittsburgh's Sleep Quality Questionnaire (PSQI)	Women with a high risk of obstructive sleep apnea (OSA) were more likely to have comorbid conditions such as depression (OR = 6.17; 95% CI: 1.24–30.62; p = 0.026). In addition, reduced sleep quality was reported to be associated with irregular menstruation (OR = 3.73; 95% CI: 1.21–11.53; p = 0.022).	7

Stage 5: Methodological Quality Assessment and Reporting of Results

In the final stage, the methodological quality and risk of bias of the included studies were assessed using the Newcastle–Ottawa Scale (NOS), a validated tool widely used for evaluating the quality of observational studies. The NOS assesses three domains: selection of study groups, comparability of groups, and assessment of exposure or outcome.

For cohort and case–control studies, the NOS includes nine items across the three domains: selection (four items), comparability (one item that can receive up to two stars), and outcome/exposure (three items). Each item is awarded a star if the study meets the specified criterion, with a maximum possible score of nine stars.

For cross-sectional studies, an adapted version of the NOS was used, which evaluates three domains (selection, comparability, and outcome) across eight items. Similar to the original scale, each item receives one point, except for the comparability domain, which may receive up to two points, resulting in a maximum attainable score of nine points.

Studies with a score of less than five were considered to have a high risk of bias. The detailed results of the quality assessment for all included studies are presented in Table 1. Finally, the findings of the included studies were synthesized and reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

Results

Study Characteristics

A total of 12 studies met the inclusion criteria and were included in this systematic review (19–30). Among these, one studies was of cohort design (20), two were case–control studies (23,27), and nine were cross-sectional studies (19,21,22,24,25,26,28,29,30). Across all included studies, a total of 2751 participants were evaluated. The age of participants ranged from 21 to 48 years. The studies included both men and women; however, the results in the original articles were stratified by gender. Therefore, in the present systematic review, only the findings related to infertile women were extracted and analyzed.

Data classification

The literature showed that the findings addressing the main research question could be classified into two categories: psychological and infertility-related factors affecting sleep quality in infertile women. In the category of psychological factors, levels of stress, anxiety and depression, body image, sleep disorders, and mental abilities are included (19, 21, 29, 24, 23, 26, 28). Moreover, in the category of infertility-related factors, variables such as type of infertility, duration of infertility, and infertility treatment characteristics (including type of treatment and treatment procedures) were included (27, 30, 22, 20, 25).

Psychological factors

In total, seven studies investigated the relationship between psychological factors and sleep quality in infertile women (19, 21, 29, 24, 23, 26, 28). Marie et al. (2013) (19), Li-Hua et al. (2019) (21), and Lingyan Wang (2023) (29) in a cross-sectional study reported a significant inverse relationship between anxiety and sleep quality. Marie et al. (2013) also reported depression as another factor associated with sleep quality reduction (P=0.03, r= - 0.238) (19). In a case–control study of 65 infertile women, Kirca (2021) reported low mean sleep quality scores among infertile women. Sleep quality was significantly associated with social support and depression, indicating a 1.7-fold higher likelihood of poor sleep quality among women with low social support or high depression compared with those without these conditions (p = 0.021; OR = 1.7) (23). Yanık (2021) also identified stress as a factor negatively affecting sleep quality in infertile women (P<0.05) (26). In another study, Azizi et al. (2019) reported that an unfavorable body image was directly associated with quality of sleep in infertile women undergoing treatment (p=0.021) (24).

Infertility-related factors

Five studies indicated a relationship between infertility-related factors and sleep quality in infertile women (27, 30, 22, 20, 25). Ceren et al. (2023) and Ya-Hui et al. (2016) found a significant association between treatment method and sleep quality (20, 22), reporting

that aggressive treatment methods were significantly correlated with reduced sleep quality. Other studies showed that the side effects of assisted reproductive techniques, such as nausea and vomiting, reduced sleep quality (24, 25). Additionally, some researchers reported that the type of infertility was directly and significantly associated with the severity of sleep disorder (20, 27). Symptoms associated with infertility, such as complications related to PCOS (p = 0.001, OR = ½) and irregular menstruation (OR: 3.73 [1.21, 11.53], p = 0.022), were also reported to be associated with sleep quality (20, 30).

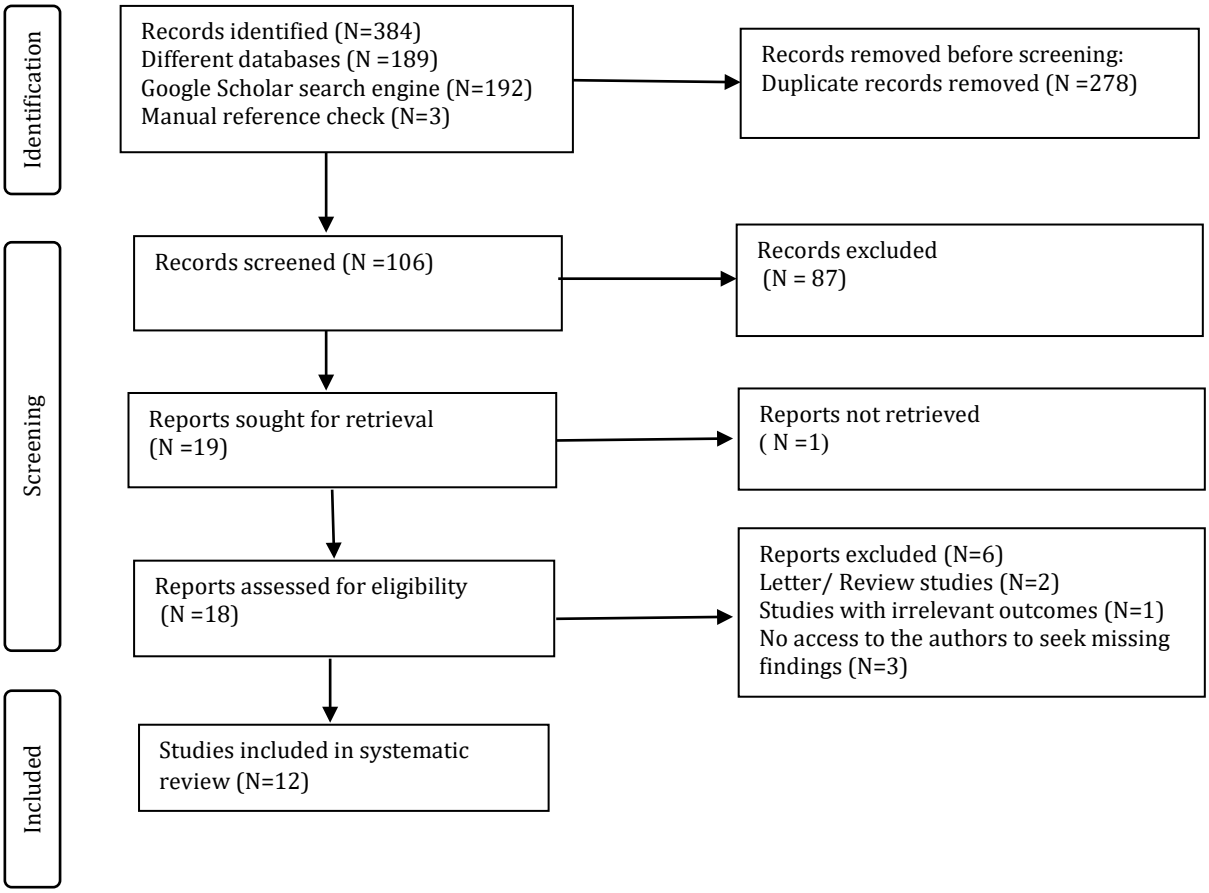

Figure 1. PRISMA 2020 flowchart illustrating the process of selecting eligible studies

Discussion

The purpose of this systematic review was to investigate factors associated with sleep quality in women undergoing infertility treatment. The findings indicate that both psychological and infertility-related factors play an important role in sleep quality among infertile women. These findings highlight the multidimensional nature of sleep disturbances in this population and suggest that both emotional and clinical aspects of infertility should be considered when addressing sleep problems in women undergoing infertility treatment.

Based on the findings of this systematic review, infertility-related factors appear to play an important role in disturbances in sleep quality among women undergoing infertility treatment. Specifically, treatment methods, medication side effects, type of infertility, and clinical symptoms related to infertility were identified as factors associated with

disturbances in sleep quality. These findings are consistent with previous studies that have also reported a relationship between infertility-related conditions and sleep disturbances among women undergoing infertility treatment. The possible explanations suggested in the literature include the physical burden of treatment procedures, hormonal changes, and the psychological stress associated with infertility and its management (19-30).

One possible explanation relates to the medical procedures and pharmacological treatments commonly used in assisted reproductive technologies (ART). Some studies have suggested that infertility medications may negatively affect sleep due to their physiological side effects, including nausea, vomiting, and changes in body weight (22, 25). These physical symptoms may directly interfere with normal sleep patterns and contribute to poorer sleep quality during treatment cycles. In addition to medication side effects, treatment procedures themselves—particularly invasive interventions—may impose both physical discomfort and emotional stress on patients. The economic burden of infertility treatment and the uncertainty surrounding treatment outcomes may further intensify stress levels, which in turn may disrupt sleep patterns among women undergoing ART (20, 24).

Another infertility-related factor highlighted in previous studies is the type of infertility and the underlying infertility cause. Ester et al. (2021) and Ceren et al. (2023) reported that both the type of infertility and infertility-related conditions are associated with sleep quality (27, 20). In many cultural contexts, primary infertility may be perceived as particularly distressing due to the absence of children, which can increase emotional strain and negatively influence sleep (21). However, some authors have suggested that women experiencing secondary infertility may also experience substantial psychological pressure. After experiencing motherhood, the desire to have additional children may intensify, and the inability to conceive again may lead to emotional distress that can manifest as sleep disturbances (23).

Furthermore, infertility attributed to female factors may impose greater psychological and social pressure on women. In many societies, women often experience social stigma, feelings of blame, and heightened emotional vulnerability when infertility is attributed to them, which may contribute to psychological distress and sleep problems (20, 27). In addition, specific medical conditions associated with infertility may also contribute to sleep disturbances. For example, Azizi et al. (2019) reported that women with PCOS may experience negative body image due to symptoms such as weight changes, acne, or hirsutism, and this unfavorable body image may be associated with poorer sleep quality (24). Similarly, menstrual irregularities and hormonal imbalances may influence sleep regulation mechanisms and contribute to sleep disturbances (20, 30). Other conditions related to infertility, such as endometriosis, may also affect sleep quality through chronic pelvic pain and discomfort, which can disrupt sleep continuity and increase nighttime awakenings (20). These findings suggest that the biological and clinical characteristics of infertility, including its underlying causes and associated symptoms, may influence sleep through both physiological pathways and psychological responses to the disease (31).

Beyond infertility-related characteristics, psychological factors appear to be among the most consistently reported determinants of sleep quality in infertile women. Several studies have demonstrated significant associations between psychological distress and sleep disturbances in this population. Huang et al. (2019) in a study involving 97 participants, reported a significant inverse relationship between anxiety levels and sleep quality, indicating that women with higher anxiety experienced poorer sleep quality (21). Similarly, Yanık et al. (2021) and Nurcan et al. (2021) identified stress as an important factor contributing to sleep disturbances among infertile women (28, 26). These findings are consistent with previous literature suggesting that infertility is often accompanied by substantial emotional stress, uncertainty, and feelings of loss of control, all of which may negatively influence sleep (31).

Depression has also been identified as another important psychological factor

associated with sleep disturbances. Marie et al. (2013) reported that sleep quality scores among infertile women were significantly related to levels of anxiety and depression (19). The coexistence of anxiety and depressive symptoms is common in individuals experiencing chronic stressors such as infertility. Previous research has demonstrated that psychiatric conditions frequently occur simultaneously, and their combined presence may exacerbate sleep disturbances (32, 33). From a physiological perspective, psychological stress can activate the hypothalamic–pituitary–adrenal (HPA) axis and increase cortisol secretion, which may disrupt circadian rhythms and interfere with normal sleep initiation and maintenance. Anxiety may also increase physiological arousal, elevate heart rate, and produce persistent cognitive activity or rumination, making it more difficult for individuals to fall asleep or maintain uninterrupted sleep. Depression, on the other hand, may alter neurotransmitter regulation and reduce melatonin secretion, thereby impairing the body's natural sleep–wake cycle and decreasing the desire or ability to sleep (33).

Overall, the findings of the present review highlight the multifactorial nature of sleep disturbances among infertile women undergoing treatment. Both infertility-related clinical factors and psychological distress appear to contribute to reduced sleep quality in this population. These results emphasize the importance of adopting a comprehensive approach when addressing sleep problems in infertile women, taking into account not only the medical aspects of infertility treatment but also the psychological challenges experienced during the infertility journey.

Despite providing valuable insights, this review has several limitations. First, access to all potentially relevant databases was limited, which may have resulted in the omission of some relevant studies. Second, considerable heterogeneity was observed among the included studies in terms of measurement tools and study designs, which prevented the possibility of conducting a meta-analysis. Third, the full text of some potentially relevant articles was not accessible. In addition, only studies published in English or Persian were included, which may have introduced language bias. Finally, the inability to control for potential confounding variables across the included studies may have influenced the interpretation of the findings. Nevertheless, this review provides important evidence regarding the factors associated with sleep quality among infertile women and highlights the need for greater attention to both psychological well-being and infertility-related clinical conditions when addressing sleep disturbances in this population.

Conclusion

Evidence suggests that both psychological and infertility-related factors are associated with disturbances in sleep quality among infertile women. Higher levels of stress, anxiety, and depression are linked to poorer sleep quality, while greater psychological resilience is associated with better sleep. In addition, infertility-related characteristics such as type and duration of infertility, treatment methods, and conditions such as PCOS and menstrual irregularities have also been reported to be associated with sleep disturbances. However, due to limited systematic evidence, further well-designed studies controlling for potential confounders are needed to draw more definitive conclusions.

Declarations

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Conflicts of interest

Authors declared no conflicts of interest.

Ethical considerations

All ethical principles were considered in conducting this review study.

Code of Ethics

This study was approved by the Ethics Committee of Mashhad University of Medical Sciences, Mashhad, Iran (Code of Ethics: IR.MUMS.NURSE.REC.1403.017).

Use of Artificial Intelligence (AI)

No artificial intelligence tools were used in the designing, analysis, or writing of this manuscript.

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Authors' contribution

All authors contributed to the conception and design of the study, data collection, data analysis and interpretation of data, as well as drafting and revising the manuscript. All authors read and approved the final version of the manuscript.

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