

# The Global prevalence of sleep disorders during menopausal period: a systematic review and meta-analysis

## Abstract

**Background:** One of the most common problems among women going through in menopause transition is sleep disorder. Sleep disorders are conditions that have long-term effects on health, quality of sexual function (QSF), productivity at work, and overall quality of life (QoL) among patients. The aim of this study was to determine the global prevalence of sleep disorders among women during menopause transition.

**Methods:** In this systematic review and meta-analysis, the PubMed, Google Scholar, Scopus, Web of Science, and Science Direct databases were searched for studies that have reported the prevalence of sleep disorders among postmenopausal women. The search was conducted with no lower time-limit and until April 2022. The heterogeneity of studies was assessed using the I<sup>2</sup> index, and a random effects model was adopted for analysis. Data analysis was performed within the Comprehensive Meta-Analysis (CMA) software (version 2).

**Results:** Out of 4061 articles identified in the initial search, and after exclusion of several articles and at the different stages, 41 studies met the eligible criteria were selected. As part of the meta-analysis, the meta-analysis results presents the overall pooled prevalence of sleep disorders among postmenopausal women was as 51.6% (95% CI: 44.6%-58.5%). Considering sleep disorders at different stages of menopause transition, the highest prevalence of sleep disorders was among postmenopausal women with 54.7% (95% CI: 47.2%-62.1%). In the study of the prevalence of various sleep disorders in among postmenopausal women, the highest prevalence of sleep disorders in postmenopausal women in the same population category was related to Restless Legs Syndrome (RLS) with a prevalence of 63.8% (95% CI: 10.6%-96.3%). Meta-regression tests showed that with increasing the sample size and year of the study values, the overall prevalence of sleep disorders among postmenopausal women decreased, which was statistically significant (p < 0.05).

**Conclusion:** In this meta-analysis, the overall prevalence of sleep disorders during menopause was reported to be high and significant. Therefore, it is strongly recommended that health policy makers offer pertinent interventions in relation to the quality of sleep to women during in menopause transition. Sleep hygiene education, and complementary medicine can significantly contribute to the improvement the quality of sleep quality and thus the quality of life of women during menopause transition.

**Keywords:** Sleep Disorders, Menopause, Obstructive Sleep Apnea Syndrome, Systematic Review, Meta-Analysis

## Introduction

Menopause is defined as the complete cessation of menstruation for 12 months (1), which marks the end of fertility in a woman's life. Menopause is a normal physiological condition whose where symptoms are often well tolerated yet managed yet can be irritating debilitating for some women and can thus therefore endanger be detrimental to their health (2). By 2030, 1.2 billion women worldwide are expected to be of menopausal or postmenopausal age due to the increase in the elderly population in the coming decades years. While in developing countries, such figures seem to be higher than what are reported, and these figures seem are higher in developing countries (3, 4).

The main symptom of menopause is follicular atrophy, which leads to a decrease in the production of estrogen and inhibin hormones and, consequently, an increase in follicle-stimulating hormone (FSH). Hormone changes, however, begin 7 to 10 years prior to the instigation of menopause. Due to hormonal changes, women experience physical and psychological changes such as mood swings, anxiety, stress, sleep disorders, forgetfulness, and sexual dysfunction (4).

Sleep is a very complex process and goes beyond closing the eyelids; in fact, it is an active state in anesthesia caused by body where the brain is in a state of relative rest (5). Sleep disorders such as insufficient **sleep time, irregular sleep patterns, poor sleep** quality and daytime drowsiness are common **in general population**. In recent years, sleep disorders have become increasingly **prevalent** globally (6) and are examined and determined by instruments such as self-report questionnaires, polysomnography and actigraphy (7).

The prevalence of sleep disorders varies in different countries (7), where the overall prevalence has been reported to be between 12% and 79% **among** women (8). Sleep disorders have many negative effects on health. These include increased risk of chronic diseases, decreased daily functioning, decreased mood (9), reduced quality of life related to health, reduced productivity at work, reduced use of healthcare, long-term effects on health (10), female sexual dysfunction (11), daytime drowsiness, decreased ability to concentrate, and mood swings, all of which can negatively affect the overall quality of life (10).

One of the most common problems **among women having menopause transition** is sleep disorder (1). Sleep and menopause **combined make up to** one-third of **women's** entire life, **and both have** major impacts on their quality of life and health (12). Sleep disorders refer to conditions that affect **a patient's** sleep quality, timing, or duration. **They also impact a patient's** ability to properly function while they are awake. **Most** sleep disorders can be characterized by one or more of the following four **criteria**: trouble falling or remaining asleep, difficulty staying awake during the day, imbalances in circadian rhythm, and unusual behaviors that disrupt sleep (13). Many recent studies **report reductions** in sleep quality with the onset of perimenopause (11-13). Studies **that have examined** the symptoms of postmenopausal women **report** that 20% to 60% of these women have sleep-related **disorders, particularly** Obstructive Sleep Apnea (OSA). These disorders often begin during the menopausal period and increase in prevalence after complete menopause (13). In pre-menopause ages the prevalence of such sleep disorders varies from 16 to 42%, in perimenopause ages from 39% to 47%, and in postmenopause from 35% to 60%. Menopausal women are 2.6 to 3.5 times more likely develop OSA **compared to non-menopausal women** (13-16). The prevalence of insomnia also increases from 38% in pre-menopause to 46%-48% in postmenopause period (3).

Given the increasing number of postmenopausal women in the **near** future, as well as the importance of sleep **quality** in these individuals, we have conducted a systematic review of studies that have reported global prevalence of sleep disorders during menopause, **in order** to pool important evidence about the issue of sleep disorders among postmenopausal women worldwide.

## Methods

We conducted the initial search in February 2022. To find relevant articles, the Science Direct, Embase, Scopus, PubMed, Web of Science (WoS), and Google Scholar were searched using **the** keywords of Sleep **D**isturbance, Sleep **P**roblems, Sleep **D**eprivation, Sleep **D**isorders, Sleep, Menopause, Long **S**leeper **S**ndrome, Restless Leg Syndrome (RLS), REM Sleep Behavior Disorder (RBD), Short **S**leeper **S**ndrome, Insomnia, **S**leep-**D**isordered **B**reathing (SDB), Obstructive Sleep Apnea Syndrome (OSAS), Narcolepsy, Sleep **W**ake Disorders, **O**bstructive **S**leep **A**pnea (**OSA**), Sleep Apnea Syndrome (SAS).

The search strings were formed using the (AND) and (OR) operators. To maintain the comprehensiveness of the search, no restrictions were imposed on articles' year of publication and articles' metadata were transferred into the EndNote reference management software. Subsequently, duplicate articles were omitted, and the remaining studies were assessed in accordance with the inclusion and exclusion criteria, and within the remaining three stages of Preferred reporting items for systematic reviews and meta-analyses (PRISMA) (i.e., screening, eligibility, and quality evaluation). To assess the eligibility of inclusion, heterogeneity of the studies was examined with the I<sup>2</sup>, and due to high heterogeneity, a random effects model was applied. Data analysis was performed within the Comprehensive Meta-Analysis software (version 2). Moreover, to maximize the number of related studies, the reference lists in the identified related articles were manually reviewed. Searches were last updated in April 2022.

### **Inclusion Criteria**

Studies were selected based on the following inclusion criteria:

- 1) Observational studies that reported prevalence of sleep disorders (apnea, insomnia, restless legs syndrome, insomnia, excessive sleep),
- 2) Studies that their full text were available (where the text was not available, the corresponding author of the study was contacted. In a few cases where the text was not available, the corresponding author of the study was contacted. In a few cases where the full text of the studies could not be secured through this approach, those studies were excluded from our review.)
- 3) Articles that provided sufficient data including sample size and number of postmenopausal individuals with various sleep disorders.
- 4) Articles written in English, also articles with English abstracts translated for non-English speakers.

### **Exclusion criteria**

The following criteria were considered when excluding certain studies:

- 1) Case reports,
- 2) Interventional studies,
- 3) Studies that their full text was unavailable,
- 4) Duplicate studies,
- 5) Studies that did not provide sufficient information to calculate the overall prevalence,
- 6) Studies in which the sample included postmenopausal women with a previous sleep disorder or due to a specific underlying disease, and
- 7) The number of menopausal individuals by exact menopausal stages has not been reported.
- 8) Articles written in a language other than English, and/or articles without an abstract written in English.
- 9) Low quality (STROBE checklist score below 16) articles.

### **Study Selection**

The study selection process was conducted in accordance with the PRISMA guidelines [14]. Initially, studies that were repeated in various databases were omitted and only one copy was retained. Then, titles and abstracts of the remaining articles were reviewed considering the inclusion and exclusion criteria, and irrelevant articles were removed. Subsequently, full texts of the remaining studies were evaluated based on the inclusion and exclusion criteria, and similarly irrelevant studies were eliminated. To avoid bias, all stages of review and data extraction were performed by two reviewers independently. In cases of a disagreement between the two reviewers, the article was examined by a third reviewer.

### Quality Evaluation

To evaluate the quality of articles, a checklist appropriate to observational studies was used. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist consists of six scales that are: title, abstract, introduction, methods, results, and discussion. In total, these 6 scales contain 32 sub-scales/items [15]. Fulfilling each of the subscales give a point, meaning any study can be scored between 0 to 32. These 32 items include various methodological aspects of the research including title, problem statement, study objectives, type of study, study statistical population, sampling method, appropriate sample size, definition of variables and procedures, study data collection tools, statistical analysis methods and findings. Accordingly, articles with scores of 16 and above were considered articles with medium and high methodological quality articles respectively, and also articles with scores below 16 were considered low quality and were therefore excluded from this review.

### Data Extraction

Information on all final papers entered into the systematic review and meta-analysis process was extracted from a pre-prepared checklist. This checklist includes article title, first author name, year of publication, place of study, sample size, sample evaluation method, menopausal stage, type of study, and prevalence of: Sleep disorders, Poor sleeper, Sleep apnea, Restless Leg Syndrome (RLS), Insomnia & Difficulty initiating sleep or maintaining sleep (DIMS), Sleepless, and Wake disorders.

### Statistical Analysis

The  $I^2$  test was adopted to evaluate the heterogeneity of the selected studies. To investigate existence of publication bias, and due to the high volume of samples included in the studies, the Egger's test was used at significance level of 0.05, and the corresponding funnel plot was drawn. Data analysis was performed within the Comprehensive Meta-Analysis software (version 2).

(Figure 1 Here)

## Results

In this systematic review and meta-analysis, we pooled the global prevalence of sleep disorders among postmenopausal women, with emphasis on the prevalence of sleep disorders and its main 6 subsets i.e., Poor sleeper, Sleep apnea, RLS, Insomnia & DIMS, Sleepness, and Wake disorders. Studies were systematically evaluated in accordance with the PRISMA guidelines. In total, 3998 articles were identified within the selected searched databases and 63 possible additional related articles were identified through a manual search. Details of all identified articles were then transferred into the EndNote reference management. Subsequently, 2061 articles were deleted due to duplication. In the screening stage, the title and abstract of the studies were reviewed, and as a result, 1798 articles were omitted based on the inclusion and exclusion criteria. In the eligibility evaluation stage, 148 articles were removed through the study of their full texts based on inclusion and exclusion criteria. In the quality evaluation stage, by examining the full text of the articles and based on the scores obtained from

the STROBE checklist, 14 studies that had low methodological quality were omitted; Finally, 41 studies were included for meta-analysis.

The studies were identified after following the four steps of PRISMA guidelines, including article identification, screening, article eligibility evaluation, and finally article selection for the meta-analysis (Figure 1). The information of the final 41 articles is listed in Table 1.

(Table 1 Here)

Most of the studies were conducted in Asia, and the number of studies conducted in China was more than other countries. No study was conducted in Oceania. Most research works used standard questionnaires for sleep disorders. Two studies used the Menopause-Specific Quality of Life (MENQOL) criteria (17, 18); Five studies adopted Pittsburgh Sleep Quality Index (PSQI) criteria (15, 19-22); Five studies used Epworth Sleepiness Scale (ESS) criteria (15, 22-25); Five studies used Menopause Rating Scale (MRS) criteria (26-30); Nine studies conducted analyses based on self-report and self-structured questionnaire (31 -38); Four studies used the Blatt-Kupperman Index (KI) criteria (39, 40); Two studies adopted the Greene Climacteric Scale (GCS) criteria (41, 42); Two studies used the Apnea Hypopnea Index (AHI) criteria (43, 44); and the rest of the studies used other criteria as shown in Table 1.

### Meta-analysis and Heterogeneity

The heterogeneity of the studies was examined with the  $I^2$  test ( $I^2$ : 98.4), and due to the high heterogeneity in the studies, the random effects method was adopted for meta-analysis. The overall prevalence of sleep disorders among postmenopausal women was 51.6% (95% CI: 44.6%-58.5%) (Figure 2). The results the Egger's test for the assessment of publication bias showed no significant publication bias( $p$ : 0.596) (Figure 3).

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(Figure 3 Here)

### Meta-regression

To investigate the influencing factors in creating high heterogeneity in studies, meta-regression test was used to examine the effect of the two variables of sample size and year of studies. Accordingly, it was found that that with increasing sample size, the overall prevalence of sleep disorders in postmenopausal women decreased (Figure 4). Increasing the year of studies (Figure 5) also reduced the overall prevalence of sleep disorders among postmenopausal women, which was statistically significant ( $p$  <0.05).

(Figure 4 Here)

(Figure 5 Here)

### Prevalence of sleep disorders in postmenopausal women by menopausal stages

In the study of the prevalence of sleep disorders among postmenopausal women by menopausal stages, the highest prevalence of sleep disorders among postmenopausal women was 54.7% (95% CI: 47.2%-62.1%) (Table 2).

(Table 4 Here)

### Prevalence of various sleep disorders among postmenopausal women

In the study of the prevalence of various sleep disorders among postmenopausal women, the highest prevalence of sleep disorders among postmenopausal women was related to RLS with a prevalence of 63.8% (95% CI: 10.6%-96.3%) (Table 3).

(Table 3 Here)

### Prevalence of various sleep disorders in postmenopausal women by menopausal stage

In the study of the prevalence of sleep disorders among postmenopausal women by menopausal stage, it was found that in apnea sleep disorder, the highest prevalence was related to postmenopause with a prevalence of 35.2% (95% CI: 12.9%-66.5%), in RLS sleep disorder, the highest prevalence was related to postmenopause with a prevalence of 53.1% (95% CI: 3.1%-97.6%), in insomnia & DIMS sleep disorder, the highest prevalence is related to perimenopause with a prevalence of 37.6% (95% CI: 28.5%-47.7%), in sleepiness, the highest prevalence was in postmenopause with a prevalence of 34.2% (95% CI: 8.5%-74.5%), and in wake disorder, the highest prevalence was in postmenopause with 14.2% (95% CI: 7.1%-26.4%) (Table 4).

(Table 4 Here)

## Discussion

The present study is the first systematic review and meta-analysis of the global prevalence of sleep disorders during the menopausal period. To our knowledge, no systematic review has been conducted to examine the global prevalence of sleep disorders in postmenopausal women. This study has been compiled using the most optimal statistical analysis techniques on the data gathered from 41 eligible primary studies. Of the total of 41, most studies reported the prevalence of several sleep disorders in their research. Moreover, all articles used in the present study were observational, and we demonstrated that the overall pooled prevalence of sleep disorders in all studies is 51.6%.

In the present meta-analysis, the prevalence of sleep disorders among women varied according to menopausal stages and type of sleep disorders. Therefore, except for insomnia which was most prevalent during perimenopause, the general prevalence of sleep disorders and its subtypes including drowsiness, apnea disorder sleep disorders, wakefulness disorders, and restless legs syndrome were all common during the postmenopausal period. In a 2011 study by Shafie et al. on 3929 women aged 41-70 years, the prevalence of sleep disorders during postmenopause was 52.20%, in perimenopause 38.40%, and in premenopause 33.7%. These results were in line with the results of our studies, showing that the prevalence of sleep disorders during postmenopause is higher than in the premenopause, and perimenopause stages (29). Additionally, in a study conducted in 2009 by Waidyasekera et al., on 683 women aged 60-45 years, the prevalence of sleep disorders was reported to be 39.6% in postmenopause stage, 31.1% in perimenopause, and 25.7% among women in the premenopause period. The results in the study were also in line with our results, and that the prevalence of this disorder was higher in the postmenopausal period (27). A study by Castro et al. in 2021 in Colombia on 984 women aged 40-50 years during the coronavirus outbreak reported that the prevalence of sleep disorders was 65.1% in postmenopause, and 54.5% in premenopause stage (65). Similar to the results of our meta-analysis, the prevalence of sleep disorders was higher in the postmenopausal period and the results of the Castro study showed that the prevalence of sleep disorders among premenopausal women during the COVID-19 pandemic could have been as high as in the postmenopausal period (65).

One of the most common sleep disorders is Obstructive Sleep Apnea Syndrome (OSAS). The prevalence of obstructive sleep apnea (OSA) is significantly increased during the postmenopausal period. Studies show that 47% to 67% of postmenopausal women have OSA (43, 66). Postmenopausal women also tend to gain weight. Weight gain leads to an increase in neck size, body mass index and

waist-to-hip ratio. As a result, the upper airway changes anatomically after menopause, causing problems such as OSA. Therefore, weight gain during postmenopause seems to be the reason for the high prevalence of OSA. However, body weight is not the only cause of the disease. Some studies have reported that testosterone is a factor that exacerbates OSA (1). The three most important risk factors for this disorder are rise of body fat, hormonal changes, and pharyngeal dilation (67). A study by Dancey et al. conducted in 2001 on 1315 premenopausal women aged 45-55 years in Toronto assessed the prevalence of apnea (using AHI) among women based on menopausal stages, and reported the prevalence of 47% at the postmenopause, yet with a lower prevalence 21% at the premenopause stage, which is similar to the results of our studies (52). The study of Heinzer in 2018 on 2121 menopausal women reported the prevalence of OSA at the postmenopause stage as 23%, and 9% at premenopause stage showing the higher prevalence of this disorder during postmenopause (67).

According to meta-regression, it was found that with increasing sample size, the overall prevalence of sleep disorders in postmenopausal women decreased, and increasing the year of studies also reduced the overall prevalence of sleep disorders among postmenopausal women. This can be due to more care during menopause and the importance of sleep, which we see in more recent studies with a lower prevalence.

Insomnia which affects between 6% to 10% of the adult population in Western countries, is not only a psychological burden for a person with the disease but is also an important public health problem. The prevalent symptoms of insomnia are inability to get to sleep (insomnia with the onset of sleep), maintaining sleep (persistent insomnia), or waking up early in the morning with an inability to return to sleep (68). Several accelerating and persistent factors, including hormonal changes, menopausal symptoms (such as hot flashes, night sweats), mood disorders, pain, and other sleep disorders, contribute to this disorder during menopause (69). Some studies have reported the prevalence of chronic insomnia among 31% to 42% of women at the end of the perimenopause period (70). As mentioned earlier, the highest prevalence of insomnia was related to perimenopause with a prevalence of 37.6%, which was the only disorder that was more prevalent during perimenopause than postmenopause. In a 2006 study by Chung et al. in China on 305 women aged 45-55 years, the prevalence of perimenopause was reported to be 21%, which was higher than postmenopausal women with a prevalence of 14.7%. These results are also in line with the results of our study (42). In a 2019 study by Valiensi et al. on 195 women 40-59 years in Brazil, the prevalence of insomnia among postmenopausal women was reported to be 15%. A 2008 study by Yang et al. in China on 9557 women aged 55-45 years found that the prevalence of parasomnia was only 10% higher among the perimenopause population than postmenopause (34). In a 2003 study by Pedro et al. in Brazil, on 367 women aged 45-60 years, it was reported that the prevalence of insomnia in postmenopausal women was 61.1%, yet this figure was reported 55.9% among perimenopausal women, which differs from the results of our study (37).

In the present meta-analysis, the overall prevalence of insomnia was 57.6%. Poor sleep is one of the most common problems reported during menopause and its prevalence varies during menopause. A study by Smith et al. in 2018 on postmenopausal women aged 54-45 years showed that the incidence of insomnia at any stage of menopause could not predict the incidence of this disorder at other stages of menopause (71).

Restless Legs Syndrome (RLS) is a disorder that causes the foot to move with discomfort. Although RLS is not associated with menopause or hormones, it appears to increase with age. The exact cause is unknown, however it may be associated with iron deficiency anemia, pregnancy, and uremia (1). In general, the prevalence of RLS increases with age, and RLS is more common among women than men (10). In the current meta-analysis of the prevalence of sleep disorders in postmenopausal women, the highest prevalence of sleep disorders in postmenopausal women was related to RLS with a prevalence of 63.8%. A study by Mohammed et al. in Egypt in 2020 reported the prevalence of RLS in the

population of 60 women over the age of 40 years old, [with incidences showing 87.9% among postmenopausal women and 81% in premenopause](#); This study has the highest percentage among the studies in Table 1 (25).

In the present meta-analysis, parasomnia was the most prevalent in the postmenopausal period, then in the perimenopause period, and the least prevalent in the premenopausal period. In general, the lowest prevalence of sleep disorders among postmenopausal women was related to wakefulness disorder with a prevalence of 9%. Limited data also show that differences in sleep-wake cycle regulation can cause sleep disorders, especially sporadic sleep or waking up early in the morning in postmenopausal women (16). Sleep disorders increase during the transition to menopause, [especially with complaints of nocturnal awakenings](#) (10). A 2005 study by Shin et al. on women aged 40-60 years reported a similar prevalence of wakefulness disorder by menopausal stage, similar to the results of our study. (10).

One of the limitations of this meta-analysis is that only articles published in English were included, and therefore pertinent research works in other languages may have been overlooked. Additionally, a few studies were excluded due to their low methodological quality. In addition, there were differences in the methods used [for data collection](#). One critical methodological limitation is the inclusion of original articles that did not measure sleep disturbances [among](#) the postmenopausal women.

## Conclusion

Various reports indicate that in the coming decades, all countries globally will face an increase of the elderly population because of the increase in life expectancy. Hence, women will spend about a third of their lives during menopause (3, 4) and by 2030, 1.2 billion women worldwide will be at menopausal or postmenopausal periods (12). Given the almost high prevalence of sleep disorders in the current meta-analysis and the growing population of postmenopausal women, it can be concluded that sleep disorders can affect the overall quality of life and long-term health of women at different stages of menopause. Policymakers can also potentially use the results of the present meta-analysis to plan future healthcare, emphasizing the importance of sleep health education, treatment of sleep disorders, and improving the quality of life of postmenopausal women as a research priority.

## Abbreviations

QSF: Quality of Sexual Function

QoL: Quality of Life

FSH: Follicle-Stimulating Hormone

OSA: Obstructive Sleep Apnea

RLS: Restless Leg Syndrome

RBD: REM Sleep Behavior Disorder

SDB: Sleep-Disordered Breathing

OSAS: Obstructive Sleep Apnea Syndrome

SAS: Sleep Apnea Syndrome

WoS: Web of Science

STROBE: Strengthening the Reporting of Observational studies in Epidemiology

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analysis.

## Declaration



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By Deputy for Research and Technology, Kermanshah University of Medical Sciences (IR) (4010163).

This deputy has no role in the study process.

### **Conflict of Interest**

All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

### **Ethical approval**

All procedures performed in studies involving human participants were in accordance with the ethical standards of the ethics committee of deputy of research and technology, Kermanshah University of Medical Sciences and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Ethics approval was received from the ethics committee of deputy of research and technology, Kermanshah University of Medical Sciences (IR.KUMS.REC.1401.096).

### **Informed consent**

This article does not contain any studies with human participants performed by any of the authors.

### **Data Availability Statement**

Datasets are available through the corresponding author upon reasonable request.

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#### **Tables Legend:**

**Table 1 : Characteristics of Included Studies**

**Table 2: Prevalence of sleep disorders among postmenopausal women by menopausal stages.**

**Table 3: Prevalence of various sleep disorders among postmenopausal women.**

**Table 4: Prevalence of various sleep disorders in postmenopausal women by menopausal stage.**

#### **Figures Legend:**

**Figure 1: PRISMA flow diagram for study selection.**

**Figure 2: The overall prevalence of sleep disorders among postmenopausal women based on the random effects model.**

**Figure 3: Funnel plot for studies on general prevalence of sleep disorders among postmenopausal women.**

**Figure 4: Meta-regression to evaluate the effect of sample size on the overall prevalence of sleep disorders among postmenopausal women.**

**Figure 5: Meta-regression to evaluate the effect of year studies on the overall prevalence of sleep disorders among postmenopausal women.**

