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Unraveling the Factors Shaping Sleep Quality among Postmenopausal Women in Indonesia

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Abstract

Introduction Sleep quality is a subjective experience related to satisfaction and feelings after waking. Many menopausal women struggle to achieve adequate sleep, averaging less than 7 hours per night.

Objective The purpose of this study was to identify unraveling the factors shaping sleep quality among postmenopausal women in Indonesia.

Methods This research is a correlative descriptive study with a quantitative approach using a cross-sectional design. Determination of the sample in this study using the accidental sampling method ($n = 256$) in women aged ≥ 40 years in Indonesia with the Pittsburgh Sleep Quality Index (PSQI) questionnaire instrument to determine sleep quality. Depression Anxiety Stress Scale (DASS-21) to assess psychological factors, the Multidimensional Scale of Perceived Social Support (MSPSS) for social support, and the Menopause Rating Scale (MRS).

Results The results showed that the proportion of menopausal women aged 50 to 72 years in Indonesia with poor sleep quality was 72.3%. Variables that significantly affect the sleep quality of menopausal women in bivariate analysis were age(OR = 2.898; 95%CI = 1.650–5.090; $p < 0.001$), level of education(OR = 2.035; 95%CI = 1.115–3.713; $p = 0.019$), anxiety level (OR = 2.027; 95%CI = 1.010–4.069; $p = 0.044$), stress level (OR = 4.640; 95%CI = 2.573–8.368; $p < 0.001$), social support(OR = 0.484; 95%CI = 0.273–0.860; $p = 0.013$) and menopausal symptoms(OR = 4.596; 95%CI = 1.069–19.766; $p = 0.026$). Then in multivariate analysis, stress level (OR = 6.075; 95%CI = 3.147- 11.727; $p < 0.001$) was the most dominant factor affecting sleep quality.

Conclusion It can be concluded that there were factors that significantly affected menopausal women, namely age, education level, anxiety level, stress level, social support, and menopausal symptoms with stress levels being the most dominating factor in menopausal women's sleep quality.

Keywords
- sleep quality
- postmenopausal
- Indonesia
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Introduction

Menopause is an important phenomenon that occurs in women's lives and is associated with the loss of fertility and the transition to a new status in life for the elderly.[1] Menopause signifies that a person has entered the final phase of life and is a physiological condition that must occur in every woman's body.[2] In recent decades, a large number of women entered the menopausal period every day due to developments in medical science and increased life expectancy.[1] Menopause refers to a specific event, namely the cessation of menstruation, and 'climacteric' refers to the gradual changes in ovarian function that begin before menopause and continue afterward for a time.[3] There are three stages of menopausal status: premenopausal, perimenopausal, and postmenopausal.[4–6] For at least 12 months, premenopausal women have experienced 12 or more regular menstrual cycles. Perimenopausal women have experienced menopausal-related changes in the frequency and flow of their periods during the past 12 months. Women who have gone 12 months or longer without a monthly period are considered postmenopausal.

It is estimated that the population of menopausal women will reach 1.2 billion in 2030 with 47 million new menopausal cases each year.[1] According to data from the Indonesian Ministry of Health, women in Indonesia have so far entered menopause around the age of 40–44 years totaling 9.408.942. In addition, for ages 45 to 49 years, there are around 8.485.479, so the total number of premenopausal women aged 40 to 49 years in Indonesia is around 17.894.421. The increasing number from year to year is the result of an increase in the elderly population and life expectancy simultaneously with the improvement in the degree, quantity, and proportion of public health.[7]

Menopause is characterized by a variety of psychological (stress, mood swings, and anxiety) and physiological (cardiac discomfort, hot flashes, etc.) symptoms including difficulty sleeping. All of these symptoms affect the general well-being of women and reduce the quality of life.[8] However, it is reported that 40% to 60% of sleep disturbances such as insomnia frequently occur in menopausal women and often persist for the rest of their lives.[9] Sleep disturbances in menopausal women can be chronic or transient and can range from minimal to severe disturbance. Sleep disturbances often present themselves such as difficulty falling asleep, frequent waking up at night, and being disturbed during sleep after waking up affect the quality of a person's sleep.[1]

Sleep quality is a complex phenomenon that is difficult to define because it is subjective and related to the quality of the sleep experience including sleep satisfaction, and one's feelings after waking. Therefore, this cannot be assessed through inspection. Based on the theory of the International Sleep Foundation, adequate sleep is around 7 to 8 hours and is very important for cognitive function in adults.[1] Unfortunately, less than two-thirds of women get that much sleep each night and the average menopausal woman sleeps less than 7 hours. One of the reasons is that women wake up more often at night and wake up earlier to take care of the household, thus disturbing their sleep. Women are also more likely to nap during the day, which can further interfere with the quality of their sleep at night.[10]

Poor and inadequate quality and duration of sleep are associated with poor health outcomes such as obesity, cardiovascular disease, death from cancer, diabetes, depression, and poor quality of life.[11] Therefore, it is necessary to understand sleep disorders and identify further risk factors for menopausal women. Sleep disturbances in menopausal women are influenced by various factors, including hormonal changes such as decreased estrogen and progesterone that affect sleep patterns, and symptoms such as hot flashes and night sweats that disrupt sleep.[6,12] In addition, changes in sleep structure, stress, anxiety, depression, and related health conditions such as obesity, diabetes, and sleep apnea also contribute. Poor lifestyle habits, such as unhealthy diet, lack of exercise, and poor sleep hygiene, also worsen sleep quality.[6,12,13] A study investigating the relationship between sleep quality and menopausal symptoms found that poor sleep quality was positively associated with higher levels of somatic and psychological symptoms and that menopausal symptoms were more common in women with frequent sleep complaints than those with infrequent sleep complaints.[14]

The exact causes of sleep disturbances in menopausal women are not fully understood and appear to vary based on the symptoms of the sleep disorder. Menopause, aging, vasomotor symptoms, distress, anxiety, and many other health conditions, including cardiovascular disease, endocrine disease, drugs, and psychosocial factors, are all potential risk factors for sleep disturbance.[15] Previous research in Indonesia, conducted on 95 menopausal women aged 50–64 in 2014, showed that there was a relationship with the physical symptoms experienced by menopausal women.[16]

This study is important because it provides new insights into factors that are associated with sleep quality in postmenopausal women in Indonesia, which have not been explored in depth with local social and cultural contexts. Although there have been several related studies, this study highlights psychological factors, such as stress levels, as dominant factors that influence sleep quality, in addition to age and education levels. In addition, this study uses a multivariate analysis approach to identify key factors simultaneously, providing more comprehensive insights. These results are expected to assist health workers and policymakers in designing more effective and culturally based interventions to improve the quality of life of postmenopausal women in Indonesia.

To get further clarity on the factors that influence sleep patterns in menopause, the researchers are interested in further research to unravel the factors shaping sleep quality among postmenopausal women in Indonesia. Identification of related factors that are key criteria for designing health interventions can provide a normative framework for efficient interventions.

Methods

Study Design

This research used a descriptive correlative study with a cross-sectional approach.

Population and Sampling

The population in this study were women aged $\geq$ 40 years throughout Indonesia. The sample in this study was 256 respondents using the accidental sampling technique and G*Power software to estimate the minimum sample size (α= 0.05, power (1-β) = 0.8, and effect size (γ) = 0.2 (small)). The inclusion criteria were willing to participate in the study, Indonesian postmenopausal women aged $\geq$ 40 years, and women who could read and write. To certainty of menopause identification by self-reported cessation of menstruation for 12 months.

The exclusion criteria were women aged $\geq$ 40 years who experienced psychiatric (psychiatric) disorders, menopausal women who consumed drugs that made drowsiness such as sedatives, hypnotics, and steroids, and menopausal women who had taken hormone replacement therapy (HRT) such as estrogen therapy, progesterone therapy, or combination therapy.

The dependent variable of this study was Sleep quality as measured by the PSQI score and the Independent Variables were age, education level, anxiety level, stress level, social support, and menopausal symptoms, etc.

Data Collection

The research was performed throughout Indonesia from March 2023 to April 2023. This research was approved by No. E.5.a/092/KEPK-UMM/IV/2023. The research was performed online by distributing questionnaires in Google form and via WhatsApp. The researchers introduced themselves and wrote informed consent when distributing the questionnaires and wrote short procedures for filling out the questionnaire on the Google form so that there were no misunderstandings during filling out the questionnaire. In addition, the questionnaire can only be filled in if the respondent agrees to fill out the questionnaire that has been given.

Measurement Instrument

In 1995, Lovibond developed the Depression, Anxiety, and Stress Scale (DASS-21), which is a questionnaire to evaluate a person's emotional state in 3 subscales, namely depression, anxiety, and stress. Each scale has 7 items that are used to measure the severity of each subscale. These items are scored using a 4-point Likert scale from 0 to 3. The total score is calculated by adding up the item scores per subscale and multiplying by a factor of 2. Thus, the total score for DASS-21 ranges from 0 to 126, and for each subscale it ranges from 0 and 42.[17]

The Multidimensional Scale of Perceived Social Support (MSPSS) is the most frequently used scale and has been adopted by many studies in multicultural settings with diverse populations. The MSPSS consists of 12 items with 3 subscales namely, family (items 3, 4, 8, and 11), friends (items 6, 7, 9, and 12), and others (items 1, 2, 5, and 10). Each item uses a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The higher the score indicates the greater the social support felt by the individual, the total score may range from 12–84 or can be assessed according to the subscales by adding items in each subscale and then dividing by 4[18]

Menopausal symptoms were assessed using the Menopause Rating Scale (MRS). The MRS consists of 11 items on a 5-point Likert scale from 0 - 4 where higher scores indicate more severe menopausal symptoms. Participants were asked to fill in the menopausal symptoms they experienced in the previous 2 weeks. MRS scores range from 0 to 44, with 0 meaning no symptoms and 44 meaning severe symptoms.[6]

The measurement of sleep quality used the PSQI (Pittsburgh Sleep Quality Index) questionnaire instrument which consists of 7 components that are broken down into 18 question items to measure a person's sleep quality. The 7 components consist of subjective sleep quality, latency, duration, efficiency of sleeping habits, disturbances experienced, use of sleeping pills, and disturbances or complaints when awakened. Each component is assigned points for the severity of sleep disturbances ranging from 0 to 3, for a maximum total of 21 points. Lower scores <5 indicate better sleep quality, and higher scores indicate poorer sleep quality.[19]

Statistical Analysis

SPSS software for Windows (version 26.0; SPSS, Chicago, IL, USA) was used for all statistical analyses. Demographic characteristics are presented as mean $\pm$ standard deviation (SD) and as percentages. Categorical variables were compared with sleep quality using the chi-square test. Multivariate analysis used a logistic regression test to determine the relationship between more than 2 independent variables and the dependent variable with a confidence level of 95% ($\alpha = 0.05$).

Results

The demographic characteristics of the respondents are shown in ►**Table 1**. The average age of the respondents was 51.86 years, indicating that most were in the menopausal stage. Among the respondents, 62.1% ($n = 159$) were aged $\geq$50 years, and the average Body Mass Index (BMI) was 25.72, classifying most respondents as overweight. Additionally, 78.5% ($n = 201$) had $\geq$2 children, and 83.2% ($n = 213$) identified as Muslim. The majority (54.3%, $n = 139$) were Javanese, 68.8% ($n = 176$) participated in social activities, and 82.0% ($n = 210$) were married. Regarding education, 75.0% ($n = 192$) had higher education (Diploma/Bachelor/Master/Doctorate), and 87.5% ($n = 224$) were employed. A significant portion (71.1%, $n = 182$) had high monthly income, and 84.4% ($n = 216$) had no history of chronic disease. Furthermore, 91.0% ($n = 233$) were non-smokers.

Psychological and social variables revealed that 94.9% ($n = 243$) of respondents had normal depression levels, 74.2% ($n = 190$) had normal anxiety levels, and 42.6%

Table 1 Demographic Characteristics (n = 256)

Variables	Mean	SD	Frequency	Percentages	95% CI
Age (years)	51.86	6.36	97	37.9	1.650-5.090
40–49			159	62.1	
≥ 50					
BMI	25.72	3.72			0.621-1.868
18-24.99			4	1.6	
25-29.99			108	42.2	
> 30			144	56.3	
Number of children					0.563-2.106
< 2 children			55	21.5	
≥ 2 children			201	78.5	
Religion					0.421-1.769
Muslim			213	83.2	
Non-Muslims			43	16.8	
Ethnic group					0.438-1.310
Java			139	54.3	
Non-Javanese			117	45.7	
Social activity					0.802-2.747
Yes			176	68.8	
No			80	31.3	
Marital status					0.508-2.099
Not Married			46	18.0	
Married			210	82.0	
Level of education					1.115-3.713
Lower			64	25.0	
Higher			192	75.0	
Work					0.910-4.213
Unemployed			32	12.5	
Employed			224	87.5	
Income					0.632-2.085
Lower			74	28.9	
Higher			182	71.1	
Chronic Disease History					0.634-2.713
Yes			40	15.6	
No			216	84.4	
Smoking Status					0.414-2.903
No			233	91.0	
Yes			23	9.0	
Psychological Changes					
Depression	1.07	0.34			0.346-4.850
Normal			243	94.9	
Mild			11	4.3	
Moderate			1	0.4	
Severe			0	0	

Table 1 (*Continued*)

Variables	Mean	SD	Frequency	Percentages	95% CI
Very Severe			1	0.4	
Anxiety	1.47	0.88			1.010-4.069
Normal			190	74.2	
Mild			22	8.6	
Moderate			38	14.8	
Severe			2	0.8	
Very Severe			4	1.6	
Stress	1.82	0.85			1.010-4.069
Normal			109	42.6	
Mild			93	36.3	
Moderate			45	17.6	
Severe			8	3.1	
Very Severe			1	0.4	
Social Support	60.34	15.39			0.273-0.860
Low			18	7.0	
Moderate			97	37.9	
High			141	55.1	
Menopausal Symptoms	11.51	15.87			1.069-19.766
Normal			8	3.1	
Mild			166	64.8	
Moderate			65	25.4	
Severe			17	6.6	
Very Severe			0	0	
Sleep Quality	7.79	3.62			
Good			71	27.7	
Bad			185	72.3	

($n = 109$) had normal stress levels. The average social support score was 60.34, with 55.1% ($n = 141$) of respondents reporting high social support. The mean menopausal symptom score was 11.51, indicating that 64.8% ($n = 166$) experienced mild menopausal symptoms. The average PSQI sleep quality score was 7.79, and 72.3% ($n = 185$) of respondents were classified as having poor sleep quality.

The bivariate analysis (►**Table 2**) identified significant associations between age (OR = 2.898; 95% CI = 1.650–5.090; $p < 0.001$), education level (OR = 2.035; 95% CI = 1.115–3.713; $p = 0.019$), anxiety level (OR = 2.027; 95% CI = 1.010–4.069; $p = 0.044$), stress level (OR = 4.640; 95% CI = 2.573–8.368; $p < 0.001$), social support (OR = 0.484; 95% CI = 0.273–0.860; $p = 0.013$), and menopausal symptoms (OR = 4.596; 95% CI = 1.069–19.766; $p = 0.026$) with sleep quality.

However, BMI ($p = 0.792$), number of children ($p = 0.800$), religion ($p = 0.688$), ethnicity ($p = 0.320$), social activity ($p = 0.207$), marital status ($p = 0.930$), occupation ($p = 0.082$), income ($p = 0.649$), chronic disease history ($p = 0.464$), smoking status ($p = 0.853$), and depression levels ($p = 0.700$) were not significantly associated with sleep quality.

The multivariate analysis (►**Table 3**) using logistic regression identified age, education level, and stress level as significant factors associated with sleep quality ($p < 0.05$). The Nagelkerke R Square value showed that these factors explained 36.9% of sleep quality variations. Further refinement (►**Table 4**) indicated that age (OR = 4.576; 95% CI = 2.363–8.863; $p < 0.001$) and stress level (OR = 6.075; 95% CI = 3.147–11.727; $p < 0.001$) were the most dominant factors associated with poor sleep quality, followed by education level (OR = 2.274; 95% CI = 1.145–4.515; $p = 0.019$).

Discussion

This study confirms that stress levels and age are dominant factors associated with sleep quality in menopausal women. As age increases, sleep disturbances become more frequent, aligning with previous research. Sleep architecture changes with aging, including reduced deep sleep (slow-wave sleep),

Table 2 Relationship Between Demographic Factors, Psychological Changes, Social Support and Menopausal Symptoms With Sleep Quality in Menopausal Women

Variables	Sleep Quality		Total	OR	*p-value*
	Good (n = 71)	Bad (n = 185)			
Age				2.898	0.000**
40-49	40(41.2%)	57(58.8%)	97(100%)		
50-72	31(19.5%)	128(80.5%)	159(100%)		
BMI				1.077	0.792
Normal	32(28.6%)	80(71.4%)	112(100%)		
Abnormal	39(27.1%)	105(72.9%)	144(100%)		
Number of children				1.089	0.800
< 2	16(29.1%)	39(70.9%)	55(100%)		
≥2	55(27.4%)	146(72.6%)	201(100%)		
Religion				0.864	0.688
Muslim	58(27.2%)	155(72.8%)	213(100%)		
Non-Muslim	13(30.2%)	30(69.8%)	43(100%)		
Ethnic group				0.757	0.320
Java	35(25.2%)	104(74.8%)	139(100%)		
Non-Java	36(30.8%)	81(69.2%)	117(100%)		
Social activity				1.484	0.207
Yes	53(30.1%)	123(69.9%)	176(100%)		
No	18(22.5%)	62(77.5%)	80(100%)		
Marital status				1.032	0.930
Not Married	13(28.3%)	33(71.7%)	46(100%)		
Married	58(27.6%)	152(72.4%)	210(100%)		
Level of education				2.035	0.019*
Lower	25(39.1%)	39(60.9%)	64(100%)		
Higher	46(24%)	146(76%)	192(100%)		
Work				1.958	0.082
No	13(40.6%)	19(59.4%)	32(100%)		
Yes	58(25.9%)	166(74.1%)	224(100%)		
Income				1.148	0.649
Lower	22(29.7%)	52(70.3%)	74(100%)		
Higher	49(26.9%)	133(73.1%)	182(100%)		
Chronic Disease History				1.312	0.464
Yes	13(32.5%)	27(67.5%)	40(100%)		
No	58(26.9%)	158(73.1%)	216(100%)		
Smoking Status				1.096	0.853
No	65(27.9%)	168(72.1%)	233(100%)		
Yes	6(26.1%)	17(73.9%)	23(100%)		
Depression				1.295	0.700
No	68(28%)	175(72%)	243(100%)		
Yes	3(23.1%)	10(76.9%)	13(100%)		
Anxiety				2.027	0.044*
No	59(31.1%)	131(68.9%)	190(100%)		

Table 2 (*Continued*)

Variables	Sleep Quality		Total	OR	*p-value*
	Good (n = 71)	Bad (n = 185)			
Yes	12(18.2%)	54(81.8%)	66(100%)		
Stress				4.640	0.000**
No	49(45%)	60(55%)	109(100%)		
Yes	22(15%)	125(85%)	147(100%)		
Social Support				0.484	0.013*
Lower	23(20%)	92(80%)	115(100%)		
Higher	48(34%)	93(66%)	141(100%)		
Menopausal Symptoms				4.596	0.026*
No	5(62.5%)	3(37.5%)	8(100%)		
Yes	66(26.6%)	182(73.4%)	248(100%)		

Note: ** *p-value < 0.001*, * *p-value < 0.05*.

Table 3 Logistic Regression Test Results Phase 1

No	Variable	Koef. Regression	Exp(B)	Wald	*p-value*
1	Age	1.742	5.711	22.488	0.000**
2	BMI	0.005	1.005	0.000	0.988
3	Number of children	0.241	1.272	0.315	0.575
4	Religion	-0.525	0.591	1.395	0.238
5	Ethnic group	-0.266	0.766	0.567	0.452
6	Social activity	0.212	1.236	0.259	0.611
7	Marital status	-0.513	0.599	1.125	0.289
8	Level of education	1.226	3.408	5.774	0.016*
9	Work	0.648	1.911	1.680	0.195
10	Income	-0.322	0.725	0.468	0.494
11	Chronic Disease History	0.169	1.184	0.126	0.723
12	Smoking Status	0.555	1.743	0.747	0.387
13	Depression Levels	-1.304	0.272	2.394	0.122
14	Anxiety Level	0.672	1.959	2.238	0.135
15	Stress Levels	1.608	4.994	17.442	0.000**
16	Social Support	-0.559	0.572	2.156	0.142
17	Menopausal Symptoms	0.367	1.443	0.181	0.670
18	Constant	-5.896	0.003	5.070	0.024

Note: ** *p-value < 0.001*, * *p-value < 0.05*.

Table 4 Logistic Regression Test Results Phase 2

No	Variable	Koef. Regression	Exp(B)	95% CI	*p-value*
1	Age	1.521	4.576	2.363-8.863	0.000**
2	Level of education	0.822	2.274	1.145-4.515	0.019*
3	Stress Levels	1.804	6.075	3.147-11.727	0.000**
4	Constant	-5.533	0.004		0.000

Note: ** *p-value < 0.001*, * *p-value < 0.05*.

increased nighttime awakenings, and decreased sleep efficiency, which may explain the observed association between age and sleep quality.

Hormonal changes caused by stress may further impact sleep quality. Chronic stress leads to elevated cortisol levels, which disrupts the hypothalamic-pituitary-adrenal (HPA) axis and affects melatonin production, leading to sleep disturbances. Estrogen and progesterone reductions during menopause exacerbate these effects by decreasing sleep-promoting neurotransmitters such as gamma-aminobutyric acid (GABA) and serotonin.

Based on the study's results, age the associated with the sleep quality of menopausal women. Age is one factor that determines the amount of sleep a person needs. As a person's age increases, the less sleep they get, which affects their sleep quality. Sleep quality can be said to be poor if you have symptoms of sleep deprivation such as daytime fatigue, decreased concentration, and fatigue and the most common symptom is frequent yawning. Sleep quality is said to be good if you look fresh when you wake up and have good concentration and enthusiasm for the day. This was shown in the research conducted, that among the 256 women who were used as respondents, an average 52-year-old woman had poor sleep quality. The results of this study are also consistent with research conducted by a previous study that the age category of menopausal women aged $\geq$ 40 years shows that there is a relationship between age and sleep quality.[12]

Although age was found to be one of the dominant factors associated with sleep quality in this study, we recognize that age may act as a confounding variable. Age factors may affect other variables such as stress levels, menopausal symptoms, and social support, which ultimately affect sleep quality. However, in this analysis, age was analyzed as a separate independent variable without being included as a covariate. We acknowledge that further analysis considering age as a covariate may provide a more comprehensive picture.

Body mass index (BMI), number of children, religion, ethnicity, social activity, marital status, education level, occupation, income, history of chronic disease, and smoking status are the factors most frequently investigated for their effect on sleep quality. However, the results are always contradictory because several studies show the association of these factors on sleep quality and vice versa, other studies show the opposite effect or no relationship. It is also shown in research that has been conducted, that body mass index (BMI), number of children, religion, ethnicity, social activity, marital status, occupation, income, history of chronic disease, and smoking status do not have a significant effect on sleep quality in menopausal women. The results of this study are in line with previous studies that the effect of sleep quality on BMI, number of children, religion, ethnicity, social activity, marital status, occupation, income, history of Chronic disease, and smoking status do not have a statistically significant effect on sleep quality in menopausal women.[1,12] However, there is one demographic factor that shows a significant association in this study, namely the level of education. These results also showed that there was a relationship between the education level of a menopausal woman and sleep quality.[1]

This study found Education level to have a significant relationship with sleep quality in postmenopausal women. Women with higher education levels tend to have better access to health information, including strategies to improve sleep quality and manage menopausal symptoms. This is in line with research showing that higher education levels are often associated with better health awareness, adoption of healthy lifestyles, and the ability to access medical resources that support sleep quality.[8] Conversely, women with lower education levels may have a limited understanding of health or stress management strategies, contributing to poor sleep quality.[20] Furthermore, higher education can also increase opportunities for more stable employment, providing better economic and emotional support. Good economic support can reduce psychological stress, which is one of the dominant factors affecting sleep quality.[12] However, it is important to note that work-related stress in women with higher education can also be a risk factor for poor sleep quality if not managed properly.[21] In addition, recent studies have shown that higher education allows individuals to better understand and adopt behavioral interventions to improve sleep quality, such as cognitive-behavioral therapy or relaxation techniques.[14] Therefore, health interventions aimed at improving sleep quality in postmenopausal women can be optimized by considering education level as an important component in program design.

Psychological changes such as depression, anxiety, and stress have a huge influence on the sleep quality of a menopausal woman. Psychological conditions that are tense in a person can trigger anxiety so it will be difficult for them to fall asleep. Based on the results of bivariate test studies, anxiety levels, and stress levels influence the sleep quality of menopausal women. Meanwhile, the level of depression did not have a significant effect on the sleep quality of menopausal women. However, in a multivariate test study, stress levels were the only psychological change that had a significant effect on sleep quality. It's different with the level of depression and anxiety which do not have a significant effect on the sleep quality. Overall, stress levels are the most dominating factor in influencing the sleep quality of menopausal women. The results of this study are supported that apart from hormonal changes, psychological stress can also contribute during the menopausal transition.[22] Women who are burdened with thoughts and have problems in their lives are one of the factors that affect the decrease and disruption in the production of the hormone estrogen in menopausal women.[23,24] In line with the results of previous research[14] psychological changes, especially the level of stress felt, show the strongest relationship with the sleep quality of a menopausal woman.

Social support is one of the factors to motivate menopausal women to get maximum sleep. Menopausal women's social relations can have a physical and psychological impact on having positive self-acceptance for their lives. Support in the form of motivation for menopausal women both emotionally, appreciatively, and informatively can provide a sense of comfort and enthusiasm for them. Social support that a person has does not guarantee that that person has good quality sleep. Sometimes people who have social support still have poor sleep quality. In line with the research conducted, different results were obtained when conducting the test. The results of the researchers were also strengthened by research conducted by[25] which showed that there was a significant relationship between social support in menopausal women. Another view says that there is no significant relationship between social support and sleep quality in menopausal women.[21] Although social support and menopausal symptoms showed significant associations in the chi-square test, they were not significant in the multivariate analysis. This suggests that while they may play a role in sleep quality, their effects may be confounded by other factors, such as stress and age.

When women enter the age of pre-menopause and menopause, certain changes occur due to deficiency/decrease in the hormone estrogen, causing several mild to severe disorders. These changes can be physical or psychological. Menopausal symptoms felt by women experiencing menopause can affect the quality of one's sleep.[26] Research says that menopausal symptoms are associated with poor sleep quality and higher PSQI scores.[20] The results of this study are also in line with research that has been conducted that menopausal women will experience several complaints in the menopausal phase due to a decrease in the hormone estrogen with the somatic domain being the most dominating complaint such as hot flushes around 75% of menopausal women. Heart complaints, sleep disturbances, and joint and muscle complaints.[27,28]

Based on the discussion previously described, stress level and age are two things that cannot be separated from sleep quality in menopausal women and are the most dominant. Sleep disturbances such as insomnia are the most common complaints during the menopausal and postmenopausal transitions. The prevalence of insomnia based on epidemiological studies is 5–35%, one of which is influenced by age. Sleep pattern disturbances generally increase as a person ages. In line with the statement of previous researchers[29] that the factors that affect sleep disturbance in menopausal women are psychological changes such as stress which causes difficulty getting to sleep, going to sleep takes > 60 minutes, the occurrence of nightmares, and difficulty getting up in the morning day and feeling less refreshed. The views of[30] are also in line with the saying that women face many challenges and stressors of personal life in midlife, including changes in family roles, loss of important people as well as health problems, and worries about retirement and growing old. Women who are experiencing menopause have a higher level of psychological distress compared with women who have not experienced menopause. As a result of the stress experienced and the perception of poor health, this is what often causes sleep disturbances in middle-aged women.

We recognize that the Pittsburgh Sleep Quality Index (PSQI) is not a gold standard tool for evaluating clinical sleep disorders such as insomnia. The PSQI is an instrument designed to subjectively assess sleep quality based on an individual's experience of various aspects of sleep, including sleep duration, sleep efficiency, and sleep disturbances. This tool does not directly diagnose specific sleep disorders, such as insomnia, sleep apnea, or other disorders, but rather provides a general picture of a person's sleep quality.[19] However, the PSQI remains one of the most widely used tools in research because its validity and reliability have been tested in various populations, including menopausal women. A meta-analysis study showed that PSQI is effective in evaluating the relationship between sleep quality and factors such as stress, anxiety, and menopausal symptoms.[20] Therefore, although the PSQI is not a clinical diagnostic tool, we used it to evaluate factors that affect overall sleep quality, which is relevant to the purpose of this study. Regarding the discussion of insomnia or other sleep disorders, this is done because many menopausal women report symptoms of sleep disorders, such as difficulty falling asleep or waking up frequently at night, which are the main characteristics of insomnia.[21] These sleep disorders are often associated with hormonal, psychological, and physical changes that occur during menopause. Thus, the discussion of insomnia or sleep disorders provides a broader context for understanding the factors that influence the sleep quality of menopausal women in this study.

In this study there were limitations to the study, namely, the population of pre-menopausal and menopausal women was difficult to identify with certainty because of the large number, and the researchers had difficulty getting respondents because not all women ≥ 40 years wanted to fill out the questionnaires that had been distributed because they had busy lives or jobs which is difficult to leave behind and research data obtained online, so the information held is limited according to the questionnaire distributed.

This study has several limitations that need to be acknowledged. The lack of a control group limits the ability to compare postmenopausal women's sleep quality with other groups, such as premenopausal or perimenopausal women. This comparison could provide a clearer picture of the specific changes associated with menopause. Future studies are recommended to include a control group to increase the power of the analysis.

Another limitation of this study is that covariate analysis was not performed to control for the influence of age. Given that age can act as a confounding variable, these results should be interpreted with caution. Further studies with covariate analysis are needed to ensure that the associations between other variables and sleep quality are not affected by age.

Others, this study did not stratify by age. Although age was analyzed as an independent variable, stratification could provide a deeper understanding of how age-specific factors interact with sleep quality. Menopausal symptoms and other related factors may vary across age groups. Stratifying the sample by age range, such as 40–50 years, 51–60 years, and above 60 years, could have provided a more detailed analysis.

Finally, the cross-sectional nature of the study limits the ability to draw causal conclusions. Longitudinal studies are recommended to explore how factors such as stress levels, education, and menopausal symptoms affect sleep quality over time. Despite these limitations, the results of this study still provide valuable insights into the factors that influence sleep quality in postmenopausal women in Indonesia.

Conclusion

This study highlights the significant associations between stress levels, age, and sleep quality in menopausal women. The findings suggest that stress management interventions and educational programs targeting menopausal health could improve sleep quality. These results are expected to be a valuable resource for health professionals, particularly in the field of women's health and menopause management, to develop targeted interventions for improving sleep quality in postmenopausal women. Future research with a larger sample size and longitudinal design is recommended to further explore these associations.

This study shows that age and stress levels are associated factors for sleep quality in menopausal women. However, we suggest further research with covariate analysis to evaluate the independent influence of other factors after controlling for the effect of age.

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Conflict of Interest
The authors report no conflict of interest.

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