

## Assessment of sleep quality and correlates in a large cohort of Colombian women around menopause

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### Abstract

**Objective:** The aim of this study was to determine the relationship between self-reported sleep quality, menopausal symptom intensity, and correlates (including ethnicity) among middle-aged women.

**Methods:** The present cross-sectional study involved 1,078 Colombian women aged 40 to 59 years who completed the Pittsburgh Sleep Quality Index (PSQI), the Menopause Rating Scale (MRS), and a general questionnaire exploring sociodemographic data.

**Results:** The median [interquartile range] age of the whole sample was 49.0 [9.0] years. Among the participants, 45.4% were postmenopausal, 57.2% had increased body mass index values, 13.9% were black, 20.7% had hypertension, 74.1% had a stable partner, and 3.8% used hormone therapy. The prevalence of poor sleep quality was 57.1% (PSQI global score  $\geq 5$ ). Significant correlations between PSQI global scores and MRS total and subscale scores were found. Multiple linear regression analysis found that higher PSQI scores (poorer quality of sleep) correlated with higher MRS psychological and somatic subscale scores (more severe symptoms), smoking habit, and hypertension. Menopause status and black ethnicity were excluded from the final regression model.

**Conclusions:** Despite study limitations, poor sleep quality is highly prevalent in this large middle-aged Colombian female sample and is related to menopausal symptom severity, tobacco use, and presence of hypertension.

**Key Words:** Pittsburgh Sleep Quality Index – Sleep quality – Menopause Rating Scale – Menopausal symptoms – Menopause – Colombian women – Hypertension – Smoking.

Insomnia and subjective poor quality of sleep are highly prevalent in middle-aged women, as determined with several subjective and objective methods.<sup>1-5</sup> Age, menopause and related symptoms, mood problems, hypertension, psychotropic drug use, perceived stress, and partner issues have been identified as related factors.<sup>1,3,6-10</sup> As reported in different countries,<sup>9-13</sup> lifestyle, work characteristics, behavioral factors (alcohol, coffee, tea, and drugs), and geographical, psychosocial, and ethnic differences may also interfere with

the normal sleeping process. The influence of ethnicity on sleep performance has been analyzed in middle-aged women living in the United States,<sup>10,12,13</sup> mostly among white (of European ancestry) and black individuals, with few studies performed among Hispanics (mestizo and other ethnical populations from Latin America) other than those living in the United States,<sup>10,14</sup> who are generally subject to the additive effects of migration and social discrimination. Data on sleep in middle-aged Hispanic women living in their usual cultural and traditional lifestyle are limited.<sup>5,15</sup> Hence, the present study aimed at determining the relationship between self-reported sleep quality (measured with the Pittsburgh Sleep Quality Index [PSQI]), menopausal symptoms (measured with the Menopause Rating Scale [MRS]), and other correlates (including ethnicity) in a large middle-aged Colombian female sample.

### METHODS

#### Design and participants

A cross-sectional study was carried out from February 2009 to March 2011 among mestizo (also called Hispanic) and black (direct descendants of African) Colombian women aged 40 to 59 years who were requested to fill out the PSQI, the MRS, and a questionnaire containing personal data. Women were recruited from urban and surrounding peripheral areas (Barranquilla and Cartagena in the Atlantic coast

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and Cali in the Pacific coast), as well as from rural regions of the Bolivar (North) and Valle del Cauca (South) Colombian departments. These sites were chosen because they are representative regions of Colombia that share a common language and Hispanic cultural background.

Door-to-door visits in the cited communities were carried out by trained personnel who sought women fitting the inclusion criteria. Women were informed about the purpose and content of the research and were requested to give a written informed consent form for participation. Exclusion criteria included women who did not consent to participate, had surgical operation in the last 6 months, had cancer or any other serious illness, were incapable of understanding the items included in the study, or did not complete the sociodemographic questionnaire.<sup>16</sup>

The study protocol of this research was approved by the institutional review board of the Cartagena University (Cartagena, Colombia) and was carried out in accordance with the principles of the Declaration of Helsinki.

### Survey

The questionnaire's personal data included age, parity, ethnicity, menopausal and marital status, body mass index (BMI), current use of hormone therapy (HT), educational level, habits (current coffee and tobacco consumption), and the presence of hypertension. Menopause status was defined using the criteria of the Stages of Reproductive Aging Workshop: premenopausal (women having regular menses), perimenopausal (irregularities >7 d from their normal cycle), and postmenopausal (no menses in the last 12 mo).<sup>17</sup> Those who had undergone bilateral oophorectomy were considered postmenopausal.

BMI was calculated as weight in kilograms divided by squared height in meters. BMI values were categorized as low (<18.50 kg/m<sup>2</sup>), normal (18.50-24.99 kg/m<sup>2</sup>), or increased (>25.00 kg/m<sup>2</sup>). Increased BMI values were further used to categorize women as overweight (>25.00-29.99 kg/m<sup>2</sup>) or obese (≥30.00).<sup>18</sup> Women on antihypertensive medication were considered hypertensive.<sup>19</sup>

### The PSQI

The PSQI is a self-rated instrument that measures sleep quality during the previous month, differentiating between good sleepers and poor sleepers. It includes nine items that cover seven sleep dimensions: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medications, and daytime dysfunction.<sup>2,20</sup> Each item can be scored from 0 (no difficulty) to 3 (severe difficulty). The items are summed up to provide a PSQI global score ranging from 0 to 21. A PSQI global score of 5 or higher was defined as poor sleep quality. However, for multiple regression analysis, PSQI global scores (continuous values) were considered as the dependant variable.

### The MRS

The MRS assesses the presence and severity of menopausal symptoms through 11 items grouped into three subscales: somatic (4 items), psychological (4 items), and urogenital

(3 items). Women may grade each item as 0 (not present), 1 (mild), 2 (moderate), 3 (severe), and 4 (very severe). Graded items within each subscale are summed up to provide a total subscale score. The sum of each total subscale score provides an MRS total score. MRS total scores of 17 or higher are defined as severe (severe menopausal symptoms).<sup>21,22</sup>

### Sample size calculation

A minimal sample size of 664 participants was calculated, assuming a 50% prevalence of poor sleep quality<sup>15</sup> with a 5% desired precision and a 99% confidence level.

### Statistical analysis

Statistical analysis was performed using SPSS version 19 (IBM, Armonk, NY). Data are presented as means, medians and interquartile ranges (IQRs), percentiles, coefficients, percentages, and 95% CIs. The internal consistency of the instruments (MRS and PSQI) was assessed by computing for Cronbach  $\alpha$  coefficients.

Kolmogorov-Smirnov test was used to determine the normality of data distribution. According to this, nonparametric continuous data were compared using Mann-Whitney *U* test (two independent samples) or Kruskal-Wallis test (various independent samples). Spearman  $\rho$  coefficients were calculated to determine the correlations between PSQI global scores and various numeric variables (bivariate analysis).

Multiple linear regression analysis was performed to assess variables related to higher PSQI scores and, therefore, worse quality of sleep. Two regression models were generated: the first included all surveyed women, and the second included only those with a partner. The dependent variable was the PSQI global score. These models were constructed from independent variables that achieved  $P = 0.10$  during bivariate analysis. Independent variables tested during bivariate analysis included age, parity, menopause status, race/ethnicity, MRS subscale values, BMI, smoking habit, coffee consumption, educational level, and HT use. Entry of variables into the model was performed using a stepwise procedure.  $P < 0.05$  was considered statistically significant.

## RESULTS

During the study period, a total of 1,085 women were asked to participate; 0.7% provided incomplete data, leaving 1,078 surveys for final analysis. For the whole sample, the median [IQR] age and educational level were 49 [9] and 11 [6] years, respectively. Most women were of mestizo ethnicity (86.1%), 65.9% consumed coffee, 12.2% were current smokers, 45.5% were postmenopausal, and only 3.8% were receiving HT for menopause (Table 1). Among them, 57.1% reported a poor quality of sleep (PSQI ≥5.0), and 9.9% reported severe menopausal symptoms, as determined by an MRS total score of 17 or higher.

A descriptive analysis of the MRS and PSQI scores is presented in Table 2. For the entire sample, the median [IQR] PSQI and MRS scores were 5.0 [5.0] and 6.0 [9.0], respectively. The computed Cronbach  $\alpha$  coefficients for the PSQI

**TABLE 1.** General demographic data of participants (N = 1,078)

	n (%)	Median [interquartile range]
Age, y		49.0 [9.0]
≤45	351 (32.6)	
46-50	282 (26.2)	
51-55	260 (24.1)	
≥56	185 (17.2)	
Ethnicity		
Mestizo	928 (86.1)	
Black	150 (13.9)	
Parity		2.0 [1.0]
0	65 (6.0)	
1-2	479 (44.4)	
≥3	534 (49.5)	
Marital status		
Married	502 (46.6)	
Single	103 (9.6)	
Widowed	78 (7.2)	
Divorced	139 (12.9)	
Cohabiting	256 (23.7)	
Educational years		11.0 [6.0]
0-6	197 (18.3)	
7-12	527 (48.9)	
≥13	354 (32.8)	
Menopause status		
Premenopausal	373 (34.6)	
Perimenopausal	215 (19.9)	
Postmenopausal	490 (45.5)	
≤5 y	282 (57.6)	
>5 y	208 (42.4)	
Time since menopause onset, y		5.0 [5.0]
Body mass index, kg/m <sup>2</sup>		25.6 [4.45]
Low	43 (4.0)	
Normal	418 (38.8)	
Overweight	485 (45.0)	
Obese	132 (12.2)	
Current smoking	132 (12.2)	
Coffee consumption	710 (65.9)	
Hypertension	223 (20.7)	
Hormone therapy use	41 (3.8)	
PSQI ≥5	615 (57.1)	
Premenopausal	190 (30.9)	
Perimenopausal	140 (22.8)	
Postmenopausal	285 (46.3)	
Severe menopausal symptoms (MRS total score ≥17)	107 (9.9)	

PSQI, Pittsburgh Sleep Quality Index; MRS, Menopause Rating Scale.

and MRS were 0.81 and 0.87, respectively. Bivariate analysis (data not presented) found that women with higher parity, without a partner, with lower education, at perimenopause, with tobacco consumption, with higher BMI values, with hypertension, of black ethnicity, and with HT use displayed higher PSQI scores.

Correlations (Spearman  $\rho$ ) between PSQI global scores, MRS (total and subscale) scores, and selected numeric sociodemographic variables are presented in Table 3. PSQI global scores displayed positive and significant correlations with parity, BMI values, and MRS total and subscale scores. Significant correlations between sociodemographic variables and MRS total and subscale scores were also found. Multiple linear regression analysis was performed using two best-fit models (all women and women with a partner) to assess variables related to higher PSQI global scores (Table 4). In both models, higher PSQI scores (worse quality of sleep) positively correlated with higher MRS somatic and psychological subscale scores, smoking habit, and hypertension. Ethnicity and menopause status were excluded from the final regression model.

### DISCUSSION

The present research examined, for the first time, quality of sleep in a large middle-aged Colombian female sample using the PSQI, taking into consideration sociodemographic variables, ethnicity, menopausal symptom intensity, hypertension, and other covariates related to lifestyle (such as coffee consumption and smoking). Computed Cronbach  $\alpha$  coefficients for the PSQI and MRS were consistent in our studied population, in which 57.1% of surveyed women reported poor sleep quality and 9.9% reported severe menopausal symptoms. Higher PSQI global scores significantly correlated with higher MRS total and subscale (somatic, psychological, and urogenital) scores—meaning that women with more severe symptoms present a worse quality of sleep. This was confirmed through multiple linear regression analysis but specifically for somatic and psychological menopausal symptoms. Other factors that may influence quality of sleep, such as age, menopause status, parity, or BMI, were excluded from the final regression model, hence suggesting that these factors may have little or no effect on sleep quality during midlife—a situation that correlates with other studies.<sup>11,23,24</sup> A possible explanation for the exclusion of menopause status as a factor related to poor quality of sleep may rely on the fact that menopausal symptom rates are evenly distributed across the phases of the menopausal transition.<sup>25</sup> Hence, sleep quality and physical and psychological morbidity may mutually correlate and potentiate. Based on a review of the literature, our model fits well with other reports claiming that sleep problems in female midlife are associated with stress and somatic and psychological menopausal complaints.<sup>3,11,26</sup>

**TABLE 2.** Descriptive analysis of MRS and PSQI scores (N = 1,078)

	MRS ( $\alpha = 0.87$ ) <sup>a</sup>				PSQI ( $\alpha = 0.81$ ) <sup>a</sup>
	Total	Somatic	Psychological	Urogenital	
Mean	7.4	3.2	2.6	1.5	5.9
Median	6.0	3.0	2.0	1.0	5.0
p25-p75	2.0-11.0	1.0-5.0	0.0-4.0	0.0-2.0	3.0-8.0
IQR	9.0	4.0	4.0	2.0	5.0

MRS, Menopause Rating Scale; PSQI, Pittsburgh Sleep Quality Index; p25, 25th percentile; p75, 75th percentile; IQR, interquartile range.

<sup>a</sup>Computed Cronbach  $\alpha$  coefficients for each scale are presented in parentheses.

**TABLE 3.** Correlations (Spearman  $\rho$ ) between PSQI global scores, MRS (total and subscale) scores, and selected numeric sociodemographic variables

	PSQI global score	MRS			
		Total score	Somatic score	Psychological score	Urogenital score
Sociodemographic variables					
Age	0.057	0.085	0.118	0.026	0.106
<i>P</i>	0.062	0.005	<0.0001	0.386	<0.0001
Parity	0.077	0.109	0.120	0.049	0.143
<i>P</i>	0.012	<0.0001	<0.0001	0.107	<0.0001
Educational level	-0.004	-0.085	-0.089	-0.074	-0.041
<i>P</i>	0.88	0.005	0.003	0.016	0.184
Body mass index	0.065	0.124	0.113	0.089	0.134
<i>P</i>	0.032	<0.0001	<0.0001	0.003	<0.0001
Tools					
MRS total score	0.630	-	-	-	-
<i>P</i>	<0.0001	-	-	-	-
MRS somatic score	0.646	0.911	-	-	-
<i>P</i>	<0.0001	<0.0001	-	-	-
MRS psychological score	0.565	0.887	0.729	-	-
<i>P</i>	<0.0001	<0.0001	<0.0001	-	-
MRS urogenital score	0.382	0.724	0.529	0.520	-
<i>P</i>	<0.0001	<0.0001	<0.0001	<0.0001	-

PSQI, Pittsburgh Sleep Quality Index; MRS, Menopause Rating Scale.

Postmenopausal women presenting with frequent moderate to severe hot flashes independently report severe symptoms of insomnia, including nighttime wakefulness and sleep fragmentation.<sup>7</sup> Among Japanese perimenopausal and postmenopausal women, one study found a significant correlation between depressed mood and insomnia.<sup>27</sup> Interestingly, psychological treatment of insomnia and hot flashes can improve sleep quality.<sup>2,28</sup>

Sleep problems increase in subjects with hypertension, diabetes, and cardiovascular disease.<sup>29,30</sup> Sleep duration has been related to hypertension risk.<sup>30,31</sup> This effect is only present in women (stronger in premenopausal women) and is independent of socioeconomic status, usual cardiovascular risk factors, and psychiatric comorbidities.<sup>9</sup> Interestingly, the PSQI has been recommended as a sleep quality assessment tool in individuals with these conditions.<sup>30</sup> In one study, the presence of hypertension was reported to be higher in bad sleepers than in good sleepers (87.1% vs 35.1%).<sup>9</sup> Both our regression models found that hypertension was an independent factor correlated to higher PSQI scores and, hence, poor sleep quality. It is important to highlight that all hypertensive were undergoing treatment; further research is needed to elucidate whether treatment of the disease or the presence of the disease per se is the risk factor.

In general, smoking habit has been associated with sleep problems, with cessation improving quality of sleep.<sup>32</sup> Nev-

ertheless, published results are controversial. Indeed, although one study found that smokers are more likely than nonsmokers to have problems with sleep induction, staying asleep, daytime sleepiness, depression, and high daily caffeine consumption,<sup>33</sup> another research study using sleep diaries reported the contrary.<sup>34</sup> Using polysomnography, another study found that cigarette smoking is independently associated with disturbances of the sleep architecture.<sup>26</sup> Consistent with the latter, smoking habit was an independent determinant of poor sleep quality in our middle-aged female population. Although our study found no association between coffee consumption and poor quality of sleep, the contrary has been reported in the literature.<sup>35</sup>

The prevalence of sleep problems among women living in the United States may differ by ethnicity.<sup>36</sup> As determined with the PSQI, 26% of middle-aged Chinese women reported poor sleep,<sup>11</sup> a value much lower than that found in the present study using the same PSQI cutoff value (57.1%). This high rate, however, is similar to that reported in a recent large multinational Latin American study using the same PSQI.<sup>15</sup> As mentioned, studies analyzing ethnicity and sleep have mainly been performed in middle-aged women (whites and blacks) living in the United States,<sup>10,12,13</sup> with few studies performed among Hispanics other than those living in the United States.<sup>10,14</sup> Our study may indeed be the first to provide data related to sleep quality in middle-aged Hispanic

**TABLE 4.** Factors related to higher PSQI scores (worse sleep quality): multiple linear regression analysis including all participants ( $N = 1,078$ )

Factor	Coefficient	Standard error	95% CI	<i>P</i>
MRS somatic	0.69	0.05	0.60-0.78	<0.0001
MRS psychological	0.23	0.05	0.13-0.32	<0.0001
Hypertension	0.56	0.24	0.09-1.90	0.019
Smoking	1.33	0.29	0.75-1.90	<0.0001

$P < 0.0001$  ( $r^2 = 0.40$ ; adjusted  $r^2 = 0.40$ ).

PSQI, Pittsburgh Sleep Quality Index; MRS, Menopause Rating Scale.

women living in their usual cultural and traditional lifestyle. Although black women displayed significantly higher median PSQI scores than mestizo women (bivariate analysis), this factor disappeared during multiple linear regression analysis, suggesting that other factors are more relevant as causes of poor sleep quality. This is contrary to what has been reported for black women from the United States.<sup>10,36</sup> Our findings seem to evidence social and cultural issues<sup>10,12-14</sup> and racial discrimination<sup>37</sup> as factors influencing sleep characteristic among specific ethnic minorities living outside their native environment. Further research using different approaches is warranted in this regard to confirm the present findings.

Finally, several study limitations should be noted. First, its cross-sectional design does not allow determination of temporality. Second, although care was taken to screen women from different important Colombian regions, it is possible that participants may not completely represent those from the general Colombian population. Moreover, the reported results concern Colombian women and thus cannot be extrapolated to other Latin American Hispanic populations. In this sense, "Hispanic" is a general denomination for a heterogeneous population that may show different endpoints.<sup>38</sup> Other potential limitations were the use of self-reported recall data and the noninclusion of polysomnography as an objective assessment of sleep quality. This was not feasible, however, basically owing to the costs involved and the sample size. Nonetheless, in women, subjective (eg, PSQI) and objective (polysomnography) assessments may not always have good correspondence.<sup>39</sup> Furthermore, although PSQI scores did not correlate with age or education, we did not examine other factors that may alter sleep, such as working hours, mood or stress, physical activity, other partner, and general demographic information.<sup>3,40-42</sup> Adjusted squared correlation coefficients for each of the analyzed multivariate models were about 40% of the total variance, a situation that should be taken into account when interpreting results. Future research should assess all the aforementioned aspects.

Despite the limitations mentioned, this study analyzed sleep quality and menopausal symptom intensity in a large sample of middle-aged women from different geographical Colombian regions who were living in their natural, native cultural environment. This may be seen as a potential strength. In addition, the study also found that the PSQI in its Spanish language version displayed high consistency and reliability, providing for the first time data from a large middle-aged Colombian sample.

## CONCLUSIONS

Poor sleep quality is highly prevalent in this large middle-aged Colombian female sample and is related to menopausal symptom severity, tobacco use, and the presence of hypertension.

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