International Journal of Women's Health

Dovepress
Taylor & Francis Group

Open Access Full Text Article

ORIGINAL RESEARCH

Sleep Quality and Its Predictors Among Pregnant Women in Jordan: A Cross-Sectional Study

Zena Alasmer[1,*], Mohammad S Nazzal[2,*], Zeinab Mohamed[1,*], Aisha Al-Jaber[1,*], Rana Ali[1,*], Feda Alshar[1], Ebaa M Ababneh[2], Eman Alshdaifat[3], Saddam F Kanaan[1]

[1]Department of Rehabilitation Science, Qatar University, QU Health, Doha, Qatar; [2]Department of Rehabilitation Sciences, Jordan University of Science and Technology, Irbid, Jordan; [3]Department of Obstetrics and Gynecology, Yarmouk University, Irbid, Jordan

*These authors contributed equally to this work

Correspondence: Saddam F Kanaan, Ibn Albetar (I-06), Department of Rehabilitation Science, College of Health Sciences, QU Health, Qatar University, Doha, Qatar, Tel +97444036077, Email saddam@qu.edu.qa

Introduction: Pregnant women often report poor sleep quality and increased sleep disturbances, especially in the second and third trimesters. Studies showed inconsistent prevalence of poor sleep quality among pregnant women, with unclear predictive factors. Furthermore, physical, psychological, and socioeconomic factors may negatively affect sleep in pregnant women.

Purpose: The study aims to explore sleep quality and to identify possible physical, psychological, and socioeconomic predictors of poor sleep quality among pregnant women.

Patients and Methods: The cross-sectional study was conducted from July 2021 to January 2022. Pregnant women in their second and third trimesters were recruited during their regular visits to the gynecology and obstetrics clinics and hospitals in northern Jordan. Using convenience sampling, two hundred six participants completed questions about sociodemographics, pregnancy, and women's health history using the interviewer-administered method. Additionally, participants completed the Pittsburgh Sleep Quality Index (PSQI), Pregnant Physical Activity Questionnaire (PPAQ), and Hospital Anxiety and Depression Scale (HADS). Descriptive statistics were used to analyze sleep quality, and a multivariable linear regression model was used to identify significant predictors of the PSQI total score.

Results: 206 pregnant women participated: 23.3% in the second trimester and 73.3% in the third, with a mean age of 30.6 years. 76.6% of pregnant women reported poor sleep quality (PSQI total score >5). The results showed that increased age (B= 0.125, 95% CI [0.042 - 0.208], p< 0.003), Low educational level (high school or lower vs higher education) (B= 1.097, 95% CI= [0.033–2.161], p= 0.043), having leg cramps (B= 1.578, 95% CI [0.627–2.529], p< 0.001), anemia during pregnancy (B= 1.311, 95% CI [0.131–2.492], p= 0.030), and increased anxiety (B= 0.355, 95% CI [0.258 - 0.452], p< 0.001) are significant predictors poor sleep quality.

Conclusion: Poor sleep is highly prevalent among pregnant women due to factors such as age, education, anxiety, and medical conditions. Clinicians should consider this high prevalence and the possible associated factors in assessing and managing sleep quality to improve pregnant women's health and quality of life.

Keywords: women's health, sleep quality, pregnancy, leg cramps, anxiety, anemia

Introduction

Sleep quality refers to an individual's satisfaction with sleep aspects such as efficiency, latency, duration, and wake after sleep onset,[1] while also encompassing both subjective perceptions (eg, self-reported satisfaction) and objective measurements (eg, actigraphy or polysomnography-derived metrics like total sleep time and arousal frequency).[2,3] Sleep plays a crucial role in various body systems functioning, including the reproductive, cardiovascular, immune, endocrine, and nervous systems. Adequate sleep is essential for maintaining these systems' health and efficiency.[4] Furthermore, good sleep quality is strongly associated with enhanced cognitive functions and mental well-being, contributing significantly to overall mental health.[4] In contrast, poor sleep quality increases the risk of type 2 Diabetes Mellitus, muscle weakness, obesity, cardiovascular disease, stroke, cancer, neurodegenerative disorders, Alzheimer's disease, and depression.[4]

Received: 27 September 2024
Accepted: 8 March 2025
Published: 7 May 2025

A variety of factors can influence poor sleep quality in pregnant women. A systematic review indicates that lower physical activity is linked to worse sleep throughout pregnancy.[5] Studies suggest that older age, multiple pregnancies, stress, and depression double the likelihood of sleep disturbances.[6] Other research points to caffeine, domestic violence, and prenatal depression as contributing factors.[7] In southern China, fear of childbirth, psychological distress, and low mental resilience are identified as significant influences.[8] Additionally, exposure to second-hand smoke and alcohol consumption are associated with poor sleep quality.[9,10] These findings highlight the need for further investigation into sociodemographic, clinical, lifestyle, and psychological predictors of sleep quality in this population.

Women often experience increased sleep disturbances, particularly during pregnancy.[11] The estimated prevalence of poor sleep quality among pregnant women worldwide ranges between 17% and 84%.[6,12,13] This broad prevalence reflects methodological variations, including differing assessment tools, population characteristics (eg, trimester, culture), and study designs.[14] Throughout the pregnancy, various physiological factors can contribute to poor sleep quality.[15] Sleep quality decreases significantly in the second trimester and even more in the third trimester.[14–16] This can be explained by the fluctuations in progesterone and prolactin levels that increase the sleep disturbances experienced during pregnancy.[15] Also, uterine contractions, urinary frequency, fetal movements, rhinitis, and nasal congestion can contribute to poor sleep quality in the second trimester.[15] In the third trimester, sleeping position, leg cramps, heartburn, and orthopnea reduce sleep quality.[15] Finally, general changes during pregnancy can affect sleep quality, including diaphragmatic elevation, decreased respiration, bladder dilation, thermal dysregulation, gastrointestinal complaints, and weight gain.[15]

Poor sleep quality is associated with increasing risk of developing common pregnancy-related complications, including preeclampsia, gestational diabetes, depression, premature birth, increased risk of cesarean section, abnormal labor duration, and intrauterine growth restriction.[16,17] A recent systematic review synthesizes evidence linking poor prenatal maternal sleep health (eg, disrupted sleep timing, sleep disorders, daytime sleepiness) to adverse offspring outcomes beyond birth, including poorer infant sleep, higher body mass index, physical health conditions (eg, hospitalizations), developmental delays, behavioral problems, and differences in brain structure/function.[18] These findings align with earlier studies showing prenatal sleep disturbances increase the risks of preterm birth and lower birth weight.[19]

Few studies have explored sleep quality among pregnant women globally and in the Middle East. Additionally, limited research has comprehensively investigated socioeconomic, clinical, lifestyle, and psychological factors as predictors of sleep quality, highlighting the need for further investigation. This study aims to explore sleep quality patterns and identify predictors of poor sleep quality among pregnant women. It will use multivariate analysis to examine potential predictors, including sociodemographic characteristics, lifestyle behaviors, physical activity, obstetric history, pre-pregnancy and antenatal clinical parameters, and mental health indicators. The study may provide critical insights into the multifaceted influences on sleep quality during pregnancy, potentially improving health outcomes for both mothers and their future children.

Materials and Methods

Research Design

This cross-sectional study, conducted between July 2021 and January 2022, used a single time point measurement to explore sleep quality patterns and investigate the associated factors of poor sleep quality among pregnant women.

Recruitment and Setting

Participants were recruited from pregnant women who routinely visited the Obstetrics and Gynecology clinics at King Abdullah University Hospital, Ministry of Health-affiliated hospitals, and private clinics in Northern Jordan. We used convenience sampling methods to select participants.

The researcher encountered potential participants while waiting for appointments to assess their eligibility for the study.

To be eligible for inclusion in the study, participants had to be pregnant women in the second or third trimester, aged between 18 and 49 years, and capable of reading, understanding, and completing questionnaires in Arabic. The study excluded pregnant women experiencing medical conditions requiring bed rest as the physician prescribes.

A prior sample size calculation was performed using G*Power version 3.[20] The calculation determined that a minimum sample size of 199 pregnant women was required. This was based on an *F*-test for linear multiple regression with a fixed model, an anticipated R^2 deviation from zero, an effect size of 0.15, a significance level (α) of 0.05, a power of 0.95, and the inclusion of 15 potential predictors.

Data Collection

A multi-questionnaire, interviewer's administered approach was used to collect information about each participant, including participant questionnaires and standard questionnaires, such as the Pregnant Physical Activity Questionnaire (PPAQ), Pittsburgh Sleep Quality Index (PSQI) and Hospital Anxiety and Depression Scale (HADS).

The participant questionnaire involved three sections covering the history of sociodemographics, women's health, and pregnancy. The sociodemographic section included questions regarding the participant's age, residency, educational level, occupation, monthly income, household size, and transportation (personal vehicle vs public transportation). The women's health section covered questions about an individual's medical history, height, and weight before and during pregnancy. Lastly, the pregnancy history section covered past pregnancies and births.

The Pittsburgh Sleep Quality Index (PSQI) is a self-evaluating questionnaire used to assess the quality of sleep and sleep disturbances for one month.[2] It consists of 19 questions evaluating the following seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, sleep medication use, and daytime dysfunction. Each component was evaluated on a scale from 0–3, with a higher score indicating a higher dysfunction.[2] The seven components combined to produce a global score indicating overall sleep quality ranging from 0–21. A score greater than five typically signifies poor sleep quality.[2] The PSQI has been validated in various populations, showing good reliability and validity. PSQI is a valid and reliable tool for assessing sleep quality in Arabic.[21,22]

The Pregnancy Physical Activity Questionnaire (PPAQ) is a valid self-evaluation questionnaire that detects women's physical activity levels during pregnancy.[23] By PPAQ, pregnant women were asked to record the total time spent on 32 varied activities, including eight sports or exercises, three transportation activities, five occupational, three inactivity, and thirteen caregiving/household activities. For each activity, the participant was asked to choose the category that aligns with the duration level for each activity per day or week in the present trimester. Each participant estimated the number of hours that they spent on each specific activity per day/week (based on the question required) for the last three months. The weekly energy expenditure average was calculated by the metabolic equivalent (1 MET is the metabolic equivalent of resting energy in the body) for hours per week MET.h/wk units.[23] The Arabic PPAQ version showed a high construct validity and excellent reliability (>0.89).[24]

The Hospital Anxiety and Depression Scale (HADS) is a standard outcome measure used in clinical and research settings for assessing anxiety and depression levels in non-psychiatric populations.[25,26] HADS is a 14-item scale that is divided into two categories. The anxiety subscale comprises the first seven items, while the depression subscale comprises the subsequent seven items. Each item on the Likert-type scale ranges from 0 to 3. Consequently, the total score for each subscale ranges from 0 to 21, with higher scores indicating more severe symptoms.[27] Furthermore, Studies demonstrated the validity and reliability of the Arabic version of the HADS questionnaire.[25]

Data Analysis

The data was analyzed using descriptive statistics, which include proportions, means and standard deviations. Univariable linear regression models were conducted to identify potential predictors for the PSQI total score, and $p<0.15$ was set for inclusion in the multivariable linear regression model. We assessed the assumptions of the multivariable linear regression, including linearity, independence, normality, homoscedasticity, and multicollinearity. Scatter and residual plots confirmed a linear relationship between the dependent and independent variables. The residuals appeared normally distributed, and the variability of the residuals was consistent across all levels of the independent variables (no evidence of heteroscedasticity). The variance inflation factor (VIF) was less than 10, indicating no significant multicollinearity among the predictors. The final model was constructed using potential predictors, with PSQI total score as the dependent variable and other potential predictors as the independent variables. A higher OSQI

total score indicates lower sleep quality. Backward and forward selection methods were used to identify the most appropriate model for the data. A cut-off point for predictor significance was set at $p<0.05$. The analysis was performed using IBM SPSS Statistics 29.0.

Ethical Consideration

This study was approved by the Institutional Review Board of Jordan University of Science and Technology (IRB approval number: 55/136/2020), and all the study procedures were conducted following the Helsinki Declaration. The mechanism of the study was fully clarified to the possible participants before entering the study. Individual involvement was voluntary, as they could retreat whenever they wanted, without any potential consequences for the quality of the health care service they were obtaining. The researcher explained the study's purpose, obtained consent, explained that participation is voluntary, and assured the confidentiality of collected data. Additionally, the research assistant was always available for each participant in case any explanations were needed. All participants signed informed consent before enrollment.

Results

Demographic, Clinical and Lifestyle Characteristics

A total of 206 pregnant women completed the study: 23.3% were in the second trimester, and 73.3% were in the third-trimester stage. The mean age was 30.6 (±5.2) years. Half of the participants live in urban areas (50%), while 36.9% of the residents live in shared accommodations. The educational level varied, as 21.4% of the participants had a high school diploma or lower, 68.4% held an undergraduate degree, and 10.2% held a postgraduate degree. 68.4% of the participants did not work. Only a third of the participants (31.1%) used public transportation. Notably, only 2.9% of the pregnant women were smoking, while nearly all participants (99.5%) were not alcohol consumers. Common clinical conditions before and during pregnancy and the results of the standardized questionnaires are summarized in Table 1.

Table 1 The Pregnant Women's Demographic, Clinical and Lifestyle Characteristics Participated in the Study

Variables		**Mean (±SD) or n (%)**
Total (n)		206 (100%)
Age (years)		30.67 (5.28)
BMI before pregnancy		25.93 (5.40)
BMI during pregnancy		29.20 (5.52)
Living area	Urban	103 (50.0%)
	Suburban/ rural	103 (50.0%)
Residency	Independent accommodation	130 (63.1%)
	Shared accommodation	76 (36.9%)
Education	High school	44 (21.4%)
	Undergraduate	141 (68.4%)
	Postgraduate	21 (10.2%)
Employment status	Unemployed	141 (68.4%)
	Employed	65 (31.6%)

(*Continued*)

Table 1 (Continued).

Variables		Mean (±SD) or n (%)
Income	Low ≤500 JD	113 (54.9%)
	High >500 JD	93 (45.1%)
Transportation	Use public transportation	64 (31.1%)
	Own transportation	142 (68.9%)
Smoking	No	200 (97.1%)
	Yes	6 (2.9%)
Alcohol	No	205 (99.5%)
	Yes	1(0.5%)
Before the Pregnancy		
Cardiovascular Disease	No	202 (98.1%)
	Yes	4 (1.9%)
Thyroid	No	192 (93.2%)
	Yes	14 (6.8%)
Hypotension	No	200 (97.1%)
	Yes	6 (2.9%)
Hypertension	No	201 (97.6%)
	Yes	5 (2.4%)
Asthma	No	201 (97.6%)
	Yes	5 (2.4%)
Blood disease	No	204 (99.0%)
	Yes	2 (1.0%)
Diabetes Mellitus	No	199 (96.6%)
	Yes	7 (3.4%)
During the Pregnancy		
Body mass index		29.204 (5.519)
Pregnancy stage	Stage 2 (14–26 weeks)	55(26.7%)
	Stage 3 (27–40 weeks)	151 (73.3%)
Gestational period (weeks)		28.80 (7.09)
Number of deliveries		1.87 (1.477)
The period between pregnancies (months)		22.16 (23.84)
Hypotension	No	187 (90.8%)
	Yes	19 (9.2%)

(*Continued*)

https://doi.org/10.2147/IJWH.S498204

Table 1 (Continued).

Variables		Mean (±SD) or n (%)
Hypertension	No	196 (95.1%)
	Yes	10 (4.9%)
Diabetes Mellitus	No	186 (90.3%)
	Yes	20 (9.7%)
Anemia	No	174 (84.5%)
	Yes	32 (15.5%)
	Yes	2 (1.0%)
Urinary Tract Infection	No	129 (62.6%)
	Yes	77 (37.4%)
	Yes	8 (3.9%)
Leg Cramps	No	147 (71.4%)
	Yes	59 (28.6%)
HADS Depression		7.94 (±3.27)
HADS Anxiety		9.52 (±4.43)
PPAQ total activity		232.5 (±134.99)

Abbreviations: BMI, Body mass index; HADS, Hospital Anxiety and Depression Scale; PPAQ, Pregnancy Physical Activity Questionnaire; SD, Standard Deviation.

Sleep Characteristics

The mean PSQI total score was 8.53 (±3.671), with 76.7% of the participants having poor sleep quality. In the subjective rating of global sleep quality, 41.7% of participants reported poor sleep, while 58.3% reported good sleep quality. Meanwhile, 17.5%, 61.7%, and 20.4% of the participants reported high, moderate, and low sleep disturbances consecutively. Further information about the sleep quality components is summarized in Table 2.

Table 2 Participants' Sleep Characteristics According to Self-Reported Pittsburgh Sleep Quality Index

Variables		N (%)
Pittsburgh Sleep Quality Total Score (Mean, SD)		8.53 (3.671)
Global Poor Sleep Quality	Good sleep quality	48 (23.3%)
	Poor Sleep	158 (76.7%)
Subjective sleep quality	Good	59 (28.6%)
	Fairly good	61 (29.6%)
	Fairly poor	60 (29.1%)
	Poor	26 (12.6%)
Sleep latency	>5	135 (65.4%)
	≤ 5	71 (34.6%)

(*Continued*)

Table 2 (Continued).

Variables		N (%)
Minutes to sleep	≤15 minutes	43 (20.9%)
	16–30 minutes	53 (25.7%)
	31–60 minutes	79 (38.3%)
	<60 minutes	31 (15.0%)
Sleep duration	≤6 hours	79 (38.3%)
	>6 hours	127 (61.7%)
Habitual sleep efficiency	Greater than 85%	114 (55.3%)
	75%–85%	35 (17%)
	65%–74.9%	24 (11.7%)
	> 65%	33 (16.0%)
Sleep disturbance	0	1 (0.5%)
	1–9	42 (20.4%)
	10–18	127 (61.7%)
	19–27	36 (17.5%)
Sleep medications	Not during the past month	56 (27.2%)
	Less than once a week	107 (51.9%)
	Once or twice a week	26 (12.6%)
	Three or more times a week	17 (8.3%)
Day time dysfunction	0	96 (46.6%)
	1–2	66 (32%)
	3–4	36 (17.5%)
	5–6	8 (3.9%)

Abbreviation: SD, Standard deviation.

Regression Analysis

Univariable regression analysis results showed that multiple factors were potential predictors of sleep quality (Table 3) and were entered into the multivariable regression model. The overall linear regression model was significant (F (5, 205) = 17.320, p >0.001). According to the multivariable linear regression results (Table 4), poor sleep quality is significantly associated with increased age (*B*= 0.125, CI 95% = 0.042–0.208, p < 0.003), high school education in comparison to the other higher education (undergraduate or postgraduate) (*B*= 1.097, CI 95%= 0.033–2.161 p < 0.043), having leg cramps (*B*= 1.578, CI 95%= 0.627–2.529, p < 0.001), having anemia during pregnancy (*B*= 1.311, CI 95%= 0.131–2.492, p <0.030), and increased anxiety score (*B*= 0.355, CI 95%= 0.258–0.452, p <0.001). The model explained 30.2% of the total PSQI score variations. Table 3 and Table 4 show the results of the univariable linear regression and the multivariable linear regression results.

Table 3 The Results of the Univariable Linear Regression Model

	B	SE	β	t	*p*	95% CI
Age	0.100	0.048	0.144	2.084	0.038	(0.005, 0.195)
BMI before	−0.07	0.48	−0.010	0.138	0.890	(−0.87, 0.100)
BMI After	0.055	0.046	0.083	1.188	0.236	(−0.036, 0.147)
Living area (Rural and suburban vs urban)	−0.117	0.513	−0.016	−0.227	0.820	(−1.128, 0.895)
Residency (Shared vs independent accommodation)	−0.992	0.527	−0.131	−1.883	0.061	(−2.031, 0.047)
High school or below (vs undergraduate and postgraduate)	1.026	0.622	0.115	1.651	0.100	(−.199, 2.252)
Undergraduate (vs high school and postgraduate)	−0.613	0.550	−0.078	−1.115	0.266	(−1.698, 0.471)
Work (Employed vs Unemployed)	0.389	0.551	0.049	0.705	0.481	(−0.698, 1.475)
Income (High vs low)	0.144	0.515	0.020	0.279	0.780	(−0.872, 1.160)
Transportation (use public transportation vs own car)	−0.359	0.554	−0.045	−0.648	0.518	(−1.450, 0.733)
Smoking (Ref: yes)	−1.682	1.520	−0.077	−1.106	0.270	(−4.679, 1.316)
Alcohol consumption (Ref: yes)	−2.244	1.838	−0.085	−1.221	0.224	(−5.868, 1.380)
Cardiovascular disorders (Ref: yes)	−2.074	1.853	−0.078	−1.120	0.264	(−5.727,1.579)
Thyroid disorder (Ref: yes)	−0.343	1.019	−0.024	−0.337	0.737	(−2.351, 1.665)
Hypotension (Ref: yes)	2.025	1.518	0.093	1.334	0.184	(−0.969, 5.019)
Hypertension (Ref: yes)	−0.137	1.666	−0.006	−0.082	0.934	(−3.423. 3.148)
Asthma (Ref: yes)	1.093	1.665	0.046	0.656	0.512	(−0.189,4.374)
Blood disease (Ref: yes)	5.015	2.591	0.134	1.935	0.054	(−0.095,10.124)
Diabetes mellitus (Ref: yes)	−0.405	1.415	−0.020	−0.286	0.775	(−3.195, 2.385)
Number of Deliveries	−0.042	0.174	−0.017	−0.239	0.812	(−0.385, 0.301)
Period between pregnancies (months)	0.005	0.011	0.032	0.463	0.644	(−0.016, 0.026)
Gestational period (months)	0.088	0.036	0.171	2.469	0.014	(0.018, 0.158)
Hypotension after pregnancy	−0.066	0.886	−0.005	−0.075	0.940	(−1.814, 1.681)
Hypertension after pregnancy	1.436	1.189	0.084	1.208	0.229	(−0.908, 3.780)
Diabetes mellitus after pregnancy	0.682	0.865	0.055	0.789	0.431	(−1.023, 2.387)
Anemia after pregnancy	1.514	0.700	0.150	2.163	0.032	(0.134, 2.894)
UTI	0.786	0.527	0.104	1.490	0.138	(−0.254, 1.825)
Leg cramps	2.031	0.549	0.251	3.698	<0.001	(0.948, 3.113)
PPAQ total Activity	0.001	0.002	0.030	0.433	0.665	(−0.003, 0.005)
HADS depression	0.316	0.076	0.280	4.160	<0.001	(0.166, 0.465)
HADS anxiety	0.374	0.052	0.452	7.228	<0.001	(0.272, 0.476)

Abbreviations: *B*, Unstandardized Coefficients; SE, Standard Error; β, Standardized Coefficients; CI, Confidence interval; BMI, Body mass index; UTI, Urinary tract infection; HADS, Hospital anxiety and depression scale; PPAQ, Pregnancy physical activity questionnaire.

Table 4 The Results of the Multivariable Linear Regression Model

Variable	*B*	SE	*p*	95% CI
Age	0.125	0.042	0.003	0.042 - 0.208
High School or lower vs higher education	1.097	0.540	0.043	0.033–2.161
Leg cramps	1.578	0.482	0.001	0.627–2.529
Anemia	1.311	0.599	0.030	0.131–2.492
HADS Anxiety	0.355	0.049	<0.001	0.258 - 0.452
Constant	0.415	1.429	0.772	−2.403–2.161

Abbreviations: *B*, Unstandardized Coefficients; SE, Standard Error, CI, Confidence interval.

Discussion

In this cross-sectional study, we investigated sleep quality and its potential determinants among pregnant women in their second and third trimesters. Our findings revealed that poor sleep quality is highly prevalent among pregnant women who participated in the study. Notably, factors such as age, the presence of anemia or leg cramps during pregnancy, anxiety, and educational level emerged as significant predictors of sleep quality in this population. Identifying the importance of recognizing significant predictors of low sleep quality in pregnancy is essential, as high sleep quality is crucial for the well-being and health of pregnant women.

Our study showed a high PSQI mean and prevalence, with more than three-quarters of pregnant women reporting poor sleep quality. Our study showed a higher prevalence compared with a meta-analysis of 24 articles that reported sleep quality results among pregnant women showed an average PSQI score of 6.07 (range 3.96 to 8.55) and a prevalence of poor sleep quality ranged between 26–76%.[14] Also, our results showed a higher mean and prevalence of PSQI compared to a recent cross-sectional study that reported a mean PSQI score of 4.84 and a prevalence of 18.2% (PSQI <7) of the pregnant women in the study who had sleep difficulties.[28] A more recent cohort study reported a prevalence of 31.1% and an estimated mean PSQI of 4.2.[29] Furthermore, our study found significant effects on various sleep parameters, including sleep latency, duration, habitual sleep efficiency, disturbances, medication and daytime dysfunction. These findings are consistent with those of previous studies, which reported a significant deviation in these sleep parameters during the second and third trimesters compared to the first trimester in a cohort of South Indian pregnant women.[30] These effects align with another study by Aladid et al, which demonstrated that sleep patterns in pregnant women could vary significantly from those in non-pregnant women.[31]

Our study aligns with prior studies that suggested a correlation between maternal age and sleep quality in pregnancy. There is an association between younger pregnant women and higher sleep quality. Studies have mentioned that pregnant women between 29 and 45 had poorer sleep quality than those aged 17 to 28.[32,33] Additional evidence of the age-related effect was proven by other studies, showing that the older age of pregnant women predicts less restful sleep.[33,34] Over half of the women during pregnancy had reported poor sleep quality, particularly in women above 30, during their third trimester.[35] The possible impact of age on sleep quality among pregnant women might be due to the aging process and its impacts on sleep patterns, such as timing, efficiency, duration, increased daytime napping and reduced nighttime sleep, decreased slow wave sleep, and increased frequent night awakenings.[36] These changes are caused by several factors, such as lifestyle, environmental, and social factors, as well as medical conditions. Sleep homeostasis and the circadian system become less robust with aging, besides altered sleep hormone secretion.[36]

In our study, the lower educational level significantly predicted poor sleep quality. This relationship can be explained by investigating the factors contributing to higher or lower levels of education associated with sleep quality. A contrasting study has attributed their findings to the notion that women with higher educational levels experience poorer sleep quality because of high workplace demands, responsibilities, and psychological burdens, particularly as they progress into late pregnancy. On the other hand, a study aligned with our results found that higher levels of education boost personal well-being, resulting in better health and income. As a result, those with greater education levels participate in more physical activity, have more social connections, and are less likely to engage in unhealthy behaviors like smoking.[37] In addition, research on second-time mothers found that low

educational levels, low monthly income, gender expectations, and unhealthy wife-husband relationships were the leading to poor sleep quality when pregnant.[33] Furthermore, studies have connected lower education and increased stress levels to frequent sleep patterns and poor sleep quality disruptions.[38] These studies align with our study, as unmanaged socioeconomic factors, such as lower educational levels, can stress pregnant women, thereby increasing anxiety levels. These different aspects highlight the intricate connection between psychological, socioeconomic, and sleep-related factors in determining sleep quality in pregnant women. Therefore, when investigating links between socioeconomic status and sleep quality, it is critical to examine psychological factors that existed before pregnancy. Patient education is essential to managing sleep problems during pregnancy since it gives pregnant women more knowledge and access to resources for regulating their sleep, resulting in better sleep quality.

Our study showed that the presence of leg cramps is a significant predictor of poor sleep quality among pregnant women in the second and third trimesters. Limited studies mentioned the correlation between leg cramps and poor sleep quality among pregnant women. However, a cross-sectional study with a sample size of 439 showed a statistically significant correlation between leg cramps and poor sleep quality in the third trimester.[39] The possible explanation for the significant correlation is that leg cramps may cause nighttime awakening due to discomfort and pain, which probably reduces sleep quality if not managed.

Anxiety is one of the predictors that affect the sleep quality of pregnant women. In our study, we found that the mean anxiety score was 9.52, and according to the HADS anxiety test, more than 6 points were considered anxiety. Many research studies have consistently found a link between anxiety levels and sleep quality during pregnancy. A study concluded that anxiety was associated with poor sleep quality, and the prevalence of anxiety was 17.41% and reached 21.04% by the end of the last trimester, and this increased because of fear of childbirth and discomfort from fetal movements.[33] However, understanding the relationship between anxiety and sleep quality is complex since both are influenced by psychological and physical changes during pregnancy. Pregnant women might experience anxiety for a variety of reasons, such as increased age, history of miscarriage and fear of childbirth, which are possible factors that are leading to poor sleep quality.[13,37] Furthermore, research has indicated that second pregnancy could make pregnant women anxious, by the influence of three key factors: low education level, low household income, and poor spousal relationship, consequently leading to a poorer sleep quality.[40]

This study found that participants with anemia during pregnancy reported poorer sleep quality. Anemia has been associated with sleep disruption. Research has found that sleep quality gets poorer in people with iron deficiency anemia. Anemia during pregnancy affects the general health of a mother and has potential implications for fetal well-being.[14] To our knowledge, no studies have found that anemia during pregnancy affects sleep quality. Our results could be attributed to various factors that influence our participants and could be associated with sleep quality.

At the community level, the study results advocate for integrating sleep quality evaluations into prenatal care by healthcare professionals. This would uncover the root causes of sleep disturbances, reducing the risk of sleep-related pregnancy complications. Additionally, it emphasizes the importance of educating expectant mothers about sleep hygiene and addressing modifiable factors that may improve sleep quality.

Strength and Limitations

One of the key strengths of this study is the use of the widely recognized and validated PSQI, which enhances the reliability of our findings and facilitates meaningful comparisons and further analysis in future sleep research. The advantage of our study is its relevance to the population in Jordan, making the findings applicable to similar demographics in the Middle East. However, our research has limitations, including a small sample size and reliance on self-reported data. Future research should involve larger sample sizes to enhance the understanding of sleep quality and the implication of objective sleep measurement techniques, such as sleep lab, which could provide more precise data. Additionally, conducting blood tests could help identify biomarkers associated with poor sleep quality among pregnant women. Finally, a limitation of this study is its cross-sectional design, which prevents the establishment of causality and limits the ability to observe changes in sleep quality over time.

Conclusion

This study spotlights the significant prevalence of poor sleep quality among pregnant women, especially in the second and third trimesters. Poor sleep quality is common among pregnant women in Jordan. Age, high school or lower level, leg cramps, anemia during pregnancy, and anxiety are common predictors of poor sleep quality among pregnant women.

Abbreviations

PSQI, Pittsburgh Sleep Quality Index; PPAQ, Pregnant Physical Activity Questionnaire; HADS, Hospital Anxiety and Depression Scale; MET, Metabolic Equivalent.

Data Sharing Statement

The data supporting this study's findings are available from the corresponding author, Saddam F. Kanaan, upon reasonable request.

Acknowledgments

We are grateful to all of the participants who provided their collaboration.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

This study was funded by a research grant (grant number: 661/2020) from Jordan University of Science and Technology. Qatar University funded the publication of this article.

Disclosure

The authors report no conflicts of interest in this work.

References

1. Nelson KL, Davis JE, Corbett CF. Sleep quality: an evolutionary concept analysis. *Nurs Forum*. 2022;57(1):144–151. doi:10.1111/nuf.12659
2. Buysse DJ. Sleep health: can we define it? Does it matter? *Sleep*. 2014;37(1):9–17. doi:10.5665/sleep.3298
3. Ohayon M, Wickwire EM, Hirshkowitz M, et al. National Sleep Foundation's sleep quality recommendations: first report. *Sleep Health*. 2017;3(1):6–19. doi:10.1016/j.sleh.2016.11.006
4. Baranwal N, Yu PK, Siegel NS. Sleep physiology, pathophysiology, and sleep hygiene. *Prog Cardiovasc Dis*. 2023;77:59–69. doi:10.1016/j.pcad.2023.02.005
5. Cannon SS, Lastella M, Evenson KR, Hayman MJ. The association between physical activity and sleep during pregnancy: a systematic review. *Behav Sleep Med*. 2023;21(4):513–528. doi:10.1080/15402002.2022.2124258
6. Anbesaw T, Abebe H, Kassaw C, Bete T, Molla A. Sleep quality and associated factors among pregnant women attending antenatal care at Jimma Medical Center, Jimma, Southwest Ethiopia, 2020: cross-sectional study. *BMC Psychiatry*. 2021;21(1):469. doi:10.1186/s12888-021-03483-w
7. Takelle GM, Muluneh NY, Biresaw MS. Sleep quality and associated factors among pregnant women attending antenatal care unit at Gondar, Ethiopia: a cross-sectional study. *BMJ Open*. 2022;12(9):e056564. doi:10.1136/bmjopen-2021-056564
8. Mei X, Du P, Li Y, et al. Fear of childbirth and sleep quality among pregnant women: a generalized additive model and moderated mediation analysis. *BMC Psychiatry*. 2023;23(1):931. doi:10.1186/s12888-023-05435-y
9. Kaneita Y, Ohida T, Takemura S, et al. Relation of smoking and drinking to sleep disturbance among Japanese pregnant women. *Prev Med*. 2005;41(5–6):877–882. doi:10.1016/j.ypmed.2005.08.009
10. Ohida T, Kaneita Y, Osaki Y, et al. Is passive smoking associated with sleep disturbance among pregnant women? *Sleep*. 2007;30(9):1155–1161. doi:10.1093/sleep/30.9.1155
11. Nowakowski S, Meers J, Heimbach E. Sleep and Women's Health. *Sleep Med Res*. 2013;4(1):1–22. doi:10.17241/smr.2013.4.1.1
12. Cai S, Tan S, Gluckman PD, et al. Sleep quality and nocturnal sleep duration in pregnancy and risk of gestational Diabetes mellitus. *Sleep*. 2017;40(2). doi:10.1093/sleep/zsw058
13. Gelaye B, Addae G, Neway B, et al. Poor sleep quality, antepartum depression and suicidal ideation among pregnant women. *J Affect Disord*. 2017;209:195–200. doi:10.1016/j.jad.2016.11.020
14. Sedov ID, Cameron EE, Madigan S, Tomfohr-Madsen LM. Sleep quality during pregnancy: a meta-analysis. *Sleep Med Rev*. 2018;38:168–176. doi:10.1016/j.smrv.2017.06.005
15. Christian LM, Carroll JE, Teti DM, Hall MH. Maternal sleep in pregnancy and postpartum part I: mental, physical, and interpersonal consequences. *Curr Psychiatry Rep*. 2019;21(3):20. doi:10.1007/s11920-019-0999-y
16. Pengo MF, Won CH, Bourjeily G. Sleep in women across the life span. *Chest*. 2018;154(1):196–206. doi:10.1016/j.chest.2018.04.005
17. Facco FL, Grobman WA, Reid KJ, et al. Objectively measured short sleep duration and later sleep midpoint in pregnancy are associated with a higher risk of gestational diabetes. *Am J Obstet Gynecol*. 2017;217(4):447e1–447e13. doi:10.1016/j.ajog.2017.05.066

18. Nevarez-Brewster M, Han D, Todd EL, Keim P, Doom JR, Davis EP. Sleep during pregnancy and offspring outcomes from infancy to childhood: a systematic review. *Biopsychosoc Sci Med*. 2025;87(1):7–32. doi:10.1097/psy.0000000000001352
19. Lu Q, Zhang X, Wang Y, et al. Sleep disturbances during pregnancy and adverse maternal and fetal outcomes: a systematic review and meta-analysis. *Sleep Med Rev*. 2021;58:101436. doi:10.1016/j.smrv.2021.101436
20. Faul F, Erdfelder E, Buchner A, Lang AG. Statistical power analyses using G*Power 3.1: tests for correlation and regression analyses. *Behav Res Methods*. 2009;41(4):1149–1160. doi:10.3758/BRM.41.4.1149
21. Zhang C, Zhang H, Zhao M, et al. Reliability, validity, and factor structure of Pittsburgh Sleep Quality Index in community-based centenarians. *Front Psychiatry*. 2020;11:573530. doi:10.3389/fpsyt.2020.573530
22. Suleiman KH, Yates BC, Berger AM, Pozehl B, Meza J. Translating the Pittsburgh sleep quality index into Arabic. *West J Nurs Res*. 2010;32 (2):250–268. doi:10.1177/0193945909348230
23. Chasan-Taber L, Schmidt MD, Roberts DE, Hosmer D, Markenson G, Freedson PS. Development and validation of a pregnancy physical activity questionnaire. *Med Sci Sports Exerc*. 2004;36(10):1750–1760. doi:10.1249/01.mss.0000142303.49306.0d
24. Younis AS, Alyousefi NA, Al-Habib DM, Al-Omran AT. The validation and cross-cultural adaptation of the Arabic version of the pregnancy physical activity questionnaire. *Saudi Med J*. 2021;42(5):499–508. doi:10.15537/smj.2021.42.5.20200826
25. Herrmann C. International experiences with the hospital anxiety and depression scale--a review of validation data and clinical results. *J Psychosom Res*. 1997;42(1):17–41. doi:10.1016/s0022-3999(96)00216-4
26. Jomeen J, Martin CR. Is the hospital anxiety and depression scale (Hads) a reliable screening tool in early pregnancy? *Psychol Health*. 2004;19 (6):787–800. doi:10.1080/0887044042000272895
27. Zigmond AS, Snaith RP. The Hospital Anxiety and Depression Scale. *Acta Psychiatr Scand*. 1983;67(6):361–370. doi:10.1111/j.1600-0447.1983.tb09716.x
28. Bahani M, Zhang Y, Guo Y, Haretebieke S, Wu D, Zhang L. Influencing factors of sleep quality in pregnant: a structural equation model approach. *BMC Psychol*. 2024;12(1):171. doi:10.1186/s40359-024-01657-1
29. Wu F, Sun L, Chen J, et al. Sleep quality during pregnancy and fetal growth: a prospective cohort study. *J Sleep Res*. 2025;34(1):e14233. doi:10.1111/jsr.14233
30. Venugopal L, Rajendran P, Parghavi V. A study on assessment of sleep quality in south Indian pregnant women. *Int J Res Med Sci*. 2018;6 (10):3197–3201. doi:10.18203/2320-6012.ijrms20183825
31. Alafif N. Worse or just different? Self-reported sleep characteristics of pregnant and non-pregnant women in the UK household longitudinal study. *Iproceedings*. 2018;4(1):e10561. doi:10.2196/10561
32. Huong NTT, Thuy NTH, Yen LTH. Quality of sleep among pregnant women. *Int J Clin Med*. 2019;10(01):1089797. doi:10.4236/ijcm.2019.101003
33. Jemere T, Getahun B, Tadele F, Kefale B, Walle G. Poor sleep quality and its associated factors among pregnant women in Northern Ethiopia, 2020: a cross sectional study. *PLoS One*. 2021;16(5):e0250985. doi:10.1371/journal.pone.0250985
34. Yang Y, Mao J, Ye Z, et al. Determinants of sleep quality among pregnant women in China: a cross-sectional survey. *J Matern Fetal Neonatal Med*. 2018;31(22):2980–2985. doi:10.1080/14767058.2017.1359831
35. Yıldız Ç, Nemmezi Karaca S, Kurt B. Evaluation of sleep quality and related factors in pregnant women. *Cumhur Med J*. 2022;44(3):296–303. doi:10.7197/cmj.1176709
36. Li J, Vitiello MV, Gooneratne NS. Sleep in normal aging. *Sleep Med Clin*. 2018;13(1):1–11. doi:10.1016/j.jsmc.2017.09.001
37. Cai Y, Shen Z, Zhou B, et al. Psychological status during the second pregnancy and its influencing factors. *Patient Prefer Adher*. 2022;16:2355–2363. doi:10.2147/PPA.S374628
38. Okun ML, Tolge M, Hall M. Low socioeconomic status negatively affects sleep in pregnant women. *J Obstet Gynecol Neonatal Nurs*. 2014;43 (2):160–167. doi:10.1111/1552-6909.12295
39. Mansouri A, Bahrami-Vazir E, Mohammad-Alizadeh-Charandabi S, Ghelichkhani F, Mirghafourvand M. The relationship between leg muscle cramps and sleep quality in pregnant women visited the health centers in Tabriz. *Research Article Shiraz E-Med J*. 2019;20(7):e84279. doi:10.5812/semj.84279
40. Tran DB, Pham TDN, Nguyen TT. The influence of education on women's well-being: evidence from Australia. *PLoS One*. 2021;16(3):e0247765. doi:10.1371/journal.pone.0247765