Quality of Sleep and Mental Health Among Pregnant Women: A Cross-sectional Study

Mojgan Firouzbakht [1], Shabnam Omidvar [2, *], Hajar Adib-rad [2], Mahbobeh Faramarzi [2] and Nooshin Fateri [3]

[1]Department of Nursing-Midwifery, Babol Branch, Islamic Azad University, Babol, Iran
[2]Infertility and Health Reproductive Research Center, Health Research Institute, Babol University of Medical Sciences, Babol, Iran
[3]Clinical Research Development Unit, Ayatollah Rouhani Hospital, Health Research Institute, Babol University of Medical Sciences, Babol, Iran

Corresponding author: Infertility and Health Reproductive Research Center, Health Research Institute, Babol University of Medical Sciences, Babol, Iran. Email: shomidvar@yahoo.com

Abstract

Background: Sleep disorders are common during pregnancy and can lead to other problems before, during, and after delivery.
Objectives: The study was conducted to compare anxiety and depression among pregnant women with and without sleep disorders
Methods: This cross-sectional study was performed on pregnant women referring to the health care centers in Babol, Iran (2018 - 2019). Women with singleton pregnancies, who met the study criteria, were chosen from selected health centers and entered the study through the convenience sampling method. Data were collected using Questionnaires. The participants answered four questionnaires, including Demographic, Pittsburg sleep quality index (PSQI), Beck Depression Inventory (BDI), and The State-Trait Anxiety Inventory (STAI) questionnaires. The data were analyzed using SPSS statistical software version 22, and $P < 0.05$ was considered statistically significant.
Results: The average ages of participants were 26.40 ± 4.76 years. The present study showed a statistically significant correlation between the score of depression and sleep quality ($r = 0.11$, $P = 0.008$). In women with poor quality of sleep, the mean of trait anxiety was significantly higher than in women with good quality of sleep ($P = 0.016$). There was a significant association between depression scores and sleep quality subscales. Logistic regression demonstrated that people with high anxiety levels were 2.3 times more likely to have sleep problems than those with low anxiety levels.
Conclusions: Sleep quality is correlated with anxiety and depression. Health professionals should be aware that women with poor sleep quality may develop mental health problems. Therefore, screening for mental health and referring them to a clinical psychologist may help their sleep quality. To investigate the causal relationship between the study variables, it is necessary to conduct an extensive cohort study that starts before the pregnancy.

Keywords: Anxiety, Depression, Mental Health, Pregnancy, Sleep Disorders

1. Background

The well-being and advancement of a community are highly dependent on women, and pregnancy and delivery have a noticeable effect on their health. Hence, maternal and newborn health is one of the priorities of health services. During pregnancy, many biological, chemical, physiological, and anatomical changes happen in women (1). Sleep is an essential and crucial behavior affected by physiological and pathological changes during pregnancy. The quality and quantity of this behavior are changed due to respiratory problems (because of fetus growth and its effects on the diaphragm), nocturia, back pain, and leg cramps. Some physical and emotional factors can disrupt the sleep pattern and cause sleep disorders. Hormonal changes, such as estrogen and progesterone increase and elevated plasma cortisol levels, also lead to sleep pattern changes (2). On the other hand, researchers have reported that sleep disorders have a significant relationship with diseases such as hypertension, cardiovascular diseases, diabetes, and depression (3).

Approximately 30% of people suffer from sleep disorders. It is reported that almost 49% of women suffer from sleep disorders during pregnancy (4). The findings of different researches differ in this regard. One study showed that 75.2% of women in the third trimester, 63% in the second trimester, and 48% in the first trimester suffer from sleep disorders during pregnancy (5). There is also evidence that pregnancy-related complications, such as ges-

tational diabetes (6), pregnancy-induced hypertension (7), fetus growth retardation (8), preterm labor, and stillbirth (9), are related to sleep disorders. Sleep deprivation leads to deleterious neurodevelopment consequences for the newborn and endangers its viability (10). Recently, it has been demonstrated that sleep deprivation is associated with higher diastolic blood pressure and higher BMI in the offspring (11). Researchers have also reported that mood and sleep are interconnected. Moreover, it is observed that women with post-partum depression are more commonly affected by sleep disorders (12). The prevalence of anxiety during pregnancy varies from 2.6 to 39% (13, 14). Antenatal anxiety is prevalent in pregnancy; approximately 23% of pregnant women experience anxiety symptoms during pregnancy. It is noteworthy that antenatal anxiety is approximately 2 - 3 times more prevalent than antenatal depression (15). Anxiety during pregnancy is a risk factor for post-partum depression in the mother and behavioral and emotional changes in the offspring (16). Considering the influence of sleep on health, particularly during pregnancy, on both the offspring and the mother, it is imperative to identify related contributing factors and address them. Thus, detecting and monitoring these factors in this period is important.

2. Objectives

This study aimed to investigate the correlation between sleep quality and mental health among pregnant women.

3. Methods

Study design and setting: This cross-sectional study was conducted in a multi-stage manner from 2018 to 2019 in Babol/ Iran. First, the healthcare centers were randomly selected through coin toss from a list provided by the authorities; then, the participants entered the study by convenience sampling method.

Study participants and sampling: All pregnant women presenting to the healthcare centers who volunteered to participate through signing a written consent form were included in the study.

Inclusion criteria were as follows: basic reading and writing literacy, singleton pregnancy, intentional pregnancy, and filling out and signing the consent form. Pregnant women without any history of infertility, pregnancy complications (asthma, thyroid and kidney disorders, diabetes, preeclampsia, fetus-growth retardations, rupture of the membranes, etc.), accidents during the past year, drugs and alcohol addiction, shift-work jobs, history of

psychological disorders, soporific drug use history, antihistamine intake, and excessive consumption of tea, coffee, and herbal medicines. Exclusion criteria were incomplete questionnaires and refusal to participate. The sample size was calculated according to the equation $n = \frac{z_{1-\frac{\alpha}{2}}^2 \times p(1-p)}{d^2}$ with a confidence level of 95% and an error of 0.05. In one study, the frequency of poor sleep quality was estimated to be approximately 40% (17). Thus, by considering 10% missing, the sample size was determined to be 620.

3.1. Data Collection Tools and Techniques

The participants completed four questionnaires, namely demographic, Beck Depression Inventory (BDI), The State-Trait Anxiety Inventory (STAI), and Pittsburgh sleep questionnaire index (PSQI). The participating pregnant women were divided into two groups according to their PSQI score.

PSQI was developed by Buysse et al. (18) to evaluate sleep quality in adults. This instrument consists of 18 questions, and differentiates good and poor sleep by evaluating 7 sleep components during the past month. This instrument is a self-reporting questionnaire and includes multiple domains (subjective sleep quality, latency, duration, habitual sleep efficiency, disturbances, sleep medication consumption, and Hypersomnia). Most of the questions are in a multiple-choice form, and the scores range from 0 to 3. The total score ranges from 0 to 21. A score of 5 or higher denotes a significant sleep disorder. This questionnaire has been psychometrically tested in Iran (19).

BDI includes 21 multiple-choice questions (with four choices each), and similar to PSQI, the scores range from 0 to 3. A score of 9 and below is considered not depressed, 10 - 12 at risk, and 12 and above are considered depressed. The Persian version of this questionnaire has high internal consistency according to Alpha-Cronbach of 87%, and its reliability has been reported to be 73% (20).

The revised form of STAI includes 40 questions. Items 1 - 20 measure state anxiety (overt) with four options (never, sometimes, usually, and very much), and items 21 - 40 for the trait anxiety with four options (Rarely; sometimes; often; almost always) (21). Panahi Shahri used the test-retest method to calculate Alpha-Cronbach for trait anxiety (92%) and state anxiety (90%) (22).

3.2. Data Analysis

The statistical analysis was performed using SPSS version 22.0 (SPSS Inc., Chicago, IL). Assessment of data normality was performed by the Kolmogorov-Smirnov test. The descriptive statistics were presented as the mean (SD) for quantitative data and the frequency and percentage for

categorical data. The data were analyzed using *t*-test, chi-square, and logistic regression. P < 0.05 was considered statistically significant.

4. Results

The respondents were 600 individuals comprised of 240 (40%) pregnant women with good quality of sleep and 360 (60%) with poor quality of sleep. The average ages of participants in the group with good quality of sleep and those with poor quality of sleep were 26.45 ± 4.32 and 26.36 ± 5.2 years, respectively. Most of the participants were housewives (90.2% and 88.9%) with higher education (97.7% and 98.7%), and most of the spouses had higher education (88.3% and 87.5%), as well. Demographic status (including age, education, employment, and spouse education) displayed no considerable differences between the two groups. The group with good sleep quality had a higher body mass index (BMI) before pregnancy. The number of pregnancies showed a considerable relationship with sleep quality, such that sleep disorder was more prevalent among women with a higher number of pregnancies (Table 1). Gestational age also displayed a significant relationship with sleep quality (Table 2).

The present study demonstrated a significant relationship between depression score and sleep quality (r = 0.11, P = 0.008). The average subscale of trait anxiety for women with poor sleep quality was significantly higher than in women with poor sleep quality (Table 3). The results showed a significant correlation between depression scores and sleep subscales. Pearson test, proved that sleep latency (r = 0.33, P < 0.001), disturbances (r = 0.35, P < 0.001) and Hypersomnia (r = 0.24, P < 0.001) display remarkable relationship with depression score. In addition to those, sleep duration (r = 0.15, P < 0.001) and sleep efficiency (r = -0.15, P < 0.001), proved to have an inverse correlation with depression score.

The probability of poor sleep quality was higher in women in their 3rd trimester, overweight women, and those with high anxiety, as demonstrated by the logistic regression analysis results (Table 4).

5. Discussion

The current study investigated the correlation between sleep quality and mental health (anxiety and depression) among women. The results demonstrated significant differences between the depression scores of women with good quality of sleep and that of women with poor quality of sleep. In addition, trait anxiety scores were significantly different in the women with good quality of sleep

Table 1. Comparison of Demographic Characteristics of Pregnant Women According to Their Sleep Quality [a]

Variables	Good Quality of Sleep (N = 360)	Poor Quality of Sleep (N = 240)	P-Value
Age			0.98
$\leq$ 30	287 (79.9)	192 (80)	
< 30	72 (20.1)	48 (20)	
Education			0.36
$\leq$ Diploma	4 (1.3)	5 (2.3)	
> Diploma	311 (98.7)	213 (97.7)	
Employment			0.60
Yes	37 (11.1)	23 (9.8)	
No	295 (88.9)	212 (90.2)	
Spouse education			0.78
$\leq$ Diploma	37 (12.5)	25 (11.7)	
> Diploma	258 (77.5)	188 (88.3)	
Gravid			0.002**
1	239 (64.2)	133 (35.8)	
$\geq$ 2	112 (35.8)	107 (48.9)	
Pre-pregnancy BMI			0.028*
Under-weight/normal	163 (50.9)	83 (41.1)	
Over-weight/obese	157 (49.1)	119 (58.9)	

[a] Chi-square test, ** P < 0.05, * P < 0.001

compared to those with poor quality of sleep. Results showed that depression was more prevalent among pregnant women with poor sleep quality.

Rad et al. reported that the risk of depression among women with sleep disorders was twice higher. They also observed significant relationships between delayed sleep phase disorder, early awakening, continuous sleep problems, disruption of daily activities, and depression (23). Asltoghiria concluded that 11.4% of pregnant women without sleep disorders and 56.2% of pregnant women with sleep disorders suffered from depression, and the risk of depression was increased 9-fold among them (24). Field et al. (25) also found that "sleep disorders had a significant relationship with depression during pregnancy; however, contrary to other studies, Kamysheva et al. did not find any relationship between sleep disorders and depression (26). This indicates that the relationship between sleep quality and depression might be complicated beyond the information presented in the literature. Santiago et al. found that the durations of REM and NREM phases of sleep decrease in the last 24 hours of gestation before delivery. This

Table 2. Comparison of Sleep Quality in Pregnant Women According to the Gestational Age

Variables	Good Quality of Sleep (N = 360)	Poor Quality of Sleep (N = 240)	χ^2	df	P-Value
Gestational age			15.725	2	< 0.001 [a]
1st trimester	68 (18.8)	28 (11.7)			
2nd trimester	168 (46.8)	92 (38.3)			
3rd trimester	124 (34.3)	120 (50)			

[a] P < 0.001

Table 3. Comparison of Depression and Anxiety in Pregnant Women According to the Sleep Quality [a]

Variables	Good Quality of Sleep (N = 360)	Poor Quality of Sleep (N = 240)	t	P-Value
Depression	2.25 ± 3.41	4.72 ± 4.93	7.149	< 0.001 [b]
Trait-anxiety	39.44 ± 9.63	41.68 ± 12.68	-2.420	0.016 [c]
State-anxiety	42.29 ± 11.24	42.03 ± 10.49	0.285	0.776

[a] Values are expressed as mean ± SD.
[b] P < 0.001
[c] P < 0.05

Table 4. Crude OR (CI 95%) Association Between Quality of Sleep and GA, BMI, and Severity of Anxiety

Variables	B	OR (CI 95%)	P-Value
Gestational age			
1th trimester	-0.678	0.50 (0.227 - 10.136)	0.069
2nd trimester	-0.715	0.489 (0.281 - 0.852)	0.012
3rd trimester	Ref.		0.030
BMI			0.0240
Underweight/normal	-0.630	0.502 (0.297 - 0.920)	
Overweight/obese	Ref.		
Severity of anxiety			
Low	00.847	(10.27 - 40.26) 20.33	00.006
Moderate	00.113	(10.70 - 0.735) 10.120	00.598
Severe	Ref.		00.012

was accompanied by an increase in estrogen and progesterone during this period. This shows that these two hormones influence sleep during pregnancy. The combined effects of these hormones are dependent on their concentrations in blood. In addition, cortisol levels were lower in the patients with depression compared to the control group. Considering the two mentioned reports, a potential role for the pituitary gland in the development of depression may be proposed (27). It might be suggested that sleep quality is related to circadian rhythm, sleep disorders, and melatonin levels, all demonstrated to be involved in mood disorders (28).

Similar to other studies, the current study showed that depression significantly correlated with sleep quality sub-scales in women with sleep disorders. Many studies have investigated the relationship between sleep disorders and depression in both genders (29). Since postpartum depression and insomnia have a significant relationship, this might indicate a relationship between sleep disorders and depression during pregnancy (30).

The present study demonstrated a significant correlation between anxiety and sleep quality. This finding was similar to the research by Afsah and Astuti, which revealed that anxiety was significantly correlated with sleep quality. They conducted a multivariate analysis on pregnant women. They showed that women with severe anxiety are 15 times more susceptible to poor sleep quality (31). Another study reported a strong relationship between average sleep score and anxiety level, and the relationship between average sleep score and depression was reported as weakly associated. (2). It can be inferred from the existing literature that sleep quality, depression, and anxiety are correlated during pregnancy. However, many complicated and obscure aspects exist regarding the correlation among these factors.

The present study demonstrated that sleep quality deteriorates with increasing gestational age. This is consistent with the results reported by Shojaie et al. (32), Facco et al. (33), and a recent systematic review by Salari et al. (34), which demonstrated that women had sleep disorders and suffered from poor sleep quality in the final months of their pregnancy. This study showed that sleep quality and gestational age are significantly correlated. The results also showed that poor sleep quality is more prevalent among pregnant women during the third trimester. Polo-Kantola et al. (35) noted that women had increased delayed

sleep phase disorder since the 20th week. Nonetheless, a study by Taskiran found no relationship between sleep quality and advanced gestational age (36).

In the present study, we have found a correlation between pre-pregnancy BMI and sleep quality. A study in Saudi Arabia reported a similar result, which indicated that people with higher BMI had poor sleep quality (37). Even though obesity is a multi-factorial condition caused by complicated genetic interactions and environmental factors (physical activity, nutrition, caffeine intake, etc.), these factors can per se affect sleep quality (38).

These findings suggest that the screening for sleep disorders and prenatal mental disorders should include not only antenatal depression but also anxiety and other mental problems if possible. This can lead to better prenatal sleep disorder management.

5.1. Limitation and Recommendation

It appears that the relationship between sleep quality and anxiety and depression is too complicated for a cross-sectional study with no follow-up cases to be conclusive. The cross-sectional design without any follow-ups can be considered a limitation of this study. To determine a causal relationship between the variables of this study, we recommend that a comprehensive cohort study commencing from the pre-pregnancy stage is designed and conducted.

5.2. Conclusions

Women with poor sleep quality may have mental health problems. Therefore, screening for mental health by health professionals and referring them to a clinical psychologist can improve their sleep quality. To investigate the causal relationship between the study variables, it is necessary to conduct an extensive cohort study that starts before the pregnancy.

Acknowledgments

Footnotes

References

1. Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS. *Williams obstetrics, 24e*. Mcgraw-hill New York, NY, USA; 2014.
2. Yucel SC, Yucel U, Gulhan I, Ozeren M. Sleep quality and related factors in pregnant women. *J Med Sci*. 2012;**3**(7):459–63.
3. Hoerster KD, Campbell S, Dolan M, Stappenbeck CA, Yard S, Simpson T, et al. PTSD is associated with poor health behavior and greater Body Mass Index through depression, increasing cardiovascular disease and diabetes risk among U.S. veterans. *Prev Med Rep*. 2019;**15**:100930. doi: 10.1016/j.pmedr.2019.100930. [PubMed: 31338278]. [PubMed Central: PMC6627033].
4. Da Costa D, Dritsa M, Verreault N, Balaa C, Kudzman J, Khalife S. Sleep problems and depressed mood negatively impact health-related quality of life during pregnancy. *Arch Womens Ment Health*. 2010;**13**(3):249–57. doi: 10.1007/s00737-009-0104-3. [PubMed: 19728037].
5. Shariat M, Abedinia N, Noorbala AA, Raznahan M. The relationship between sleep quality, depression, and anxiety in pregnant women: a cohort study. *J Sleep Sci*. 2017;**2**(1-2):20–7.
6. Reutrakul S, Zaidi N, Wroblewski K, Kay HH, Ismail M, Ehrmann DA, et al. Interactions between pregnancy, obstructive sleep apnea, and gestational diabetes mellitus. *J Clin Endocrinol Metab*. 2013;**98**(10):4195–202. doi: 10.1210/jc.2013-2348. [PubMed: 23966237]. [PubMed Central: PMC3790617].
7. Facco FL, Liu CS, Cabello AA, Kick A, Grobman WA, Zee PC. Sleep-disordered breathing: a risk factor for adverse pregnancy outcomes? *Am J Perinatol*. 2012;**29**(4):277–82. doi: 10.1055/s-0031-1295658. [PubMed: 22105436].
8. Odibo AO, Rada CC, Cahill AG, Goetzinger KR, Tuuli MG, Odibo L, et al. First-trimester serum soluble fms-like tyrosine kinase-1, free vascular endothelial growth factor, placental growth factor and uterine artery Doppler in preeclampsia. *J Perinatol*. 2013;**33**(9):670–4. doi: 10.1038/jp.2013.33. [PubMed: 23558430].
9. Micheli K, Komninos I, Bagkeris E, Roumeliotaki T, Koutis A, Kogevinas M, et al. Sleep patterns in late pregnancy and risk of preterm birth and fetal growth restriction. *Epidemiology*. 2011;**22**(5):738–44. doi: 10.1097/EDE.0b013e31822546fd. [PubMed: 21734587].
10. Pires GN, Benedetto L, Cortese R, Gozal D, Gulia KK, Kumar VM, et al. Effects of sleep modulation during pregnancy in the mother and offspring: Evidences from preclinical research. *J Sleep Res*. 2021;**30**(3). e13135. doi: 10.1111/jsr.13135. [PubMed: 32618040].
11. Harskamp-van Ginkel MW, Ierodiakonou D, Margetaki K, Vafeiadi M, Karachaliou M, Kogevinas M, et al. Gestational sleep deprivation is associated with higher offspring body mass index and blood pressure.

Sleep. 2020;**43**(12). doi: 10.1093/sleep/zsaa110. [PubMed: 32496519]. [PubMed Central: PMC7734474].

12. Qiu C, Enquobahrie D, Frederick IO, Abetew D, Williams MA. Glucose intolerance and gestational diabetes risk in relation to sleep duration and snoring during pregnancy: a pilot study. *BMC Womens Health*. 2010;**10**:17. doi: 10.1186/1472-6874-10-17. [PubMed: 20470416]. [PubMed Central: PMC2885310].

13. Leach LS, Poyser C, Fairweather-schmidt K. Maternal perinatal anxiety: A review of prevalence and correlates. *Clin Psychol*. 2020;**21**(1):4–19. doi: 10.1111/cp.12058.

14. Goodman JH, Chenausky KL, Freeman MP. Anxiety disorders during pregnancy: a systematic review. *J Clin Psychiatry*. 2014;**75**(10):e1153–84. doi: 10.4088/JCP.14r09035. [PubMed: 25373126].

15. Bayrampour H, McDonald S, Tough S. Risk factors of transient and persistent anxiety during pregnancy. *Midwifery*. 2015;**31**(6):582–9. doi: 10.1016/j.midw.2015.02.009. [PubMed: 25823754].

16. Biaggi A, Conroy S, Pawlby S, Pariante CM. Identifying the women at risk of antenatal anxiety and depression: A systematic review. *J Affect Disord*. 2016;**191**:62–77. doi: 10.1016/j.jad.2015.11.014. [PubMed: 26650969]. [PubMed Central: PMC4879174].

17. Sedov ID, Cameron EE, Madigan S, Tomfohr-Madsen LM. Sleep quality during pregnancy: A meta-analysis. *Sleep Med Rev*. 2018;**38**:168–76. doi: 10.1016/j.smrv.2017.06.005. [PubMed: 28866020].

18. Buysse DJ, Reynolds C3, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res*. 1989;**28**(2):193–213. doi: 10.1016/0165-1781(89)90047-4. [PubMed: 2748771].

19. Ranjkesh F, Nasiri M, Sharif Nia SH, Goudarzian AH. Validation of the Persian version of the sleep condition indicator in pregnant women. *Iran J Epidemiol*. 2019;**14**(4):366–74.

20. Ghassemzadeh H, Mojtabai R, Karamghadiri N, Ebrahimkhani N. Psychometric properties of a Persian-language version of the Beck Depression Inventory–Second edition: BDI-II-PERSIAN. *Depress Anxiety*. 2005;**21**(4):185–92. doi: 10.1002/da.20070. [PubMed: 16075452].

21. Malmir T, Jafari H, Ramezanalzadeh Z, Heydari J. Determining the Effectiveness of Acceptance and Commitment Therapy (ACT) on Life Expectancy and Anxiety Among Bereaved Patients. *Mater Sociomed*. 2017;**29**(4):242–6. doi: 10.5455/msm.2017.29.242-246. [PubMed: 29284992]. [PubMed Central: PMC5723182].

22. Panahi Shahri M. *Spielberger State-Trait test standardization among students in Isfahan*. Tehran, Iran: Tarbiat-Modares University; 1994.

23. Rad P, Amir Ali Akbari S, Sadeghniiat KH, Alavi Majd H. [Relationship between sleep disorder and pregnancy depression in primigravidae referring to health–treatment centers of Ahvaz Jundishapur University of Medical Sciences in 2010]. *SSU J*. 2011;**19**(4):454–62. Persian.

24. Asltoghiria M. Study of the Relation between Sleep Disorder and Depression at Late Stage of Pregnancy. *J Sleep Disord Ther*. 2012;**1**(4):2167–277. doi: 10.4172/2167-0277.1000103.

25. Field T, Hernandez-Reif M, Diego M. Newborns of depressed mothers who received moderate versus light pressure massage during pregnancy. *Infant Behav Dev*. 2006;**29**(1):54–8. doi: 10.1016/j.infbeh.2005.07.004. [PubMed: 17138261].

26. Kamysheva E, Skouteris H, Wertheim EH, Paxton SJ, Milgrom J. A prospective investigation of the relationships among sleep quality, physical symptoms, and depressive symptoms during pregnancy. *J Affect Disord*. 2010;**123**(1-3):317–20. doi: 10.1016/j.jad.2009.09.015. [PubMed:19822370].

27. Santiago JR, Nolledo MS, Kinzler W, Santiago TV. Sleep and sleep disorders in pregnancy. *Ann Intern Med*. 2001;**134**(5):396–408. doi: 10.7326/0003-4819-134-5-200103060-00012. [PubMed: 11242500].

28. Ko SH, Chang SC, Chen CH. A comparative study of sleep quality between pregnant and nonpregnant Taiwanese women. *J Nurs Scholarsh*. 2010;**42**(1):23–30. doi: 10.1111/j.1547-5069.2009.01326.x. [PubMed: 20487183].

29. Gelaye B, Barrios YV, Zhong QY, Rondon MB, Borba CP, Sanchez SE, et al. Association of poor subjective sleep quality with suicidal ideation among pregnant Peruvian women. *Gen Hosp Psychiatry*. 2015;**37**(5):441–7. doi: 10.1016/j.genhosppsych.2015.04.014. [PubMed: 25983188]. [PubMed Central: PMC4558240].

30. Dorheim SK, Bjorvatn B, Eberhard-Gran M. Can insomnia in pregnancy predict postpartum depression? A longitudinal, population-based study. *PLoS One*. 2014;**9**(4). e94674. doi: 10.1371/journal.pone.0094674. [PubMed: 24732691]. [PubMed Central: PMC3986207].

31. Afsah Y, Astuti Y. The Factors Influencing Sleep Quality of Pregnant Women in Yogyakarta, Indonesia. *Third International Conference on Sustainable Innovation 2019-Health Science and Nursing (IcoSIHSN 2019)*. Atlantis Press; 2019.

32. Shojaie S, Askarizadeh G, Mousavi NSH. The effectiveness of relaxation training on general health and sleep quality of pregnant women in the last trimester of pregnancy. *J Shahid Sadoughi Univ Med Sci Health Ser*. 2017;**24**(11):887–98.

33. Facco FL, Grobman WA, Kramer J, Ho KH, Zee PC. Self-reported short sleep duration and frequent snoring in pregnancy: impact on glucose metabolism. *Am J Obstet Gynecol*. 2010;**203**(2):142 e1–5. doi: 10.1016/j.ajog.2010.03.041. [PubMed: 20510182]. [PubMed Central: PMC3178265].

34. Salari N, Darvishi N, Khaledi-Paveh B, Vaisi-Raygani A, Jalali R, Daneshkhah A, et al. A systematic review and meta-analysis of prevalence of insomnia in the third trimester of pregnancy. *BMC Pregnancy Childbirth*. 2021;**21**(1):1–8. doi: 10.1186/s12884-021-03755-z. [PubMed: 33836686]. [PubMed Central: PMC8034118].

35. Polo-Kantola P, Aukia L, Karlsson H, Karlsson L, Paavonen EJ. Sleep quality during pregnancy: associations with depressive and anxiety symptoms. *Acta Obstet Gynecol Scand*. 2017;**96**(2):198–206. doi: 10.1111/aogs.13056. [PubMed: 27861713].

36. Taskiran N. Pregnancy and sleep quality. *J Turk Soc Obstetr Gynecol*. 2011;**8**(3):181–7.

37. Mirghaforvand M, Mohammad-Alizadeh-Charandabi S, Zarei S, Effati-Daryani F, Sarand FS. The relationship between depression and sleep quality in Iranian pregnant women. *Int J Women Health Rreprod Sci*. 2017;**5**(2):147–52. doi: 10.1111/ijn.12518. [PubMed: 28120358].

38. Chaput JP, Perusse L, Despres JP, Tremblay A, Bouchard C. Findings from the Quebec Family Study on the Etiology of Obesity: Genetics and Environmental Highlights. *Curr Obes Rep*. 2014;**3**:54–66. doi: 10.1007/s13679-013-0086-3. [PubMed: 24533236]. [PubMed Central: PMC3920031].