Original Research

The Relationship between Sleep Quality, Depression, and Anxiety in Pregnant Women: A Cohort Study

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Abstract

Background and Objective: Sleep disturbances are common in women, especially during pregnancy. This can result in emotional and psychological consequences in pregnant women. The aim of this study was to assess the prevalence and identify the relationship between sleep quality, anxiety, and depression during pregnancy.

Materials and Methods: This cohort study included 283 pregnant women. Participants completed Beck Depression Inventory, State-Trait Anxiety Inventory, and Pittsburgh Sleep Quality Index at first, second, and third gestational trimesters. Data were analyzed by descriptive statistics and Cramer's V correlation technique.

Results: The findings indicated that nearly 30% of participants suffered from depression. Mild depression reported from the first, second, and third trimesters was 18%, 11%, and 4.9%, respectively, while severe depression frequency was found to be 4.9% in the third trimester. Moreover, the highest proportion of mild anxiety was 28.3% in the first trimester, and moderate and severe anxiety had a prevalence of 4.9 and 14.1% in the third trimester, respectively. In the third trimester, sleep quality was lower and the prevalence of sleep problems was 75.26%. The findings also showed that there is a significant association between sleep problems and depression and anxiety ($P < 0.0500$).

Conclusion: Psychological problems such as anxiety and depression were prevalent among the studied population of pregnant women. Thus, psychological counseling before pregnancy or early pregnancy in this population may provide safer pregnancy, convenient delivery, and healthier newborns.

Keywords: Anxiety; Depression; Pregnancy trimesters; Sleep hygiene

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Introduction

Sleep is a systematic and organized behavior that is routinely repeated on the basis of a biological rhythm. Sleep significantly contributes to the revitalization of mental and physiological power and is required for accepting new tasks and roles (1). Sleep problems consist of one or more of the problems such as insomnia, frequent waking in the night, and increasing sleepiness during the day, complaining moods, and feeling unusual during sleep (2). About two-third of pregnant women complain of abnormal sleep patterns. Sleep disorders during pregnancy usually increase with every trimester. Furthermore, total sleep time and night sleep increase during the first trimester (3, 4). Pregnant women suffer from sleep onset problems, frequent awakenings, reduced hours of night sleep, and decreased sleep efficiency, which starts as early as week 12 of pregnancy to 2 months postpartum (5). The results of a research indicated

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that 25% of pregnant women had a significant sleep disorder in the first gestational trimester, and it increases up to 15% in the third trimester, meanwhile sleep duration during pregnancy decreases progressively (6). Guendelman et al. also reported that 26% of healthy nulliparous women who were interviewed between 6 and 20 weeks of pregnancy had a night sleep < 7 hour (7).

Several emotional factors can disrupt sleep patterns. These factors along with physical and hormonal changes in pregnancy can increase anxiety and lead to impaired sleep as well (8). Depression is one of the most important emotional changes in pregnant women. The latest research has indicated that depression is observed more frequently during pregnancy than the postpartum period (9). Symptoms of depression may be considered normal in pregnant women. Furthermore, changes such as tiredness, sleep disturbances, and loss of appetite are not recognized as symptoms of depression (10). Depression during pregnancy affects the ability of self-care, the quality of diet and sleep, and ignorance of medical advice. Fifty percent of depressed pregnant women experience the same problem after pregnancy. On the other hand, mother's depression, stress, and anxiety significantly influence the development of the fetus (11). Sleep disorder would cause mood changes and excitement; sleep pattern could be a predictor of depression (12, 13). Skouteris et al. investigated sleep quality and depression on 273 pregnant women and showed that at three trimesters with an interval of 8 weeks, there is a strong correlation between the scores obtained from Beck Depression Inventory (BDI) and Pittsburgh Sleep Quality Index (PSQI) (14).

In terms of the severity, the severity of depression symptoms in the third stage was greatly higher than two other stages. In terms of sleep quality, it deteriorates linearly with every trimester (the worst in the third, and least worse in the first trimester). Martin's research confirmed this association, but other studies did not find any association between sleep disorders and depression (14-16).

Mothers' health can significantly influence the health, growth, and development of her fetus. Prenatal care services are designed to enable pregnant women to undergo pregnancy with the minimum possible complications. Thus, regarding the necessity of examination of quantity and quality of sleep, as well as anxiety and depression in pregnancy, it is important to identify and follow-up the problems in this period. The aim of this study was to assess the prevalence and identify the relationship between sleep quality, anxiety, and depression during pregnancy.

Materials and Methods

The current cohort study was performed on 283 pregnant women using a convenient sampling method in Milad and Vali Asr Hospitals in Tehran City, Iran, during 2014-2015. All healthy pregnant women who were content (in written form) to cooperate and provide supplementary data for the research were included. Data collection tools included demographic characteristics' questionnaire, BDI, Spielberger State and State-Trait Anxiety Inventory (STAI), and PSQI. Pregnant women completed research tools at the three gestational trimesters including first (8-12 weeks), second (16-20 weeks), and third (30-36 weeks). Notably, completion of the questionnaires was carried out at the time of prenatal care services in a room in Women Clinic in Milad and Vali Asr Hospitals, Tehran. BDI consists of 21 items, and it is designed to measure feedback and symptoms of depressed patients. The content of this inventory mainly revolves around the symptoms of depression but focuses more on the cognitive content. It is a self-assessment test requiring 5-10 minutes time to completion. The tool comprises of a total of 21 relevant items with different symptoms, and the participant should respond to them on a four-point scale from 0 to 3. The subject matter of these items includes sadness, pessimism, sense of failure, guilt, sleep disturbances, loss of appetite, and self-loathing. The spectrum of depression from mild to very severe depression is determined and the relevant scores range from 0 to 63. A review study on research using this tool by Beck et al. showed that reliability coefficient ranges from 0.48 to 0.68 depending on the distance between the frequency of implementation and study setting. Beck et al. once again in 1996 obtained test–retest reliability coefficient (0.93) within 1 week. Various researches have been conducted on the validity of BDI. The mean correlation of the BDI with the scales including Hamilton psychiatric rating scale (HRSD), Zung self-rating depression scale, MMPI depression scale, multiple emotional traits of depression, and SCL-90 is more than 0.60. The psychometric properties of BDI have also been studied in Iran. One study obtained BDI's reliability coefficient to

be 0.78 (17). In other research, such as Partovi, Vahab Zadeh, and Chegini, the BDI's reliability was 70-90 percent (18).

Spielberger State and STAI is composed of 40 multiple-choice items, item 1-20 comprised of state anxiety (never, sometimes, often, generally, and a lot), and items 21 to 40 concerned with trait anxiety (almost never, sometimes, often, and almost always). A high correlation has been reported between trait anxiety scale and other tests that measure anxiety. The correlation between this scale and Tylor trait anxiety scale varies from 0.79 to 0.83, and the correlation between trait anxiety and emotion's trait list is reported to be 52-58 percent. This inventory has a high internal consistency. The mean of alpha coefficients in various meetings in the state mode was 0.92 and in the trait mode was 0.90. The reliability coefficient of the items that make up Spielberger STAI for the state anxiety (items 1-20) is 0.889 and for the trait anxiety (items 21-40) is 0.864. Given the high and positive correlation, none of the test items have been removed (19). PSQI assesses sleep quality during the preceding month and contains 18 statements differentiating well from poor sleep quality (0.36). Each of the 7-item scales (Cronbach's alpha) had validity and internal consistency of about 36 and 83%, respectively. Seven scales that comprise the inventory include subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleep medications, and daytime dysfunction. All seven scales of the questionnaire have 0-3 scores. The questionnaire's total scale is 0-21 (20).

Data analysis was performed using statistical software SPSS (version 20, IBM Corporation, Armonk, NY, USA). Descriptive results were provided by frequency distribution, mean, and standard deviation, and Cramer correlation test was applied for data analysis. $P < 0.0500$ was considered statistically significant.

Results

The results showed that present study participants' aged between 17 and 43 years old (mean ± standard deviation of 28.95 ± 4.28). Demographic characteristics of the participants are presented in table 1. Table 2 presents the frequency of depression, anxiety, and sleep disturbance at each gestational trimester.

Based on table 2, 70% of the participants had no depression symptoms at each of the three trimesters. Mild depression increased up to 1.7% in the second trimester compared to the first and third trimester. Moderate depression was higher in the first trimester, and severe depression gradually increased from the first trimester toward the third trimester. Furthermore, in the first trimester, anxiety had the frequency of 28.6% in terms of state anxiety and 30% in terms of trait anxiety (Table 2). In the second trimester, the highest frequency was 29.7% and 33.6% for moderate and lower anxiety, respectively. In the third trimester, the state and trait anxiety prevalence was 34%. According to the prevalence of anxiety, the results indicated that severe anxiety was 4.9% in terms of the state anxiety scale in the third trimester; relatively severe anxiety was 14.5% in the third trimester; severe anxiety was 3.9% in the second trimester in terms of trait anxiety scale.

Table 1. Demographic characteristics of pregnant women

Variables	n (%)	Variables	n (%)
Occupation		Contact support	
Housekeeper	229 (80.9)	Yes	246 (86.9)
Employed	54 (19.1)	No	37 (13.1)
Educational level		Spouse support	
Lower than diploma	29 (10.2)	Yes	265 (93.6)
Diploma	139 (49.1)	No	18 (6.4)
Higher than diploma	115 (40.7)		
Marital satisfaction		History of psychiatric treatment	
Bad	1 (0.4)	Yes	15 (5.3)
Average	21 (7.4)		
Good	128 (45.2)	No	268 (94.7)
Excellent	133 (47)		
History of abortion		History of taking psychiatric medications	
Yes	56 (19.8)	Yes	14 (4.9)
No	227 (80.2)	No	269 (95.1)

Table 2. The distribution of depression, anxiety, and sleep disturbance according to gestational trimesters in pregnant women

Variables	First trimester n (%)	Second trimester n (%)	Third trimester n (%)
Depression			
No symptom of depression	200 (70.7)	199 (70.3)	197 (49.4)
Mild depression	46 (16.3)	51 (18)	46 (16.3)
Moderate depression	31 (11)	23 (8.1)	26 (9.2)
Severe depression	6 (2.1)	10 (3.5)	14 (4.9)
State anxiety			
Mild anxiety	80 (28.3)	72 (25.4)	66 (23.3)
Moderate-to-low anxiety	81 (28.6)	95 (33.6)	95 (33.6)
Moderate-to-severe anxiety	78 (27.6)	78 (27.6)	68 (24)
Relatively severe anxiety	33 (11.7)	31 (11)	40 (14.1)
Severe anxiety	11 (3.9)	7 (2.5)	14 (4.9)
Trait anxiety			
Mild anxiety	76 (26.9)	77 (27.2)	67 (23.7)
Moderate-to-low anxiety	85 (30)	84 (29.7)	94 (33.2)
Moderate-to-severe anxiety	84 (29.7)	72 (25.4)	72 (525.4)
Relatively severe anxiety	31 (11)	39 (13.8)	41 (14.5)
Severe anxiety	7 (2.5)	11 (3.9)	9 (3.2)
Sleep disturbance	137 (48.41)	177 (62.54)	213 (75.26)

Table 2 indicates that sleep disturbance increases in the third trimester compared to the first and second trimesters. In other words, sleep disturbance increased from the first trimester to the third trimester. According to table 3, sleep problems with its subscales increase from the first trimester to the third trimester (Table 3).

According to table 4, the highest frequency of normal sleep is related to the normal group without depression symptoms in the first, second, and third trimesters (30.5, 44.2, and 58%, respectively). In the first and second trimesters, the highest frequency of sleep disturbance is associated with the moderate depression (74.2% and 91.3%, respectively). In the third trimester, the prevalence of sleep disturbance in association with severe depression was 100% (Table 4).

The highest correlation between sleep quality and anxiety in terms of state and trait anxiety was observed during the first trimester (Tables 5 and 6). In addition, the highest correlation in state and trait anxiety scale during the third trimester was observed in association with severe anxiety (Tables 5 and 6).

To examine the significant association between depression variables and sleep quality, Cramer's V was used as the correlation coefficient. Based on Cramer's V correlation coefficient, weak yet, significant correlations were observed between depression in the first trimester and the total score of sleep quality ($V = 0.484$, $P = 0.0040$), depression in the second trimester and the score of total sleep quality ($V = 0.427$, $P = 0.0010$), and depression in the first trimester and the total score of sleep quality ($V = 0.334$, $P = 0.0040$) (Table 7).

Based on Cramer's V correlation coefficient, moderate and significant correlations were found between state anxiety in the first trimester and the total score of sleep quality ($V = 0.427$, $P = 0.0050 < 0.0500$), trait anxiety in the first trimester and the total score of sleep quality ($V = 0.378$, $P = 0.0005 < 0.0500$), state anxiety in the first trimester and the total score of sleep quality ($V = 0.427$, $P = 0.0050$), trait anxiety in the first

Table 3. Sleep quality according to gestational trimesters in pregnant women in 2014-15

Sleep quality	First semester Mean ± SD	Second semester Mean ± SD	Third semester Mean ± SD	P-value
Sleep quality	0.98 ± 0.72	1.20 ± 0.74	1.51 ± 0.83	< 0.0001
Sleep latency (min)	1.42 ± 1.03	1.45 ± 0.99	1.60 ± 0.94	< 0.0001
Duration of sleep (hour)	0.61 ± 0.94	0.80 ± 1.07	1.15 ± 1.16	< 0.0001
Sleep quality	0.62 ± 0.94	0.75 ± 1.03	0.73 ± 1.03	< 0.0001
Sleep disturbance	1.47 ± 0.60	1.58 ± 0.65	1.78 ± 0.60	< 0.0001
Sleep medication	0.03 ± 0.24	0.0 ± 0.0	0.06 ± 0.33	< 0.0040
Morning function disturbance	1.09 ± 0.93	1.14 ± 0.76	1.21 ± 0.88	< 0.0001
Total score	6.21 ± 3.45	6.91 ± 3.41	8.04 ± 3.47	< 0.0001

SD: Standard deviation; Sleep efficiency: Sleep time (hour)/Time in bed

Table 4. Distribution of depression according to sleep quality in pregnant women

Sleep disorder	First trimester (%)		Second trimester (%)		Third trimester (%)	
Depression	Normal sleep	Sleep disturbance	Normal sleep	Sleep disturbance	Normal sleep	Sleep disturbance
No depression symptoms	116 (58)	84 (42)	88 (42.2)	111 (55.8)	60 (30.5)	137 (69.5)
Mild depression	20 (43.5)	26 (56.5)	14 (27.5)	37 (72.5)	8 (17.4)	38 (82.6)
Moderate depression	8 (25.8)	23 (74.2)	2 (8.7)	21 (91.3)	2 (7.7)	24 (92.3)
Severe depression	2 (33.3)	4 (66.7)	2 (20)	8 (80)	0 (0)	14 (100)
Total	146 (51.6)	137 (48.4)	106 (37.5)	177 (62.5)	70 (24.7)	213 (75.3)
χ^2 (P-value)	13.55 (0.0040)		15.49 (0.0010)		13.45 (0.0040)	

trimester and the total score of sleep quality (V = 0.378, P = 0.0005), state anxiety in the second trimester and the total score of sleep quality (V = 0.395, P = 0.0005), and weak significant correlation between trait anxiety in the second trimester and the total score of sleep quality (V = 0.387, P = 0.0100).

There was also a weak significant correlation between state anxiety in the third trimester and the total score of sleep quality (V = 0.342, P = 0.0010), and a weak yet, significant correlation between trait anxiety in the third trimester and the total score of sleep quality (V = 0.342, P = 0.0005) (Table 7).

Discussion

Sleep disturbances are common in women, especially during pregnancy, and are associated with emotional and psychological consequences. The results of the current study indicated that the highest average prevalence of moderate depression was in the first trimester, for mild depression in the second trimester, and for major depression in the third trimester. In the State Anxiety Inventory, the highest prevalence of mild anxiety was in the first trimester, for moderate anxiety in the second trimester, and for severe anxiety in the third trimester. In the trait anxiety inventory, higher prevalence of moderate anxiety was in the first trimester, for mild and severe anxiety in the second trimester, and for moderate and relatively severe anxiety in the third semester. In the research performed by Signal et al., on 406 pregnant women using Edinburgh Postnatal Depression Scale, by the end of pregnancy, 22%, 25%, and 55% of the women experienced symptoms of depression, anxiety, and stress, respectively. Less than 55% of women reported depressed mood for more than 2 weeks, and factors such as the history of maternal depression and younger age were important predictors of depression, stress, and anxiety caused by a feeling of inefficiency. Maternal mental health should be considered equally important in pregnancy period and the postpartum period (21). Rallis et al. revealed that the rate of depression symptoms, anxiety, and stress during pregnancy trimesters differ, and increased rates of depression in pregnancy can be a predictor of depression in later stages and also increased anxiety and stress in the late pregnancy (22). Consistent with other studies, current findings underline the importance of mental problems incidence in early pregnancy and a history of it even before pregnancy on sleep quality of pregnant women. Accordingly, in the current article, moderate depression, mild anxiety, and moderate anxiety were reported in the first trimester. Severe anxiety and depression had a higher incidence in the third trimester. Thus, to have a good mental and physical health during pregnancy, the prevalence of psychiatric disorders and its treatment should be taken into account, and mental-emotional health screening in early pregnancy seems to have much importance.

Table 5. Distribution of state of anxiety based on sleep situation in the pregnant women

Sleep disorder	First trimester (%)		Second trimester (%)		Third trimester (%)	
State anxiety	Sleep disorder	Normal sleep	Sleep disorder	Normal sleep	Sleep disorder	Normal sleep
Mild anxiety	62 (77.5)	18 (22.5)	40 (55.6)	32 (44.4)	20 (30.3)	46 (69.7)
Moderate–to-low anxiety	48 (59.3)	33 (40.7)	42 (44.2)	53 (55. 8)	34 (35.8)	61 (64.2)
Moderate-to-high anxiety	30 (38.5)	48 (61.5)	20 (25.6)	58 (74.4)	14 (20.6)	54 (79.4)
Relatively severe anxiety	6 (18.2)	27 (81.8)	2 (6.5)	29 (93.5)	2 (5)	38 (95)
Severe anxiety	0	11 (100)	2 (28.6)	5 (71.4)	0	14 (100)
Total	146 (51.6)	137 (48.4)	106 (37.5)	177 (62.5)	70 (24.7)	213 (75.3)
χ^2 (P-value)	55.26 (0.0001)		29.52 (0.0001)		20.93 (0.0010)	

Table 6. Distribution of trait of anxiety based on sleep situation in pregnant women

Sleep disorder	First trimester (%)		Second trimester (%)		Third trimester (%)	
Trait anxiety	Sleep disorder	Normal sleep	Sleep disorder	Normal sleep	Sleep disorder	Normal sleep
Mild anxiety	60 (78.9)	16 (21.1)	40 (51.9)	37 (48.1)	26 (38.8)	41 (61.2)
Moderate-to-low anxiety	46 (54.1)	39 (45.9)	32 (38.1)	52 (61.9)	26 (27.7)	68 (72.3)
Moderate-to-high anxiety	32 (38.1)	52 (61.9)	22 (30.6)	50 (69.4)	14 (19.4)	58 (80.6)
Relatively severe anxiety	8 (25.8)	23 (74.2)	10 (25.6)	29 (74.4)	4 (9.8)	37 (90.2)
Severe anxiety	0	7 (100)	2 (18.2)	9 (81.8)	0	9 (100)
Total	146 (51.6)	137 (48.4)	106 (37.5)	177 (62.5)	70 (24.7)	213 (75.3)
χ^2 (P-value)	40.28 (0.0001)		12.45 (0.0140)		16.54 (0.0050)	

In analyzing sleep quality in the first, second, and third trimesters, the results showed that poor sleep quality has a higher prevalence in the third trimester. Sleep quality scales such as sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleep medications, and daytime dysfunction were disrupted. A review of sleep quality during pregnancy indicates that sleep problems increase gradually from the first trimester to the last trimester. A research performed by Swanson et al. on pregnant and postpartum women indicated a high prevalence of psychiatric and sleep disorders including insomnia, depression, and anxiety; among which insomnia had a higher frequency in the perinatal period (23). Mindell et al. examined sleep pattern during pregnancy and showed that the subjects during pregnancy have a poor quality of sleep, decreased sleep efficiency at night, and high daytime sleepiness. Nearly all of the subjects reported repeated awakenings at night, nap during the day, symptoms of insomnia, respiratory disorders, and restless legs syndrome. No difference was seen in terms of sleep-disordered breathing, daytime sleepiness, and fatigue. Furthermore, physical problems related to pregnancy such as frequent urination and lack of convenient sleep can lead to sleep disturbance. Thus, such sleep disorders during pregnancy should be treated, because sleep disturbance and poor sleep can negatively impact maternal and fetus health after pregnancy (24). Sharma et al. reported that sleep disturbance during pregnancy can have a considerable impact on pregnancy outcomes. For example, strong snoring could be a risk factor for hypertension during pregnancy and cesarean section (25, 26). Moreover, lack of sleep (short and inadequate sleep, and insomnia) during pregnancy leads to low mental and social performance. Poor sleep is a risk factor in creating side effects during pregnancy (27). In reviewing the quality of sleep and sleep disturbances during pregnancy, Rezaei et al. reported that poor sleep and poor quality of sleep can be more prevalent in the second trimester of pregnancy (28).

There are several researches performed on sleep during pregnancy that can confirm the results obtained from the present research. In the research performed by Rezaei et al., it is indicated that sleep disturbance can be more prevalent in the third trimester of pregnancy (28), while we found that maternal sleep disturbance is lower in the third trimester. Given the increasing psychiatric problems at the past 3 months of pregnancy, sleep problems and low quality of sleep are more tolerable by women, such that most research confirms the results obtained from the present research.

We also found that there is a significant correlation between sleep quality and psychiatric disorders, and increased level of anxiety and depression would decrease sleep quality. A community-based study by Dorheim et al. on women in week 32 of pregnancy showed that the prevalence of insomnia according to DSM-IV-TR was high (61.9%), significantly higher than the general population. Dorheim et al. results implied that the symptoms of depression are highly correlated with insomnia, including sleep duration of 5 or 10 hours, sleep efficiency < 75%, everyday sleep disturbances, and long sleep with a delayed onset in late pregnancy (29).

Table 7. The correlation between depression, state, and trait anxiety with the sleep condition in pregnant women

Sleep quality	First trimester	P-value*	Second trimester	P-value*	Third trimester	P-value*
Variables						
Depression	0.484	0.0040	0.427	0.0010	0.334	0.0040
State anxiety	0.427	0.0005	0.395	0.0005	0.342	0.0010
Trait anxiety	0.378	0.0005	0.387	0.0100	0.342	0.0005

P*: P value. Statistical test: Cramer's-V, the values < 0.05 were considered to be statistically significant

Pelvic pain and pain associated with insomnia are correlated with depression. A cohort study reported the correlation between psychiatric disorders with short sleep, exhaustion, and perceived stress in early pregnancy (30). One research examined the association between sleep quality and symptoms of depression in pregnancy, and the findings showed that sleep quality in early pregnancy can predict the symptoms of depression at late pregnancy with high certainty (through controlling the past depression). In contrast, the symptoms of depression at early pregnancy cannot predict sleep quality in the later stages of pregnancy. Given that the symptoms of depression can lead to major depression, and also due to the prevalence of depression during and after pregnancy, the findings indicate that screening of sleep problem during pregnancy may be of clinical importance (14). Furthermore, insomnia during pregnancy is a predictor of recurrent postpartum depression in women who have had a previous history of depression, and thus, specialists recommend consideration of sleep quality in early pregnancy (31-33). As sleep may be disrupted due to depression and anxiety and available evidence, there is a definite association between the variables, and it is of significance to address maternal emotional-mental health in the early pregnancy. Along with routine prenatal care and treatments, psychiatric and psychological treatments should be done leading to the mental and physical health of pregnant women, future mothers, and newborns.

Conclusion

The current research showed that depression and anxiety are more prevalent in the third trimester of pregnancy and sleep quality decreases more substantially in the third trimester than the 1st and 2nd months of pregnancy. Moreover, there is a significant correlation between anxiety and depression with sleep quality.

Conflict of Interests

Authors have no conflict of interests.

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