

# Factors affecting subjective sleep quality in the third trimester of pregnancy in urban areas of Turkey and Iraq

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## Abstract

**Background and objectives:** Significant changes in hormonal levels result in certain physical and mental changes that can lead to sleep disorders in pregnant women. This study aimed to determine the relative contribution and interrelationship among physiological and psychological factors in the third trimester of pregnancy, and to compare the study results between Turkish and Iraqi women.

**Methods:** A cross-sectional study was done on 582 pregnant women were recruited (convenient sampling) in the third trimester of their pregnancy, of those 296 were Turk participants, and 286 were Iraqi participants. Data were collected by using multiple tools, including a questionnaire, Pittsburg Sleep Quality Index (PSQI), Whooley questions, State Anxiety Inventory (STAI-S), Restless Legs Syndrome assessment scale(s), and Gastroesophageal Reflux Disease Questionnaire (GERD-Q).

**Results:** The highest percentage of the study sample (66.4%, 65.5%) in both Iraqi and Turkish group had poor quality of sleep, respectively, and there were not significant difference between them. There was highly significant difference between two groups regarding having anxiety, depression, restlessness leg syndrome and GERD. Binary logistic regression analysis of the data indicates that those who had depression (OR=2.096), anxiety (state) (OR=2.202), are in late gestational age (OR=12.273), with read and write and basic school educational level (OR= 3.494 and 3.958), and snoring (OR= 1.984) had poor quality of sleep.

**Conclusion:** gestational age, state anxiety, perinatal depression, and disturbing gastroesophageal reflux are associated with poor sleep quality. Moreover, this study determined that factors associated with sleep quality might differ depending on the country where pregnant women live.

**Key words:** Pregnancy, sleep quality, Associated factors, Iraq, Turkey

## 1. Introduction

Pregnancy is characterized by significant physiological changes and a variety of symptoms, many of which are likely to disturb sleep (Pien & Schwab, 2004). Most pregnant women (84%) report some frequency of sleep problems and 30% indicate that they occasionally or never get a good

night's sleep throughout pregnancy (Polo-Kantola et al., 2017). Significant changes in hormonal levels result in certain physical and mental changes that can lead to sleep disorders in pregnant women (Miller et al., 2004). Progesterone and its 5 $\alpha$ -reduced metabolites have significant sedative properties (Smith et al., 1999); contrarily, estrogen typically has stimulating effects in the nervous system and is associated with a decrease in the expression of Rapid Eye Movement (REM) sleep (Fang & Fishbein, 1996). Therefore, variation in these hormones could be reflected in the insomnia found in healthy pregnant women during the third trimester of pregnancy (Zib et al., 1999).

As pregnancy progresses, sleep becomes more disturbed and fragmentary and thus the quality of

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sleep deteriorates (Mindell et al., 2015), and sleep disorders increase both in number and length in late pregnancy (Sut et al., 2016). In last trimester of pregnancy, women often have difficulty sleeping, awakening early in the morning, and falling asleep (Reichner, 2015), and have increased snoring (Facco et al., 2010), and night walking (Santiago, 2001). Sleep efficiency, which is defined as time spent sleeping as a percentage of time spent in bed, is also reduced during pregnancy and further declines as pregnancy advances, mostly as a result of increased time spent awake after sleep onset (Wilson et al., 2011).

Common etiologies of declining sleep quality in the last trimester of pregnancy include general discomfort including back pain, urinary frequency due to a mechanical effect of the enlarged uterus (Baratte-Beebe & Lee, 1999), fetal movement, heartburn (Bondad & Abedian, 2004), and Restless Leg Syndrome (RLS) ("Sleeping by the trimesters: 3rd Trimester," 2018). RLS is one of the distinct sleep disorders that can negatively influence a pregnant woman's ability to get at least eight hours of sleep per night (Meharaban et al., 2015).

The majority of women experience depression while pregnant (Gaynes et al., 2005) and the prevalence of depression increase in third trimester of pregnancy (Accortt et al., 2014). Women with depression reported significantly higher levels of poor sleep and greater anxiety score in the third trimester of pregnancy (12). On the other hand, poor sleep quality in pregnancy was associated with a 1.7-fold increase in odds of suicidal ideation even after adjusting for depressive symptoms (Gelaye et al., 2015).

The poor sleep quality could have worse outcomes in pregnant women. Significant relationship has been found between the quality of sleep during pregnancy and birth outcome (Zaky, 2015), and postpartum depression (Wu et al., 2014). It is also been shown that sleep deprivation during pregnancy is associated with gestational hypertension, preeclampsia and diabetes, complicated labour and delivery, and adverse newborn outcomes (Miller et al., 2012). Poor sleep quality has been associated with increased levels of systemic inflammation and shorter gestational length, indicating that it may contribute to preterm birth. that it may be a potential contributor to preterm birth (Blair et al., 2015). Naghi and colleagues reported that pregnant women with poor sleep quality were 20% more likely to undergo cesarean section (Naghi et al., 2011). The potential for sleep disruption affecting the quality of life can be particularly harmful for pregnant woman and

her offspring. Although, factors that contribute to the sleep disturbances during the last trimester of pregnancy partially investigated in previous research, the complex interrelationship between these factors was not well established. This study aimed to determine the relative contribution and interrelationship among physiological and psychological factors in the third trimester of pregnancy. A second aim of this study is to compare the study results between Turkish and Iraqi women. This study addressed the following research questions;

1- How is the sleep quality of Turkish and Iraqi women in their third trimester of pregnancy?

2- What are the factors affecting sleep quality of Turkish and Iraqi women in their third trimester of pregnancy?

3- Are there differences between the sleep quality of Turkish and Iraqi women in their third trimester of pregnancy?

## 2. Method

### 2.1. Design, sample and setting

This cross-sectional study was conducted between April 2019 and April 2020 in selected urban areas of Turkey-Ankara and Iraq-Erbil. The sample size consisted of pregnant women in their third trimester of pregnancy. Participants with multifetal pregnancy and with medical complications such as active cancer, cardiovascular diseases, chronic obstructive pulmonary diseases, gestational diabetes, gestational hypertension were excluded. Pregnant women in the third gestational trimester (27-42 weeks) were invited to participate and informed about the purposes and procedure of the study. Women who accepted to participate were signed an informed consent and completed the questionnaires. A total of 582 pregnant women were recruited (convenient sampling) in the third trimester of their pregnancy, of those 296 were Turk participants, and 286 were Iraqi participants. Turkish participants were recruited in the waiting room of the antenatal outpatient clinic in a state hospital while waiting for their prenatal consultations by nurse providing direct nursing care of pregnant women. Iraqi participants were recruited from several primary health care centers who attended for antenatal visits.

### 2.2. Instruments

Data were collected by using multiple tools, including a questionnaire, Pittsburg Sleep Quality Index (PSQI), Whooley questions, State Anxiety Inventory (STAI-S), Restless Legs Syndrome assessment scale(s), and Gastroesophageal Reflux

Disease Questionnaire (GERD-Q).

### 2.3. Questionnaire Form

The questionnaire consisted of three parts. The first part of the questionnaire comprised of questions on socio-demographic data that included information about the pregnant women's age, educational status, occupational status, family type, and economic status. The second part comprising information on obstetrical characteristics, such as gestational age, gravity, and willingness of pregnancy. Last part included sleep and medical history of the participants such as sleepwalking, snoring, and chronic diseases, which were obtained from the self-report of the participants. Participants' weight (kilogram) and height (meter) used for calculation of current body mass index (BMI) (Prevention, 2020).

**2.3.1. Snoring** was categorized as habitual snorers who are already snoring early in pregnancy, gestational snorers who start to snore after 1st trimester, and non-snorers who never snore. Women who are habitual snorers or gestational snorers will be asked to rank their rate of snoring, using the alternatives always, often, sometimes, seldom, and never (Sarberg, Bladh, Josefsson, & Svanborg, 2016).

**2.3.2. Perinatal depression** was assessed using the Whooley questions recommended by the National Institute for Health and Care Excellence (NICE) (Littlewood et al., 2016). This questionnaire consists of two short items for evaluating aid, and one item for identifying the help of perinatal depression. Participants answer two initial items as 'yes or no'. Participants say 'yes' to one of these questions, those answer the third question as 'yes, but not today or no'. Responders were categorized as 'Whooley positive or negative' according to responding either two initial questions 'yes or no' respectively. In the present study, nurse practitioners and midwife practitioners collecting data were trained on how to ask the questions before commencing the study (Howard et al., 2018).

**2.3.3. Pittsburg Sleep Quality Index (PSQI)** PSQI, which was developed by (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989), is a self-report scale that evaluates sleep quality and impairment over the last month. In total, the scale comprises of 24 items, of those 5 items are related to the person's bedmate and these items are not taken into consideration to calculate global score. Items

weighed on a scale of 0–3 and contains seven components of subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, sleeping medication use, and daytime dysfunction. The global PSQI ranges from 0 to 21, with a score of 5 indicating worse sleep quality.

**2.3.4. State-Trait Anxiety Inventory (STAI):** STAI, which was developed by (Spielberger, Gorsuch, & Lushene, 1970), is a 4-point Likert scale and has 40 items on a self-report basis. The scale consists of two subscales - the State Anxiety Scale (S-Anxiety) and the Trait Anxiety Scale (T-Anxiety)- that each has 20 items allocated. As S-Anxiety indicates how individuals feel anxiety at the current time, T-Anxiety evaluates how individuals generally feel by pointing out intensity of their symptoms of anxiety. The total score of each subscale range from 20 to 80 with a higher score indicating a higher level of anxiety.

**2.3.5. Gastroesophageal Reflux Disease Questionnaire (GERD-Q):** The GERD-Q evaluates the frequency of symptoms in the previous week on a self-report basis. It is useful to distinguish between the patients who have frequent symptoms and occasional symptoms. GERD-Q is 3-point Likert-type scale and consists of six items in total: four items about symptoms and two items about the effects of the disease. Each item equates to a 0–3 score and total score ranges between 0 and 18. In addition, the sum of the scores obtained from the items evaluating the effects of the disease is the impact score (ranges from 0 to 6). An impact score of 3 or more indicates that the individual is highly influenced by gastroesophageal reflux. Finally, the total score and impact score are used to calculate the overall GERD-Q score. A total score with a mean of 0-7 interprets a low reflux probability; a total score of 8-10 and an impact score of less than 3 or a total score of 11-18 and an impact score of less than 3 indicates an inconveniencing GERD; and a total score of 8-10 and an impact score of 3 or more or a total score of 11-18 and an impact score of 3 or more is considered as a disrupting GERD (Fock et al., 2016).

**2.3.6. Restless Legs Syndrome (RLS):** The symptoms of restless legs syndrome of participants were assessed by the essential diagnostic criteria for RLS developed by International Restless Legs Syndrome Study Group (Allen et al., 2003). The four criteria include (i) the desire to move the limbs associated with paresthesias/dysesthesias, (ii) motor

restlessness, (iii) symptoms are worse or exclusively present at rest (i.e., lying, sitting) with at least partial or temporary relief by activity, and (iv) symptoms are worse at evening/night. Participants responding all questions with 'yes' identified as RLS positive.

#### 2.4. Statistical analyses

Frequency and percentages were performed for reporting demographic data. Pearson's chi-squared tests was used to examining differences in categorical variables. As at least 20% cells of the contingency table have expected count less than 5 and the minimum expected count is smaller than 5, Fisher's exact tests were used. We used binary logistic regression analyses to find significantly associated factors with sleep quality. Sleep quality (poor sleep quality coded as  $\geq 5$  global score of PSQI=1, scores  $<5=0$ ) was used as dependent variable and sociodemographic characteristics, medical and obstetrical characteristics, anxiety, depression, RLS, and GERD were used as independents variables. The crude odds ratios were reported. Data analysis was performed using the Statistical Package for the Social Sciences (SPSS) for Windows version 22.0 by accepting the significance level as  $P < 0.05$ .

#### 2.5. Ethics

The ethical approval of this cross-sectional quantitative study was obtained from the ethics committee of the Gazi University in Turkey. In Iraq, the proposal of the study approved by Scientific and Ethical Committee of College of Nursing Hawler Medical University. All participants were informed about the aim of the study and invited attend the study obtaining their informed consent. To ensure the confidentiality of participant information, paper-based questionnaires were de-identified by allocating a code number.

### 3. Results

The results show highly significant difference between Iraqi and Turkish sample in term of age, educational level, occupation, number of family members, family income and BMI (Table 1).

Regarding obstetrical characteristics of the study sample there was highly significant difference between both Iraqi and Turkish sample in term of gestational age and gravity but not willingness of pregnancy (Table 2).

Both of the study samples significantly are different in snoring and the highest percentage in both groups was not snore. From those who were snoring the highest percentage started after

pregnancy. The highest percentages of the study sample in both groups had no chronic disease and were not walk unconsciously in night (Table 3).

The highest percentage of the study sample (66.4%, 65.5%) in both Iraqi and Turkish group had poor quality of sleep, respectively, and there where not significant difference between them. There was highly significant difference between two groups regarding having anxiety, depression, restlessness leg syndrome and GERD (Table 4).

Table 5 and 6 indicates highly significant association between sleep quality and age, educational level, family income and number living in room, anxiety (state), depression, GERD, snoring, gestational age and gravidity. But there were no significant association between sleep quality and occupation, BMI, anxiety (trait), having chronic disease, starting snoring, RLS and willingness of pregnancy.

Table 7 and 8 shows the association of sleep quality with sociodemographic, obstetric and medical characteristics of the sample in both Iraqi and Turkish, separately. The most significant associated factors were among Iraqi sample.

Binary logistic regression analysis of the data indicates that those who had depression (OR=2.096), anxiety (state) (OR=2.202), are in late gestational age (OR=12.273), with read and write and basic school educational level (OR= 3.494 and 3.958), and snoring (OR= 1.984) had poor quality of sleep (Table 9).

### 4. Discussion

The purpose of this study was to determine the factors associated with the sleep quality of third-trimester pregnant women, and to compare the study results between Turkish and Iraqi women. This study showed that almost two third of the pregnant women in their third trimester had poor sleep quality. The research confirmed that gestational age was the most associated factor with quality of sleep, followed by illiteracy, anxiety at the current time, perinatal depression, and disturbing gastroesophageal reflux, respectively. Additionally, it was revealed that the country in which pregnant women live was associated with the factors contributing to poor sleep quality.

According to our study findings, pregnant women experience poor sleep quality in the third trimester of pregnancy, and it was getting worse at the late of the trimester. There is plausible evidence to support that the quality of sleep decrease in the third trimester compared to previous weeks of pregnancy (Christianet al., 2019; Garbaza et al.; Kim et al., 2020; Sut et al., 2016; Tsai et al., 2016;

Umeno et al., 2020). A large cross-sectional study from the Poland with 7000 pregnant women revealed that women in their third trimester experience prolonged sleep onset latency and frequent number of awaking in the night (Smyka et al., 2020). Additionally, data exist objectively evaluating sleep pattern of third-trimester pregnant women to support these subjective perceptions of poor sleep quality (Kang et al., 2020 ; Sweet et al., 2020).

The present study demonstrated that there was no significant association between sleep quality and included socio demographic and obstetric variables except for illiteracy in the third trimester of pregnancy. Previous findings conducted with pregnant women in their third trimester showed that quality of sleep did not differ according to maternal age (Joseph et al., 2019; Tsai et al., 2016; Wang et al., 2019), educational level, working status (Joseph et al., 2019; Tsai et al., 2016), family type, gravity (Joseph et al., 2019), willingness of pregnancy (Wang et al., 2019), and current body mass index (Tsai et al., 2016) unless it goes up  $\geq 35$  (Kalmbach et al., 2019). The poverty is frequently defined in the literature as an associated factor to decrease quality of sleep among pregnant women with resulting some negative consequences to mother and fetus (Kalmbach et al., 2019) (Silva-Perez et al., 2019). Our result that illiteracy was associated with poor sleep quality was not consistent with previous findings, however, this result is likely to be explained with the bidirectional relationship between educational level and poverty. Education that regarded as reducing power to decrease poverty is also negatively affected by poverty in terms of the accessing educational opportunity (Mihai et al., 2015).

The findings of this study were in concordance with evidence whereby state anxiety was strongly associated with poor sleep quality among the third-trimester pregnant women (Rahmawati & Ungsianik, 2017; Shariat et al., 2018). On the other hand, this finding contradicted a previous study conducted in Iran which reports trait anxiety was associated with quality of sleep in the third trimester (Shariat et al., 2018). Similarly, our results showed that perinatal depression were strongly associated with poor sleep quality among the third-trimester pregnant women (Gao et al., 2019; Shariat et al., 2018; Tsai et al., 2016; Zhou et al., 2020)

contradicting previous research which reported depression was not associated with sleep quality in the third trimester (Rahmawati & Ungsianik, 2017). Pregnant women with poor sleep quality generally

had diagnosis of depression (Tsai et al., 2016) and poor sleep quality also could be a cue for envisaging postnatal depression (Zhou et al., 2020). Therefore, the relationship between poor sleep quality and depression in the pre- and postnatal periods is recommended to be in consideration to improve the quality of antenatal care (Gao et al., 2019).

In our study, snoring was determined as one of the strongest factors to predict poor sleep quality of pregnant women in their third trimester. Previous studies revealed that almost half of the third-trimester pregnant women frequently reported snoring (Dunietz et al., 2018; Kalmbach et al., 2019; Tsai et al., 2018), in particular obese ones (Garbaza et al., 2020). In addition to this, snoring is important symptom in terms of being a hallmark for clinically serious sleep disorders resulting adverse perinatal outcomes (Dunietz et al., 2018).

Findings of this study showed that the severity of gastroesophageal reflux disease (GERD) was significantly associated with poor sleep quality in the third trimester of pregnancy. Besides pregnancy is defined as one of the predisposing factors for GERD (Shakeri et al., 2018), the bidirectional relationship between poor sleep quality and GERD is defined in previous studies (Fill Malfertheiner et al., 2017; Hashmi et al., 2016; Okun, 2019; Shibli et al., 2020; Silvestri & Aricò, 2019). Pregnant women who frequently report the experience symptoms of GERD generally benefit from acid-suppressive drugs (Dağlı & Kalkan, 2017; Hashmi et al., 2016) or medicinal herbs (Shakeri et al., 2018) to treat the GERD. In this study sample, only one participant reported taking antacid medicine.

While this study did not define that restless legs syndrome (RLS) was associated with poor sleep quality, previous studies reported a high rate of poor sleep quality among women with gestational RLS (Darvishi et al., 2020; Dunietz et al., 2017; Steinweg et al., 2020). Prevalence of RLS is high among pregnant women in their third trimester compared with previous gestational weeks (Arasu et al., 2020; Darvishi et al., 2020; Dunietz et al., 2017; Okun, 2019; Querejeta Roca et al., 2020). In present study, no relationship between poor sleep quality and RLS may be explained by the low prevalence rate of RLS in our study sample and cultural differences.

This study demonstrated that there were no differences between the rate of poor sleep quality of Turkish and Iraqi women in their third trimester of pregnancy. However, factors affecting sleep quality of pregnant women showed changes between two countries. While state anxiety and disturbed GERD were more prevalent among



Turkish pregnant women, Iraqi ones frequently experienced trait anxiety, depression, RLS, snoring, and inconveniencing GERD. Additionally, there were not illiterate participants in the Turkish sample contrary to the Iraqi sample. The results of the present showed that cultural differences should be considered while assessing the sleep quality of pregnant women in their third trimester of pregnancy and developing strategies to prevent and treat sleep disturbances.

The present study has both strengths and weaknesses. The strength of this study is the research data collected from two different countries by using reliable and valid measurement instruments. One of the limitations of our study is that the data was collected independently in Turkey and Iraq which have different languages and cultures. Another limitation is that self-reported data was collected, no objective measurement tool and no clinical assessment were used. Lastly, the results cannot be generalized for each country as limited sample in each country was recruited in the study. Therefore, further studies should be planned to overcome these limitations. Additionally, further studies are needed to determine factors underlying poor sleep quality in the third trimester of pregnancy differentiated across the countries.

### Conclusions

As a conclusion, this study determined some factors associated with poor sleep quality. Among those factors, showed that the highest was gestational age and it was followed by state anxiety, perinatal depression, and disturbing gastroesophageal reflux, respectively. Moreover, this study defined that factors associated with sleep quality might differ depending on the country where pregnant women live. This study suggested that healthcare providers should develop interventions to improve prenatal sleep quality, with considering their gestational week.

### Author contributions

The authors contributions as follow: the design and implementation of the research: ID, HMA. The analysis of the results: HMA. The writing of the manuscript as follows: ID, NB, HMA, TJP, KS. Collecting data: EE for Turkish data. Critical review & editing: ID, NB, HMA, TJP, KS

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## Tables

Table 1. Sociodemographic characteristics of the study sample

Variables	Iraq No. (%)	Turkey No. (%)	P-value
Age (N=582)			
- <19	11(3.8)	9(3)	
- 20-29	146(51.0)	184(62.2)	
- 30-39	95(33.2)	98(33.1)	<0.001
- ≥40	34(11.9)	5(1.7)	
Educational level (N=581)			
- Illiterate	36(12.6)	0(0)	
- Read and write	28(9.8)	11(3.7)	
- Basic	41(14.4)	125(42.2)	
- High school	86(30.2)	116(39.2)	<0.001
- University	94(33.0)	44(14.9)	
Occupation (N=579)			
- Employment	81(28.6)	36(12.2)	
- Unemployment	202(71.4)	260(87.8)	<0.001
Number of family members (N= 556)			
- ≤5	238(84.1)	265(97.1)	
- >5	45(15.9)	8(2.9)	<0.001
Family income (N=533)			
- Low	107(37.4)	195(78.9)	
- Lower middle	137(47.9)	50(20.2)	
- Upper middle	39(13.6)	2(0.8)	<0.001
- Higher	3(1.1)	0(0)	

Table 2. Obstetrical characteristics of the study sample

Variables	Iraq No. (%)	Turkey No. (%)	P-value
Gestational age (N=582)			
- 27 - 34	119(41.6)	17(5.7)	
- 35 - 42	167(58.4)	279(94.3)	<0.001
Gravity (N=581)			
- Prim gravida	44(15.4)	86(29.1)	
- Multigravida	168(58.9)	194(65.5)	<0.001
- Grand multigravida	73(25.6)	16(5.4)	
Willingness of pregnancy (N=567)			
- Yes	120(43.5)	145(49.8)	
- No	156(56.5)	146(50.2)	0.152

Table 3. Sleep and medical history of the study sample

Variables	Iraq No. (%)	Turkey No. (%)	P-value
Walking unconsciously in night? (N=578)			
- Yes	39(13.7)	46(15.7)	0.557
- No	246(86.3)	247(84.3)	
Snoring (N=582)			
- Yes	118(42)	46(15.5)	<0.001
- No	166(58)	250(84.5)	
Starting snoring (N=166)			
- Before pregnancy	57(47.5)	17(37)	0.229
- After pregnancy	63(52.5)	29(63)	
Having chronic disease (N=582)			
- Yes	34 (11.9)	30(10.1)	0.511
- No	252(89)	266(89.9)	
BMI (N=487)			
- <18.5	4(1.4)	15(7.2)	<0.001
- 18.5-24.9	147(52.9)	125(59.8)	
- 25-30	85(30.6)	48(23)	
- >30	42(15.1)	21(10)	

Table 4. Sleep quality, anxiety, depression, RLS, GERD among study sample

Variables	Iraq No. (%) N=286	Turkey No. (%) N=296	P-value
Sleep quality			
- Good	96(33.6)	102(34.5)	0.861
- Poor	190(66.4)	194(65.5)	
Anxiety (STAI-Trait)			
- Low anxiety	40(14)	90(30.4)	<0.001
- High anxiety	246(86)	206(69)	
Anxiety (STAI-State)			
- Low anxiety	169(59.1)	60(20.3)	<0.001
- High anxiety	117(40.9)	236(79.7)	
Depression			
- Depressed	178(62.2)	109(36.8)	<0.001
- Not depressed	108(37.8)	187(63.2)	
RLS			
- Positive	16(56)	68(23)	<0.001
- Negative	270(94.4)	228(77)	
GERD			
- Low reflux probability	176(61.5)	188(63.5)	0.016
- Inconveniencing GERD	34(23.8)	49(15.5)	
- Disrupting GERD	76(14.7)	59(20.9)	

Table 5. Association of sleep quality with sociodemographic characteristics (total sample of Iraqi and Turkey)

Variables	N	Sleep quality		P – value
		Good No. (%)	Poor No. (%)	
Age				
- <19	20	3(15)	17(85.0)	0.001
- 20-29	330	129(39.1)	201(60.9)	
- 30-39	193	62(32.1)	131(67.9)	
- ≥40	39	4(10.3)	35(89.7)	
Educational status				
- Illiterate	47	4(11.1)	32(88.9)	0.035
- Read and write	153	11(28.2)	28(71.8)	
- Basic school	157	58(34.9)	108(65.1)	
- Secondary school	130	76(37.6)	126(62.4)	
- University	94	48(34.8)	90(65.2)	
Occupation				
- Employed	117	40(34.2)	77(65.8)	1.000
- Unemployed	462	156(33.8)	306(66.2)	
Family income				
- Low	302	118(39.1)	184(60.9)	<0.001
- Lower middle	187	62(33.2)	125(66.8)	
- Upper middle	41	3(7.3)	38(92.7)	
- High	0	0(0)	3(100)	
Number living in house				
- ≤ 5	503	180(35.8)	323(64.2)	<0.001
- > 5	53	4(7.5)	49(92.5)	

Table 6. Association of sleep quality with medical and obstetrical characteristics (total sample of Iraqi and Turkey)

Variables	N	Sleep quality		P – value
		Good No. (%)	Poor No. (%)	
Anxiety (STAI-Trait)				
- Low anxiety	130	48(36.9)	82(63.1)	0.462
- High anxiety	254	150(33.2)	302(66.8)	
Anxiety (STAI-State)				
- Low anxiety	229	94(41)	135(59)	0.004
- High anxiety	249	104(29.5)	249(70.5)	
Depression				
- Depressed	287	60(20.9)	227(79.1)	<0.001
- Not depressed	295	138(46.8)	157(53.2)	
RLS				
- Positive	84	25(29.8)	59(70.2)	0.387
- Negative	498	173(34.7)	325(65.3)	
GERD				
- Low reflux probability	364	149(40.9)	215(59.1)	<0.001
- Inconveniencing GERD	83	22(26.5)	61(73.5)	
- Disrupting GERD	135	27(20)	108(80)	
Having chronic disease				
- Yes	64	16(25)	48(75)	0.124
- No	518	182(35.1)	336(64.9)	
Snoring				
- Yes	166	31(18.7)	135(81.3)	<0.001
- No	416	167(40.1)	249(59.9)	
Starting snoring				
- Before pregnancy	74	17(23)	57(77)	0.104
- After pregnancy	92	12(13)	80(87)	
Gestational age (weeks)				
- 27- 34	136	11(8.1)	125(91.9)	<0.001
- 35 - 42	446	187(41.9)	259(58.1)	
Gravidity				
- Primigravida	130	45(34.6)	85(65.4)	0.004
- Multigravida	362	136(37.6)	226(62.4)	
- Grand multigravida	89	17(19.1)	72(80.9)	
Willingness of pregnancy				
- Yes	265	84(31.7)	181(68.3)	0.591
- No	302	103(34.1)	199(65.9)	
BMI				
- < 18.5	19	8(42.1)	11(57.9)	0.164
- 18.5 – 24.9	272	99(36.4)	173(63.6)	
- 25 – 29.9	133	45(33.8)	88(66.2)	
- ≥ 30	50	14(22.2)	49(77.8)	



Table 7. Association of sleep quality with sociodemographic characteristics in both Iraqi and Turkey separately

Variables	Sleep quality in Iraqi sample		P-value	Sleep quality in Turkey sample		P-value
	Good No.(%)	Poor No.(%)		Good No.(%)	Poor No.(%)	
Age						
- <19	3(27.3)	8(72.7)	<0.001	0(0)	9(100)	0.093
- 20-29	65(44.5)	81(55.5)		64(34.8)	120(65.2)	
- 30-39	27(28.4)	68(71.6)		35(35.7)	63(64.3)	
- ≥40	1(2.9)	33(97.1)		3(60)	2(40)	
Educational status						
- Illiterate	4(11.1)	32(88.9)	0.002	0(0)	0(0)	0.379
- Read and write	9(32.1)	19(67.9)		2(18.2)	9(81.8)	
- Basic school	9(22)	32(78)		49(39.21)	76(60.8)	
- Secondary school	40(46.5)	46(53.5)		36(31)	80(69)	
- University	33(35.1)	61(64.9)		15(34.1)	29(65.9)	
Occupation						
- Employed	23(28.4)	58(71.6)	0.329	17(47.2)	19(52.8)	0.094
- Unemployed	71(35.1)	131(64.9)		85(32.7)	175(67.3)	
Family income						
- Low	52(48.5)	55(51.4)	<0.001	66(33.8)	129(66.2)	0.161*
- Lower middle	43(31.4)	94(68.6)		19(38)	31(62)	
- Upper middle	1(2.6)	38(97.4)		2(100)	0(0)	
- High	0(0)	3(100)		0(0)	0(0)	
Number living in house						
- ≤ 5	92(38.7)	146(61.3)	<0.001	88(33.2)	177(66.8)	0.476
- > 5	2(4.4)	43(95.6)		2(25)	6(75)	

\*Fischer exact test was used.

Table 8. Association of sleep quality with medical and obstetrical characteristics in both Iraqi and Turkey separately

Variables	Sleep quality in Iraqi sample		P-value	Sleep quality in Turkey sample		P-value
	Good No. (%)	Poor No. (%)		Good No. (%)	Poor No. (%)	
Anxiety (STAI-Trait)						
- Low anxiety	16(40)	24(60)	0.370	32(35.6)	58(64.4)	0.894
- High anxiety	80(32.5)	166(67.5)		70(34)	136(66)	
Anxiety (STAI-State)						
- Low anxiety	69(40.8)	100(59.2)	0.002	25(41.7)	35(58.3)	0.224
- High anxiety	27(23.1)	90(76.9)		77(32.6)	159(67.4)	
Depression						
- Depressed	37(20.8)	141(79.2)	<0.001	23(21.1)	86(78.9)	<0.001
- Not depressed	59(54.6)	49(43.4)		79(42.2)	108(57.8)	
RLS						
- Positive	1(6.3)	15(93.8)	0.026	24(35.3)	44(64.7)	0.885
- Negative	95(36.2)	175(64.8)		78(34.2)	150(65.8)	
GERD						
- Low reflux probability	71(40.3)	105(59.7)	<0.001	78(41.5)	110(58.5)	0.001
- Inconveniencing GERD	15(44.1)	19(55.9)		7(14.3)	42(85.7)	
- Disrupting GERD	10(13.2)	66(86.8)		17(28.8)	42(71.2)	
Gestational age (weeks)						
- 27- 34	7(5.9)	112(94.1)	<0.001	4(23.5)	13(76.5)	0.435
- 35 - 42	89(53.3)	78(46.7)		98(35.1)	181(64.9)	
Gravidity						
- Primi gravida	17(38.6)	27(61.4)	<0.001	28(32.6)	58(67.4)	0.891
- Multi-gravida	68(40.5)	100(59.5)		68(35.1)	126(64.9)	
- Grand multi-gravida	11(15.1)	62(84.9)		6(37.5)	10(62.5)	
Willingness of pregnancy						
- Yes	34(28.3)	86(71.7)	0.361	50(34.5)	95(65.5)	1.000
- No	53(34)	103(66)		50(34.2)	96(65.8)	
Having chronic disease						
- Yes	6(17.6)	28(82.4)	0.051	10(33.3)	20(66.7)	1.000
- No	90(35.7)	162(64.3)		92(34.6)	174(65.4)	
Snoring						
- Yes	23(19.2)	97(80.8)	<0.001	8(17.4)	38(82.6)	0.011
- No	73(44)	93(56)		94(37.6)	156(62.4)	
Starting snoring						
- Before pregnancy	13(22.8)	44(77.2)	0.158	4(23.5)	13(76.5)	0.325
- After pregnancy	8(12.7)	55(87.3)		49(33.8)	25(86.2)	
BMI						
- < 18.5	1(25)	3(75)	0.261	7(46.7)	8(53.3)	0.552
- 18.5 – 24.9	55(37.4)	92(62.6)		44(35.2)	81(64.8)	
- 25 – 29.9	27(31.8)	58(68.2)		18(37.5)	30(62.5)	
- ≥ 30	9(21.4)	33(78.6)		5(23.8)	16(76.2)	

Table 9. Binary logistic regression of associated factors of poor-quality sleep

	B	Sig.	OR	95% C.I. for OR	
				Lower	Upper
<b>Depression</b>	0.74	0.002	2.096	1.302	3.375
<b>GERD</b>		0.054			
Low reflux probability (reference)					
Inconveniencing GERD	0.605	0.085	1.832	0.92	3.647
Disrupting GERD	0.616	0.044	1.852	1.016	3.377
<b>STAI-State</b>	0.789	0.001	2.202	1.363	3.559
<b>Gravidity</b>		0.685			
Primigravida (reference)					
Multigravida	-0.128	0.807	0.880	0.316	2.455
Grand multi gravida	-0.306	0.508	0.736	0.297	1.825
<b>Gestational age</b>	2.507	0.000	12.273	5.441	27.683
<b>Number living in house</b>	0.41	0.546	1.507	0.399	5.692
<b>Age (year)</b>		0.249			
< 19 (reference)					
20-29	-1.015	0.190	0.362	0.079	1.655
30-39	-0.782	0.332	0.458	0.094	2.222
≥ 40	0.092	0.932	1.096	0.133	9.058
<b>Education level</b>		0.063			
Illiterate	1.451	0.010	4.267	1.425	12.778
Read and write	1.306	0.443	1.358	0.622	2.963
Basic school	-0.007	0.977	0.993	0.618	1.595
Secondary school	-0.123	0.593	0.884	0.563	1.389
University (reference)					
<b>Snoring</b>	0.685	0.017	1.984	1.131	3.48
Constant	-0.752	0.439	0.471		