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Sleep Quality and Health-Related Quality of Life in Pregnancy

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ABSTRACT

The aim of this study was to investigate sleep quality and health-related quality of life in pregnancy. In a cross-sectional design, 492 women (292 pregnant and 200 nonpregnant healthy controls) were included in this study between November 2014 and June 2015. Participants completed a survey on sociodemographic characteristics, the Pittsburgh Sleep Quality Index (PSQI), and the European Quality of Life–5 Dimensions (EQ-5D). The PSQI total and EQ-5D scores of pregnant women were significantly worse than the controls ($P = .017$ and $P < .001$, respectively). Linear regression analysis showed that only pregnancy status was related to PSQI scores ($\beta = .117$; $P = .009$). Compared with the first trimester, the risk of poor sleep quality increased 2.11-fold in the second trimester ($P = .048$) and 1.86-fold in the third trimester ($P = .054$). Compared with the first trimester, EQ-5D scores significantly decreased in the second ($P = .038$) and third ($P < .001$) trimesters. Sleep quality and health-related quality of life of pregnant women were worse than those of nonpregnant healthy controls. Healthcare professionals need to be aware of deteriorations in sleep quality and health-related quality of life of pregnant women.

Key Words: health-related quality of life, pregnancy, pregnancy trimesters, sleep

Pregnancy is a process that creates significant anatomical, physiological, and biochemical changes in a woman's life. These changes affect the physical and emotional behaviors of women and can lead to decreased health-related quality of life.[1] Pregnancy is an emotional and enjoyable event for many women and leads to excitement and anticipation. However, it can also lead to sleep disturbances, even in women without prior sleep problems. Hormonal changes during pregnancy are one of the reasons for sleep disturbances. For instance, daytime sleepiness in the first trimester can be explained by rising progesterone levels and snoring can be explained by the inhibitory effect of hormonal changes on muscles.[2] Nausea and other discomforts during pregnancy can lead to a significant loss of sleep, and anxiety about the upcoming birth can lead to insomnia.[2] Therefore, sleep disturbances during pregnancy are a concern for pregnant women.[2] The purpose of this study was to investigate sleep quality and health-related quality of life in samples of both pregnant and nonpregnant healthy women. A second aim was to investigate sleep quality and health-related quality of life as they relate to pregnancy trimesters.

BACKGROUND

Sleep is a basic requirement comprising psychological, physiological, and social dimensions; thus, it affects one's health and health-related quality of life.[3,4] Mechanical and hormonal changes that occur during pregnancy can alter the sleep patterns of women. The majority of women (97%) have reported sleep disturbances by the third trimester of pregnancy.[5] The National Sleep Foundation[2] noted that 78% of pregnant women reported more sleep disturbances during pregnancy than at any other time in their lives. Several sleep disorders are common during pregnancy, such as insomnia, restless legs syndrome, sleep apnea,

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nocturnal gastroesophageal reflux, and frequent nighttime urination.[2,5–7] In a prospective cohort study, Facco et al[8] investigated the prevalence and noted the pattern of sleep disturbances during pregnancy among healthy nulliparous women. They reported shorter mean sleep durations and increased frequent snoring in the third trimester when compared with the baseline assessment. They also reported increased restless legs syndrome (31.2%) and overall poor sleep quality (53.5%) in the third trimester. In healthy nulliparous women, sleep disturbances and poor sleep quality are more prevalent while the mean sleep duration is shorter.[8]

Sleep becomes more restless and fragmentary as pregnancy advances and thus sleep quality worsens. Deterioration in sleep quality is a significant problem for pregnant women since it may affect physiological, cognitive/behavioral, emotional, and social health. Other factors affected may include the inflammatory system, fat/glucose metabolism, social/professional relationships, cognitive functions, mental/mood states, and overall health-related quality of life.[7,9] In the first trimester of pregnancy, total sleep time increases but sleep quality is disturbed. The amount of reported sleep begins to decrease in the second trimester, and sleep disturbances (restless legs syndrome and nightly nocturnal awakenings) reach the highest rates in the third trimester.[10] Many women report extreme fatigue, especially during the first and third trimesters of pregnancy. Sleep problems and fatigue can depend on changing hormonal levels.[2] Lee and Gay[11] reported that sleeping less than 6 hours per night can affect longer labors and more cesarean births. Beebe and Lee[12] also reported progressively deteriorating sleep quality in the last 5 days of pregnancy.

Sleep patterns are disrupted in pregnancy, and it may take years after the birth to reestablish undisturbed sleep. Sleep problems are at the highest level in the first postpartum month, especially for first-time mothers.[13] Deterioration of sleep quality during pregnancy increases the risk of postpartum depression, but determining sleep quality and eliminating sleep disorders during pregnancy can reduce depressive symptoms.[5] This study investigates the sleep quality and health-related quality of life in pregnant women and provides additional information to the literature on sleep quality characteristics together with health-related quality of life during pregnancy.

LITERATURE REVIEW

Sleep disturbances are more common during pregnancy. Lee[14] noted that nocturia is the most prevalent complaint negatively affecting sleep quality and leg cramps increase from 10-15% during early pregnancy to 75% during the third trimester. Kennedy et al[15] noted that 70% of pregnant women had sleep disturbances due to urinary frequency and nocturia during the antepartum period. Pregnant women sometimes have difficulty getting back to sleep when they awake at night.[15] Signal et al[16] noted that total sleep time of pregnant women adjusted by age, ethnicity, employment status, and socioeconomic status was 30 minutes less on average than nonpregnant women in the population. In addition, the risk of excessive daytime sleepiness in pregnant women was 1.8 times higher than that of nonpregnant women.[16] Picchietti et al[17] noted that restless legs syndrome affects approximately one-fifth of women during pregnancy in Western countries and negatively impacts sleep quality. Treatment options during pregnancy focused on diet and lifestyle modifications, as pregnant women were unwilling to take any medications for sleep disturbances.[14] Simple modification of bedroom environment may improve sleep quality.[18] Also, mindful yoga intervention in the second trimester of pregnancy improves sleep quality and diminishes total number of awakenings at night.[19]

A quarter of the female population is at high risk for obstructive sleep apnea. Habitual snoring is the most prevalent symptom among those women.[20] Obstructive sleep apnea in a cohort of obese pregnant women is associated with more frequent preeclampsia.[21] Franklin et al[22] examined 502 pregnant women adjusting for age and weight, and they noted that snoring is an independent risk factor for both hypertension and preeclampsia. Once sleep disordered breathing is diagnosed in pregnant women and treated, as a consequence, complications such as preeclampsia may be prevented.[23]

Poor sleep quality during pregnancy is associated with mood swings.[24,25] An association was reported between sleep disturbances and depressive symptoms in the third trimester of pregnancy and during the third month postpartum.[26] Maternal snoring is reported to be an independent factor associated with prenatal depressive symptoms.[27]

The health-related quality of life is a concept consisting of many components that address the physical, social, emotional, and psychological status of an individual.[1] In a cross-sectional study, Nicholson et al[28] examined health-related quality of life among early pregnant women receiving prenatal care using the SF-36 scale. They reported poor health-related quality of life during early pregnancy in women with depressive symptoms. In a prospective observational study, Lacasse et al[29] examined the effect of nausea and vomiting on health-related quality of life during pregnancy. They reported that the presence and severity of nausea and vomiting decrease health-related quality of life. In addition, more than half of pregnant women report

back pain during pregnancy, and back pain reduces health-related quality of life in pregnancy, especially in the third trimester.[30]

METHODS

Subjects and data collection procedures

In a cross-sectional design, 292 pregnant women and a control group comprising 200 nonpregnant healthy women were matched for age, education, and region. This study was conducted in 2 cities (Edirne and Kırklareli) in Turkey between November 2014 and June 2015. Pregnant women who applied for a routine pregnancy follow-up visit to the Departments of Gynecology and Obstetrics of Trakya University Medical Faculty (Edirne) and Special Medikent Hospital (Kırklareli) were included. Nonpregnant healthy women were selected by a random sampling method and were matched with pregnant women for age, education, and region.

Pregnant and nonpregnant healthy women between 18 and 49 years of age were included in this study. Women meeting the following criteria were excluded from the study: those with a psychiatric or sleep disorder history, those taking a psychiatric drug or sleeping pills, those with any chronic health problems, and those younger than 18 years or older than 49 years.

All participants completed a survey that was developed by researchers to obtain sociodemographic characteristics. They also completed the Pittsburgh Sleep Quality Index (PSQI) for sleep quality and the European Quality of Life–5 Dimensions (EQ-5D) scale to assess health-related quality of life.

Measurement instruments

The PSQI was developed by Buysse et al[31] in 1989 to evaluate sleep quality. It consists of 18 items of which 4 questions are open-ended and 14 are ranked on a Likert scale from 0 to 3. Higher scores indicate poor sleep quality. A total score higher than 5 is assessed as poor sleep quality. This cutoff point has a sensitivity of 89.6% and a specificity of 86.5%.[31] The validity and reliability of the Turkish version of the PSQI were reported by Ağargün et al[32] in 1996 (Cronbach $\alpha = 0.80$). The Cronbach α for the PSQI was reported as 0.75 in another study conducted on a Turkish nurse sample.[33] In this study, the Cronbach α coefficient of the PSQI was found to be 0.74 and assessed as having moderate reliability.

The EQ-5D scale is a standardized health-related quality-of-life instrument that was developed for measuring health outcomes. It is a short and simple questionnaire that consists of 5 items: mobility, self-care, usual activities (eg, work, study, housework, family, or leisure activities), pain/discomfort, and anxiety/depression. Each item is ranked on a 3-point Likert scale, such as 1 = no problems, 2 = some problems, or 3 = major problems. The EQ-5D scale produces an index score indicating quality of life as a single value, which ranges from −0.59 to 1.[34] Higher scores indicate a good health-related quality of life. In a previous study, the Cronbach α coefficient for the EQ-5D scale was 0.86.[35] The Cronbach α coefficient for the EQ-5D scale in this study was 0.73, and it was assessed as having moderate reliability.

Ethical consideration

The Scientific Research Ethical Committee of the authors' institution reviewed and approved this study (TUTF-BAEK 2014/180). The aims of this study were explained to the participants at the beginning of the study. The women who volunteered to participate completed the questionnaires during face-to-face interviews.

Statistical analysis

Internal consistency of the scales was assessed by the Cronbach α coefficient. The normality of distribution of numeric variables was tested by a 1-sample Kolmogorov-Smirnov test. The ages of pregnant and control groups were compared by the Student t test due to the normal distribution. The number of children was compared by the Mann-Whitney U test due to the nonnormal distribution. Education, working status, daily regular exercise, smoking, alcohol consumption, and caffeine intake variables between the pregnant and control groups were compared using χ^2 tests. For comparison of the PSQI scores between the pregnant and control groups, the Mann-Whitney U test was used, and for the EQ-5D score comparisons, the Student t test was used.

The effects of pregnancy, age, number of children, education, working status, daily regular exercise, smoking, alcohol consumption, and caffeine intake (cola, coffee, etc) on the PSQI and EQ-5D scores were investigated by univariable linear regression analyses. The variables that were significant factors in the univariable linear regression model were then entered into the multivariable linear regression model.

Women were classified as having "good sleep quality" (PSQI score ≤ 5) and "poor sleep quality" (PSQI score >5) according to the PSQI scores; sleep quality between pregnant and control groups was then compared using χ^2 tests. The effects of pregnancy status on poor sleep quality were examined by logistic regression analysis. The PSQI and EQ-5D scores among pregnancy trimesters were compared by

the Kruskal-Wallis test. SPSS 20.0 statistical software (released 2011; IBM Corporation, Armonk, New York) was used for statistical analyses, and P values of less than .05 were accepted as statistically significant.

RESULTS

As noted in Table 1, of the 492 women enrolled in this study, 292 (59.3%) were pregnant and 200 (40.7%) were healthy controls. The average age was 28.4 ± 6.0 years, and the median number of children was 1. No significant differences were found in age or education level between the pregnant and control groups ($P = .713$ and $P = .335$, respectively). The number of children of women in the control group was higher than that for pregnant women ($P = .017$). Working status, smoking, alcohol consumption, and caffeine intake of pregnant women were significantly lower than those of the controls ($P < .001$, $P = .002$, $P < .001$, and $P = .003$, respectively). Daily regular exercise in the pregnant group was higher than that of the control group, but this was not statistically significant ($P = .093$).

As noted in Table 2, the effects of pregnancy and several other factors on sleep quality and health-related quality of life were investigated by univariable and multivariable linear regression analyses. Among the variables (pregnancy, age, number of children, education, working status, daily regular exercise, smoking, alcohol consumption, and caffeine intake [cola, coffee, etc]) entered into the univariable linear regression analysis, only pregnancy status ($\beta = .117$; $P = .009$) was an effective factor on sleep quality. Therefore, a multivariable linear regression model was not created. This showed that pregnancy was significantly associated with worse sleep quality. Also, among those variables, pregnancy ($\beta = -.336$; $P < .001$), education ($\beta = .110$; $P = .014$), and working status ($\beta = .101$; $P = .025$) were found to be factors related to health-related quality of life. These 3 variables were then entered into the multivariable linear regression model, and pregnancy ($\beta = -.330$; $P < .001$) and education ($\beta = .093$; $P = .035$) were found to be factors related to health-related quality of life. The multivariable linear regression model showed that pregnancy was significantly associated with worse health-related quality of life and having more than an 8-year education level was associated with better health-related quality of life.

Comparisons of the EQ-5D and PSQI scores by pregnancy status are shown in Table 3. The PSQI total score of pregnant women was significantly higher than that of the controls ($P = .017$). Furthermore, the PSQI score in the third trimester was significantly higher than that in the first trimester ($P = .048$). However, there were no significant differences in PSQI scores between the first and second trimesters or the second and third trimesters ($P > .05$). The percentage of poor sleep quality in pregnant women (31.5%) was higher than that of the

Table 1. Demographic characteristics of participants

	Total ($N = 492$)	Pregnant ($n = 292$)	Control ($n = 200$)	P
Age, mean ± SD, y	28.4 ± 6.0	28.3 ± 5.4	28.5 ± 6.8	.713
Number of children, median (interquartile range)	1 (0-1)	0.5 (0-1)	1 (0-2)	.017[a]
Education, *n* (%)				
≤8 y	217 (44.1)	134 (45.9)	83 (41.5)	.335
>8 y	275 (55.9)	158 (54.1)	117 (58.5)	
Working status, *n* (%)				
No	281 (57.1)	190 (65.1)	91 (45.5)	<.001[a]
Yes	211 (42.9)	102 (34.9)	109 (54.5)	
Daily regular exercise, *n* (%)				
No	323 (65.7)	183 (62.7)	140 (70.0)	.093
Yes	169 (34.3)	109 (37.3)	60 (30.0)	
Smoking, *n* (%)				
No	394 (80.1)	247 (84.6)	147 (73.5)	.002[a]
Yes	98 (19.9)	45 (15.4)	53 (26.5)	
Alcohol, *n* (%)				
No	478 (97.2)	290 (99.3)	188 (94.0)	<.001[a]
Yes	14 (2.8)	2 (0.7)	12 (6.0)	
Caffeine (cola, coffee, etc) intake, *n* (%)				
No	142 (28.9)	99 (33.9)	43 (21.5)	.003[a]
Yes	350 (71.1)	193 (66.1)	157 (78.5)	
Pregnancy, *n* (%)				
No	200 (40.7)	. . .	. . .	. . .
Yes	292 (59.3)	. . .	. . .	. . .

[a] *P* values are significant.

Table 2. **Related factors with PSQI and EQ-5D scores**

Covariates	Types of covariates	PSQI score		EQ-5D score			
		Univariate		Univariate		Multivariate	
		Standardized β	*P*	Standardized β	*P*	Standardized β	*P*
Pregnancy	0: No						
	1: Yes	.117[a]	.009[a]	−.336[a]	<.001[a]	−.330[a]	<.001[a]
Age	Numeric	−.018	.692	−.057	.206	. . .	. . .
Number of child	Numeric	.019	.667	−.048	.291	. . .	. . .
Education	0: ≤8 year						
	1: >8 year	−.026	.570	.110[a]	.014[a]	.093[a]	.035[a]
Working status	0: No						
	1: Yes	−.064	.158	.101[a]	.025[a]	.011	.802
Daily regular exercise	0: No						
	1: Yes	−.045	.319	.018	.692	. . .	. . .
Smoking	0: No						
	1: Yes	.065	.149	.0005	.992	. . .	. . .
Alcohol	0: No						
	1: Yes	−.033	.460	.072	.108	. . .	. . .
Caffeine (cola, coffee, etc) intake	0: No						
	1: Yes	−.023	.610	.015	.742	. . .	. . .

Abbreviations: EQ-5D, European Quality of Life–5 Dimensions; PSQI, Pittsburgh Sleep Quality Index.
[a] *P* values are significant.

controls (24.5%). Compared with the controls, the risk of poor sleep quality increased 1.41-fold (95% confidence interval [CI], 0.94-2.12) in pregnant women, but this was not significantly different ($P = .092$). Compared with the first trimester, the risk of poor sleep quality increased 2.11-fold (95% CI, 1.00-4.45) in the second trimester ($P = .048$) and 1.86-fold (95% CI, 0.99-3.51) in the third trimester ($P = .054$). The mean EQ-5D score in pregnant women was significantly higher than that of the controls ($P < .001$). Compared with the first trimester, the EQ-5D scores significantly decreased in the second ($P = .038$) and third ($P < .001$) trimesters. However, there were no significant differences in the EQ-5D scores between the second and third trimesters ($P = .379$).

DISCUSSION

This study evaluated sleep quality and health-related quality of life during pregnancy. The primary finding from this study was that sleep quality of pregnant women was worse than that of nonpregnant controls. A logistic regression model showed that, compared

Table 3. **Comparisons of the EQ-5D and PSQI scores by pregnancy status**

	EQ-5D score	PSQI score				
		PSQI score, median (interquartile range)	Good sleep quality (PSQI ≤5), *n* (%)	Poor sleep quality (PSQI >5), *n* (%)	*P*	OR (95% CI)
Groups						
Control	0.87 ± 0.18	3 (2-5)	151 (75.5)	49 (24.5)		1
Pregnant	0.72 ± 0.21	4 (2-6)	200 (68.5)	92 (31.5)	.092	1.41 (0.94-2.12)
P	<.001	.017				
Trimesters						
First	0.81 ± 0.18	3.5 (2-5)	61 (78.2)	17 (21.8)		1
Second	0.72 ± 0.23[a]	4 (2-6.25)	39 (62.9)	23 (37.1)	.048	2.11 (1.00-4.45)
Third	0.68 ± 0.21[b]	4 (3-7)[a]	100 (65.8)	52 (34.2)	.054	1.86 (0.99-3.51)
P	<.001	.045				

Abbreviations: CI, confidence interval; EQ-5D, European Quality of Life–5 Dimensions; OR, odds ratio; PSQI, Pittsburgh Sleep Quality Index.
[a] $P < .05$ compared with first trimester.
[b] $P < .001$ compared with first trimester.

with the first trimester, the risk of poor sleep quality increased in both the second and third trimesters. Multivariable linear regression models showed that pregnancy was significantly associated with a worse health-related quality of life. Compared with the first trimester, health-related quality of life decreased in the second and third trimesters.

Women experience significant sleep problems during pregnancy,[36] and poor sleep quality in pregnancy has been associated with preterm birth.[37] Sleep disturbances seen in pregnancy may be linked to adverse outcomes, such as gestational hypertension and cesarean birth.[38] Furthermore, Zafarghandi et al[39] reported that the quality and duration of sleep can affect birth type, labor length, birth weight, and Apgar score. The proportion of poor sleep quality in the present study was 31.5%. This result is similar to those of Van Ravesteyn et al[40] (39%) and Pınar et al[41] (39.6%) for pregnant women. However, Mindell et al[36] reported a higher rate (76%). These findings indicate that at least one-third of pregnant women experience poor sleep quality during any part of pregnancy. Changes in sleep patterns during pregnancy can be explained by several hormonal and mechanical factors.[5] Okun et al[42] reported that a household income for pregnant women that was less than US $50 000 per year is associated with poorer sleep quality and greater sleep fragmentation. Correspondingly, Pınar et al[41] reported that low socioeconomic level is associated with poorer sleep quality during pregnancy.

The results of the univariable linear regression model showed that pregnancy was significantly associated with a worse PSQI score. Correspondingly, Ko et al[43] found that pregnant women experienced a deterioration in sleep quality compared with healthy controls. Lee[14] noted that sleep disturbances are more common during pregnancy. Nocturia was the most prevalent complaint affecting sleep quality, and leg cramps increased from 10-15% during early pregnancy to 75% during the third trimester. Total sleep time of pregnant women adjusted by age, ethnicity, employment status, and socioeconomic status is average 30 minutes less than that of nonpregnant women in the population.[16]

When compared with the first trimester, a significant deterioration in sleep quality in the third trimester was observed. However, no significant difference was observed in sleep quality between the second and third trimesters. These results are similar to the findings of Hayase et al,[44] who reported no significant difference in sleep quality between the second and third trimesters in pregnant women with pregnancy-induced hypertension and gestational diabetes mellitus. Back muscle pains, general discomfort, night waking, snoring, leg cramps, and restless legs syndrome, which were seen in the third trimester, can lead to a deterioration in sleep quality.[2] Sleep disturbances such as frequent snoring, excessive daytime sleepiness, restless legs syndrome, insomnia, and poor sleep quality are prevalent. Mean sleep duration is shorter among healthy nulliparous women, and these disturbances increase as the pregnancy progresses.[8]

The results of the multivariable logistic regression analysis showed that the risk of poor sleep quality increased in the second and third trimesters when compared with the first trimester. In the work of Facco et al,[8] the prevalence of poor sleep quality and sleep disturbances during pregnancy among healthy nulliparous women was investigated in a prospective cohort design. Similarly, they reported higher PSQI scores in the third trimester than at the baseline assessment. They reported an increase in poor sleep quality in the third trimester.[8]

The results of the multivariable linear regression model showed that pregnancy was significantly associated with health-related quality of life and educational level. Significantly lower health-related quality of life scores in pregnant women were observed than those in nonpregnant healthy controls. Also, a significant decrease was observed in the health-related quality of life during the second and third trimesters of pregnancy when compared with the first trimester. Da Costa et al[1] reported that the quality of life in the third trimester significantly decreased when compared with the Canadian normative means of healthy women. Furthermore, in that same study, sleep problems were found to negatively affect the quality of life during pregnancy.[1] Consistent with the results of Horan et al[45] in the current study, better health-related quality of life was observed in women who had greater than an 8-year education level. Findings from the present study support the conclusion that pregnancy negatively affects health-related quality of life and that deterioration in sleep quality during pregnancy can negatively affect health-related quality of life.

Poor sleep patterns during pregnancy may increase the risk of postpartum depression in the mother.[5] Wu et al[46] reported that poor sleep quality during the third trimester increased the risk of postpartum depressive symptoms and sleep problems have been associated with depressive symptoms during pregnancy.[47] Studies have also demonstrated that anxiety and depression increase as a result of increased psychological symptoms in pregnancy.[48,49] Findings of this study indicate that a deterioration in sleep quality during pregnancy, especially in the third trimester, can increase the risk of postpartum depressive symptoms. Perinatal healthcare professionals need to be aware of deteriorations in sleep quality of pregnant women. This information enables healthcare professionals to provide

adequate counseling to pregnant women relative to the impact of sleep quality on adverse outcomes as well as general expectations regarding sleep disturbances by pregnancy trimester.

Findings of this study support the hypothesis that pregnancy negatively affects both health-related quality of life and sleep quality. Poor sleep quality may further reduce health-related quality of life. In this study, sleep quality and health-related quality of life of pregnant and nonpregnant healthy women were compared in a cross-sectional design. Future studies might include interventions to improve sleep quality and assess the consequences of such interventions during pregnancy.

LIMITATIONS

This study has both strengths and weaknesses. Pregnant women at different health centers who received routine prenatal care in 2 cities in Turkey were included, and controls were selected by a random sampling method from these 2 cities. To avoid any selection bias, controls were matched for age, education, and region. Validated questionnaires were used to measure sleep quality and health-related quality of life, thus avoiding information bias.

There were some limitations as well. The survey method was cross-sectional; thus, prospective follow-up studies would be more accurate for defining the effect of pregnancy on sleep quality and health-related quality of life. Furthermore, pregnant women in 2 centers may not be truly representative of pregnant women elsewhere in Turkey or in other communities or countries, so generalizability is limited. The tools used were self-report questionnaires and represented the perceptions of the study participants and not the physiological data documenting sleep quality. Thus, self-reported data obtained by self-report questionnaires are subject to recall and nonsystematic errors.

CONCLUSION

The findings of this study demonstrate that sleep quality and health-related quality of life of pregnant women were worse than those of the nonpregnant healthy controls. Risk of poor sleep quality increased in both the second and third trimesters compared with the first trimester. Compared with the first trimester, health-related quality of life significantly decreased in the second and third trimesters. More studies are needed to clarify the role of improved sleep quality in health-related quality of life during pregnancy.

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