The Effect of Impaired Sleep on Preterm Labour

M Dolatian[1], Z Mehraban[2], K Sadeghniat[3]

ABSTRACT

Background: *Sleep disturbance has become an important health problem for pregnant women. In fact, pregnancy-associated sleep disorder has been recognized as a distinct clinical entity. We aimed to study the relationship between sleep disturbance and preterm birth during pregnancy in a sample of Iranian women.*

Methods: *In this analytical cohort study, 231 pregnant women in their 28th–32nd gestational week were recruited, using the multistage sampling method, from four healthcare centres in Ardabil, Iran, during 2010. The women were followed-up until 37-week gestation. One hundred and twelve women did not have sleep disturbances while 119 women had sleep disturbances. The Insomnia Severity Index (ISI), Epworth Sleepiness Scale (ESS), and a demographic data questionnaire were used for data collection. Data were analysed using SPSS software. Descriptive statistics, t, Chi-square, Fisher's exact, and Mann-Whitney tests were used as appropriate.*

Results: *The prevalence of preterm labour was 11.8% in women with sleep disorder compared with 11.6% in women without sleep disorder (*$p = 0.9$*). Sleep duration less than eight hours, daytime dysfunction and impaired quality of life as a component of ISI showed a significant relationship with preterm birth (*$p = 0.02$*,* $p = 0.044$*, and* $p = 0.047$*, respectively).*

Conclusion: *Although daily dysfunction and lower quality of life because of sleep problems, and total sleep duration were variables associated with preterm birth, we found no significant relationship between sleep disorder and preterm birth.*

Keywords: Epworth Sleepiness Scale (ESS), Insomnia Severity Index (ISI), pregnancy, preterm labour, sleep, sleep disturbances

Efecto de los Trastornos del Sueño en el Trabajo de Parto Prematuro

M Dolatian[1], Z Mehraban[2], K Sadeghniat[3]

RESUMEN

Antecedentes: *La alteración del sueño se ha convertido en un importante problema de salud para las mujeres embarazadas. De hecho, los trastornos del sueño asociados con el embarazo han sido reconocidos como una entidad clínica distinta. El objetivo del presente trabajo fue estudiar la relación entre los trastornos del sueño y los nacimientos prematuros durante el embarazo en una muestra de mujeres iraníes*

Métodos: *En este estudio de cohorte analítica, se reclutaron 231 mujeres embarazadas en su semana gestacional de 28 – 32, utilizando el método de muestreo por etapas, de cuatro centros de atención a la salud en Ardabil, Irán, durante el año 2010. Las mujeres tuvieron seguimiento hasta la semana 37 de gestación. Ciento doce mujeres no tuvieron trastornos del sueño, en tanto que 119 mujeres tuvieron trastornos del sueño. El índice de severidad de insomnio (ISI), la escala de somnolencia de Epworth (ESS) y un cuestionario de datos demográficos, fueron utilizados para la recolección de datos. Los datos fueron analizados usando el software SPSS. La estadística descriptiva, t, Chi-cuadrado, el test exacto de Fisher, y las pruebas de Mann-Whitney, fueron usadas según correspondiera.*

Resultados: *La prevalencia del trabajo de parto prematuro fue de 11.8% en las mujeres con trastorno del sueño, en comparación con el 11.6% en las mujeres sin trastorno del sueño (*$p = 0.9$*). La duración del sueño de menos de ocho horas, la disfunción diurna, así como el deterioro de la calidad de vida como un*

From: [1]Department of Midwifery and Reproductive Health, Shahid Beheshti University of Medical Sciences, Tehran, Iran, [2]Department of Medicine, Ardabil Branch, Islamic Azad University, Ardabil, Iran and [3]Department of Occupational Medicine, Tehran University of Medical Sciences, Tehran, Iran.

Correspondence: Dr Z Mehraban, Basij Sque, Department of Medicine, Ardabil Branch, Islamic Azad University, Ardabil, Iran. E-mail: zahraob81@yahoo.com

DOI: 10.7727/wimj.2012.305

*componente de ISI, mostraron una relación significativa con los nacimientos prematuros (*p = *0.02,* p = *0.044 y* p = *0.047, respectivamente).*
Conclusión: *Aunque la disfunción diurna y el deterioro de la calidad de vida debido a problemas con el sueño, al igual que la duración total del sueño, fueron variables asociadas con el parto prematuro, no hallamos ninguna relación significativa entre el trastorno del sueño y los nacimientos prematuros.*

Palabras claves: Escala de Somnolencia de Epworth (ESS), Índice de Severidad del Insomnio (ISI), embarazo, trabajo de parto prematuro, sueño, trastornos del sueño

West Indian Med J 2014; 63 (1): 63

INTRODUCTION

Preterm birth is defined as birth before 37 completed gestational weeks. It has an incidence of about 5% and 25% in developed and developing countries, respectively (1). Preterm birth accounts for 75% of perinatal mortalities and more than half of the long-term morbidities. It also imposes excessive costs for diagnosis, treatment and care. Moreover, it is a great challenge for families and healthcare providers with respect to time and energy consumption to overcome the resultant financial burden (2, 3).

Some serious complications of preterm labour for neonates include death, respiratory distress syndrome, necrotizing enterocolitis, intraventricular haemorrhage and long-term disability (4, 5). Despite improved living standards, healthcare and diagnostic and therapeutic technologies, the cause of two-thirds of preterm labour is still unknown. High rates of preterm birth are seen in poor communities, which might result from biological and psychosocial factors. The mental health of the mothers during pregnancy affects maternal health as well as fetal development (6–8).

Proper sleep is an important process leading to psychological and physical health. High-quality sleep affects health and the process of recovery from illness (9). Physical work, exercise, illness, pregnancy and psychological stress are situations in which an individual needs more sleep (10). On the other hand, pregnancy causes both an increase in sleep disorders and a relevant change in the sleep profile and pattern. About two-thirds of pregnant women consider their sleep pattern to be abnormal (11). Sleep disturbance has become an important health problem for pregnant women. In fact, pregnancy-associated sleep disorder has been recognized as a distinct clinical entity (12).

Coleman and colleagues believed that if women at risk for preterm labour could be diagnosed, their prenatal prognosis might improve. Therefore, the best way to prevent preterm labour is to provide adequate antenatal care for pregnant women in order to identify risk factors (13). A few studies have shown that one of the risk factors of preterm labour could be altered sleep patterns and sleep disorders (14–16).

Considering the importance of healthy sleeping during pregnancy, the high prevalence of sleep disorders in late pregnancy and its potential impact on perinatal outcome and preterm birth and the lack of studies on sleep disorders in pregnancy in our country, we aimed to assess the relationship between sleep disorders and preterm birth in a sample of pregnant women referred to healthcare centres during 2010.

SUBJECTS AND METHODS

The multi-stage sampling method was used in this cohort study to sample 241 pregnant women recruited from four healthcare centres (Bakeri, Shahid Hatami, Azadegan and Bahonar) in Ardabil, Iran between June 20 and November 28, 2010.

The inclusion criteria were: (a) being in the 28^{th}–32^{nd} weeks of gestation, (b) singleton pregnancy, (c) between 18 and 40 years of age, (d) the ability to read and write, (e) did not work on night shifts, (f) had no addiction to drugs, did not smoke or drink alcohol, (g) had no history of diagnosed medical or obstetrical complication before and during pregnancy and (h) no history of psychiatric disorder leading to sleep impairment or diagnosed sleep disorders. Women with diagnosed obstetrical complications at the time of study and those who were recently treated for urinary or vaginal tract infection were excluded.

The data collection tools were demographic and midwifery questionnaires, the Insomnia Severity Index (ISI) and the Epworth Sleepiness Scale (ESS) which have been validated for the Iranian population (17, 18). The ISI is a brief self-report instrument, measuring the patient's perception of his or her insomnia and includes seven items; each is rated on a 0–4 scale and the total score ranges from 0–28. A higher score suggests more severe insomnia. The ESS measures daytime sleepiness (6). It is a self-administered questionnaire in which the subjects are asked to rate the likelihood that they would fall asleep or doze off in each of the eight common situations in life on a scale of 0–3. Each participant would then be given a total score out of 24. A higher ESS score represents more severe subjective sleepiness. The internal consistency reliability (α Cronbach) was 0.77 and 0.83 for the ESS and the ISI questionnaires, respectively, which was acceptable.

Written informed consent was obtained from each participant, who then completed both questionnaires during routine office visits. After completing the questionnaire, the pregnant women whose responses indicated that they had impairment were considered in the sleep disorder group while the women who indicated that they were without any disturbance were considered in the group without sleep disorder. Finally,

231 pregnant women (112 women in the group without sleep disorder and 119 women in the group with sleep disorder) were followed-up until their 37th week of gestation for the occurrence of preterm birth. After delivery, data were obtained from their records upon referral to health centres. If the women were not referred to health centres, they would be followed-up using their address or through phone calls using the numbers provided in their records.

Data were analysed using SPSS software, version 17. Descriptive statistics, *t*, Chi-squared, Fisher's exact, and Mann-Whitney tests were used as appropriate. The significance level was set at 0.05.

RESULTS

Two hundred and forty-one pregnant women were asked to complete the questionnaires. Ten women were excluded from the study because of obstetrical (such as preterm birth, pre-eclampsia, vaginal bleeding *etc*) and medical complications. One hundred and twelve (48.5%) women had no sleep disorders compared with 119 (51.5%) women who had sleep disorders. Of the women without sleep disorder, 13 (11.6%) developed preterm labour compared with 14 (11.8%) with preterm labour in the group with sleep disorder ($p = 0.9$; Table 1). Table 2 shows the demographic characteristics of the study population.

Table 1: Comparison of sleep variables between the term and preterm groups

Sleep variable		Term group Mean ± SD	Pre-term group Mean ± SD	*p*-value
Sleep disorder	No	99 (88.4)	13 (11.6)	$p = 0.9$
	Yes	105 (88.2)	14 (11.8)	
Total sleep time (> 8 hours)		8.87 ± 1.81	8.44 ± 2.17	$p = 0.02$*
Insomnia Severity Index (ISI)		7.68 ± 4.62	6.52 ± 4.51	$p = 0.3$
Epworth Sleepiness Scale (ESS)		6.15 ± 3.30	6.27 ± 3.56	$p = 0.5$
ISI: difficulty falling asleep (%)		93 (45.6)	9 (3.33)	$p = 0.06$
ISI: difficulty staying asleep (%)		77 (37.7)	10 (37)	$p = 0.1$
ISI: difficulty waking too early (%)		71 (34.8)	12 (44.4)	$p = 0.5$
ISI: satisfaction with sleep (%)		115 (56.4)	15 (55.6)	$p = 0.3$
ISI: daily dysfunction (%)		126 (61.8)	13 (48.1)	$p = 0.044$*
ISI: impairing quality of life (%)		95 (46.6)	17 (63)	$p = 0.047$*
ISI: worry about sleep (%)		101 (49.5)	18 (66.7)	$p = 0.3$

Table 2: Demographic characteristic of the pregnant women in the study population

Characteristic	Group	Women without sleep disorder n (%)	Women with sleep disorder n (%)
Age (years)	18–24	39 (38.4)	57 (47.9)
	25–29	38 (33.9)	30 (25.2)
	30–34	28 (25)	29 (24.4)
	35–45	7 (6.3)	3 (2.5)
Body mass index (kg/m^2)	< 19.8	6 (2.6)	15 (6.6)
	19.9–25	44 (19.3)	51 (22.4)
	25.1–28	24 (10.5)	25 (11)
	> 28.1	36 (15.8)	27 (11.8)
Education	Initial	27 (24.1)	21 (17.6)
	Guidance school	17 (15.2)	21 (17.6)
	High school	47 (42)	57 (47.9)
	University	21 (18.8)	20 (16.8)
Partner's education	Initial	26 (23.2)	25 (21.2)
	Guidance school	23 (20.5)	24 (20.3)
	High school	43 (38.4)	46 (39)
	University	20 (17.9)	23 (19.5)
Employment status	Housewife	117 (98.3)	104 (92.9)
	Working	2 (1.7)	8 (7.1)
Partner's job	Employee	20 (16.9)	24 (21.4)
	Padrone	0 (0)	1 (0.9)
	Worker	19 (16.1)	20 (17.9)
	Open work	78 (66.1)	65 (58)
	No work	1 (0.8)	2 (1.8)
Marital length (years)	< 5	56 (50.5)	63 (53.4)
	6–9	28 (25.2)	27 (22.9)
	10–13	13 (11.7)	14 (11.9)
	> 14	14 (12.6)	14 (11.9)
Parity	1	59 (50.5)	71 (60.2)
	2	36 (32.1)	25 (21.2)
	3	13 (11.6)	15 (12.7)
	4	1 (0.9)	4 (3.4)
	> 5	3 (2.7)	3 (2.5)
Gestational age at the first assessment (weeks)	28	41 (36.6)	46 (39)
	29	11 (9.8)	14 (11.9)
	30	13 (11.6)	9 (6.7)
	31	19 (17)	9 (6.7)
	32	28 (25)	40 (33.9)
Present weight (kg)	45–50	0 (0)	5 (4.2)
	51–60	11 (9.9)	14 (11.9)
	61–70	40 (36)	43 (36.4)
	71–80	28 (25.2)	30 (25.4)
	81–90	26 (23.4)	13 (11)
	> 90	6 (5.4)	13 (11)
Caffeine use	No	96 (85.7)	105 (88.2)
	Yes	16 (14.3)	14 (11.8)

The pregnant women who had sleep disorder were younger housewives with higher body mass indices (BMIs) and nearly all of them had upper high school education. However, we found no significant relationship between sleep disorder and the variables such as age, education level, partner's educational level, occupation, spouse's employment status, duration of marriage, gestational age, weight of the women at the beginning of the study, caffeine consumption before bed and type of delivery.

The women diagnosed with sleep disorder had higher ESS and ISI scores without any significant statistical difference (Table 1). However, we found that variables such as inadequate sleep (*ie* less than eight hours), daytime sleepiness and lower quality of life because of sleep disturbance were significantly associated with preterm birth ($p = 0.02$, $p = 0.044$, and $p = 0.047$, respectively). The relative risk of preterm birth for people who slept less than eight hours was 2.26 times. The corresponding figure for women with sleep disturbance was 1.48 times.

Of pregnant women with sleep disorder, 59.2% underwent Caesarean section compared with 68% of women without sleep disorder ($p = 0.19$). The fetal birthweights of pregnant women diagnosed with sleep disorder were lower than the neonates of women without sleep disorder ($p = 0.07$, Table 3).

Table 3: Birth outcome of pregnant women diagnosed with and without sleep disorder

Birth outcome	Women without sleep disorder n (%)	Women with sleep disorder n (%)	*p*-value
Birthweight (g)			
< 2500	3 (1.4)	2 (0.9)	
2600–3000	30 (13.6)	29 (13.2)	0.07
3001–4000	70 (31.8)	78 (35.5)	
> 4001	5 (2.3)	3 (1.4)	
Delivery type			
Caesarean	66 (68)	61 (59.2)	0.19
Normal vaginal delivery	31 (32)	42 (40.8)	

DISCUSSION

The relationship between sleep disorder and preterm delivery was investigated and the findings revealed that only daily dysfunction, lower quality of life because of sleep problems and total sleep duration were variables associated with preterm birth. Nevertheless, the relationship between sleep disorder and preterm birth was not significant. At the beginning of this study, the demographic data and gestational age of the two groups of women were compared. Caffeine use before bed, type of delivery, fetal gender and birthweight were similar between the groups, so their potential effects on preterm birth were identical in both groups.

Almost one-fourth (22.4%) of pregnant women with sleep disturbance and 19.3% of women without sleep disturbance had a BMI of 19.9–25 kg/m^2, which was in the normal range. Previous studies have reported a lower BMI range [< 19.8–21] (19–21). Different BMI can affect the sleep pattern because women with a high BMI have an increased neck circumference which predisposes them to obstructive sleep apnoea and causes them to wake up more frequently at night, with a decreased functional capacity during the day. However, different BMI between various studied groups showed no significant impact on preterm birth (17, 22).

The mean overall sleep hours in the preterm group were 8.44 ± 2.17. The risk of preterm birth was 2.2 times higher in women who slept less than eight hours. In another study that examined the relation between sleep quality and preterm labour, the mean night's sleep between the two studied groups with term and preterm births was about 7.42 ± 1.30 hours, but the amount of sleep did not affect the type of labour (16). Another study showed that sleeping less than or equal to eight hours/day in the second and third trimester was a risk factor for gestational age. In the referenced study, the length of sleep was investigated with one question and the response varied according to the subjective perception of sleep duration and individual differences in sleep length (19). The effect of sleep length on preterm labour can be better investigated using objective methods such as polysomnography and actigraphy.

We found a correlation between daily dysfunction as a variable of the ISI, and preterm birth ($p = 0.044$); 61.8% and 48.1% of the women in the term and preterm birth groups, respectively experienced daily dysfunction. Previous studies have shown that daily dysfunction occurs in 46.2–54% of women during pregnancy (16, 20, 23). In those studies, the Pittsburgh Sleep Quality Index (PSQI) questionnaire was used and the researchers found that taking naps can reduce the amount of daily dysfunction, although the exact definition and specifications of naps were not mentioned in the questionnaire. In our study, 46.6% of the women with term delivery had an impaired quality of life. The corresponding figure for the women with preterm delivery was 63%. We found a correlation between impaired quality of life and preterm birth. Sleep disturbance affects both physical and psychiatric aspects of an individual's life. Da Costa and colleagues observed that quality of life was reduced considerably during the third trimester (24). However, quality of life is influenced by many factors such as anxiety, depression, sleep disturbance and unhealthy lifestyles during pregnancy.

The incidence of preterm birth was 11.8% in the group with sleep disorder. There was no significant difference between the groups with and without sleep disorder regarding preterm delivery. However, based on the relative risk test (RR), preterm birth was 1.48 times higher in the group with sleep disorders. In the study by Strange and colleagues (16), 62.5% of women with poor sleep quality had preterm delivery although this finding was not statistically significant. In that study, the researchers had used the PSQI questionnaire to assess the sleep quality. The women included in the study had multiple pregnancies, genitourinary infections during pregnancy and used sleeping pills and alcohol (16). Therefore, the

results of that survey cannot be compared with those of the current study given the difference in inclusion criteria.

In our study, the measurements of sleep disorder were done in the third trimester – a period close to the time of delivery and which is accompanied by more maternal stress. Stress *per se* has been mentioned as a confounding factor for preterm labours in some studies, hence affecting our results (25, 26).

The evaluation of sleep disorder solely based on subjective and self-reported responses makes it impossible to assess the objective physiological measurements of sleep. Polysomnography is a gold standard for the evaluation of sleep-wake parameters. However, it was not suitable for screening large populations because of its cost and difficulty in clarifying sleep nature. Polysomnography is usually performed on a single night while women with sleep disorder experience the problem on different nights with various degrees. So the finding of polysomnography cannot be extrapolated to all nights of the pregnancy period. Besides, the participants may not sleep well when monitored.

Studies that evaluated the correlation between subjective and objective assessments using polysomnography revealed that the subjects frequently underestimated total sleep time (27). However, other studies have revealed that subjective assessments closely mirrored those obtained from polysomnography (27–29).

In our study, the women with sleep disorder did not have higher Caesarean section rates compared with the women without sleep disorder (59.2% *vs* 68%). The total Caesarean section rate was approximately 63.5% and the type of birth between the groups was not statistically significant. Sleep disorders did not increase the incidence of Caesarean birth (although Caesarean birth rates were 1.34-fold higher in the sleep disturbance group). In Lee and Gay's study (30), Caesarean section rate had a five-fold increase in the sleep disorder group. Aliakbari and colleagues also reported a 2.7-fold increase in Caesarean birth rate in the group with sleep impairment (18). The reason for these different results was obstetrical factors, such as delivery type, which could affect the outcome of labour. However, the evaluation between the type of delivery and sleep disorders was not one of the aims of our study and we did not investigate this in detail.

The main strength of our study is its prospective design with serial questionnaire that made it possible to assess sleep trends during pregnancy. Moreover, we included healthy women to reduce or eliminate certain potential confounding factors, such as sleep disturbances caused by medical conditions. Despite the significant difference found between variables such as sleep length, quality of life and daily dysfunction because of sleep disorder, and preterm birth, the general lack of association between the other measured variables in this study (ISI, ESS) and preterm birth may be explained by limitations in measurement. Another limitation might also be the subjective nature of sleep disorder measurements. While both the ESS and ISI evaluate important aspects of sleep disorder, they are limited by the individual's perception and may not accurately reflect true sleep disorders. The principal limitation of this study is that it only assessed subjective sleep symptoms.

CONCLUSION

Randomized controlled trials with larger samples using subjective and objective tools are needed to accurately determine maternal and fetal outcomes of sleep disorder diagnosed during pregnancy. Sleep disorder during pregnancy may cause adverse fetal outcomes. Sleep disorder symptoms should be assessed in all pregnant women and suspected cases should be referred for polysomnography. Early diagnosis and management may decrease the adverse outcomes associated with sleep disorder during pregnancy.

ACKNOWLEDGMENTS

This study was supported by the School of Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran. We owe much gratitude to all the nursing staff of the mother healthcare centres of the School of Medicine, Ardabil University (Bakeri, Shahid Hatami, Azadegan and Bahonar) and the participants in this study. We also wish to thank Mrs Aliakbari and Geimadi for their help in preparing the questionnaire.

REFERENCES

1. Steer P .The epidemiology of labour. BJOG 2005; **112:** 1–3.
2. Goldenberg RL, Gulhane JF, Romero R. Epidemiology and causes of preterm birth. Lancet 2008; **371:** 75–84.
3. Johnson TS, Rottier KJ, Luellwitz A, Kirby RS. Maternal pre-pregnancy body mass index and birth of a preterm infant in Missouri 1998–2000. Public Health Nurs 2008; **26:** 3–31.
4. Chandraharan E, Arulkumaran S. Recent advances in management of preterm labor. J Obstet Gynecol India 2005; **55:** 118–24.
5. Cunningham FG, Gant NF, Leveno KJ, Gilstrap LC, Hauth JC, Wenstrom KD. Williams obstetrics. 21st ed. New York: McGraw-Hill; 2005.
6. Jesse DE, Seaver W, Wallace DC. Maternal psychosocial risk predicts preterm birth in a group of women from Appalachia. Midwifery 2003; **19:** 191–202.
7. Holzman C, Jetton J, Siler-Khodr T, Fisher R, Rip T. Second trimester corticotropin. Obstet Gynecol 2001; **97:** 657–63.
8. Federenko IS, Wadhwa PD. Women's mental health during pregnancy influence fetal and infant developmental and health outcomes. CNS Spectr 2004; **9:** 198–206.
9. Potter PA, Perry AG. Fundamentals of Nursing. 6th ed. Salami S et al, translators. Tehran: Salami; 2005. [Persian]
10. Kaplan HI, Sadok BJ. Synopsis of psychiatry: behavioral sciences/clinical psychiatry. 3rd ed. Poorafkari N, translator. Tehran: Shahrab Publication; 2003. [Persian]
11. Lopes EA, Carvalho LB, Seguro PB, Mattar R, Silva AB, Prado LB et al. Sleep disorders in pregnancy. Arg Neuropsiquiatr 2004; **62:** 217–21.
12. Ko SH, Chang SC, Chen CH. A comparative study of sleep quality between pregnant and non-pregnant Taiwanese women. J Nurs Scholarsh 2010; **42:** 23–30.
13. Coleman MA, Keelan JA, McCowan LM, Townend KM, Mitchell MD. Predicting preterm delivery: comparison of cervicovaginal interleukin (IL)-1beta, IL-6 and IL-8 with fetal fibronectin and cervical dilatation. Eur J Obstet Gynecol Reprod Biol 2001; **95:** 154–8.
14. Chang JJ, Pienbe GW, Duntleycf SP, Maconesdg GA. Sleep deprivation during pregnancy and maternal and fetal outcomes. Sleep Med Rev 2010; **14:** 107–14.
15. Okun ML, Roberts JM, Marsland AL, Hall M. How disturbed sleep may be a risk factor for adverse pregnancy outcomes: a hypothesis. Obstet Gynecol Surv 2009; **64:** 273–80.

16. Strange LB, Parker KP, Moore ML, Strickland OL, Bliwise DL. Disturbed sleep and preterm birth: a potential relationship? Clin Exp Obstet Gynecol 2009; **36:** 166–8.
17. Sadeghniiat K, Labbafinejad Y. Sleepiness among Iranian lorry drivers. Acta Medica Iranica 2007; **45:** 149–52.
18. Aliakbari S, Bloori B, Sadeghniat KH, Alavimjd H. Relationship between sleep disturbances in last month of pregnancy and length of labor and type of birth in women referring to health centers saggez. JIUMS 2006; **15:** 8–14. [Persian]
19. Abeysena C, Jayawardana P, DE A Seneviratne R. Maternal sleep deprivation is a risk factor for small for gestational age: a cohort study. Aust N Z J Obstet Gynaecol 2009; **49:** 382–7.
20. Leung LP, Hui DSC, Leung NT, Yuen PM, Lau TK. Sleep disturbances in Chinese pregnant women. BJOG 2005; **112:** 1568–71.
21. Naud K, Ouellet A, Brown C, Pasquier JC, Moutquin JM. Is sleep disturbed in pregnancy? J Obstet Gynaecol Can 2010; **32:** 28–34.
22. Sahin FK, Koken G, Cosar E, Saylan F, Fidan F, Yilmazer M et al. Obstructive sleep apnea in pregnancy and fetal outcome. Int J Obstet Gynaecol 2008; **100:** 141–6.
23. Azevedo S, Maia B, Pereira AT, Marques M, Soares MJ, Macedo VA. Sleep disturbances in late pregnancy. Sleep Med 2007; **8:** 51.
24. Da Costa D, Dritsa M, Verreault N, Balaa C, Kudzman J, Khalifé S. Sleep problems and depressed mood negatively impact health-related quality of life during pregnancy. Arch Womens Ment Health 2010; **13:** 249–57.
25. Dole N, Savitz DA, Hertz-Picciotto I, Siega-Riz AM, McMahon MJ, Buekens P. Maternal stress and preterm birth. Am J Epidemiol 2003; **157:** 14–24.
26. Orr ST, Reiter JP, Blazer DG, James SA. Maternal prenatal pregnancy-related anxiety and spontaneous preterm birth in Baltimore, Maryland. Psychosom Med 2007; **69:** 566–70.
27. Johns MW. A new method for measuring daytime sleepiness: the Epworth sleepiness scale. Sleep 1991; **145:** 40–5.
28. Morin CM, Belleville G, Bélanger L, Ivers H. The insomnia severity index: psychometric indicators to detect insomnia cases and evaluate treatment response. Sleep 2011; **34:** 6018.
29. Bastien CH, Vallières A, Morin CM. Validation of the insomnia severity index as an outcome measure for insomnia research. Sleep Med 2001; **2:** 297–307.
30. Lee KA, Gay CL. Sleep in late pregnancy predicts length of labor and type of delivery. Am J Obstet Gynecol 2004; **191:** 2041–6.