Sleep disturbances are a common occurrence in pregnant women. The National Sleep Foundation estimates that 78% of women experience sleep disturbances during pregnancy. Sleep disturbance issues occur in response to changes in normal sleep/wake patterns. Excessive daytime sleepiness (EDS), sleep deprivation, night waking, daytime napping, insomnia, and restless leg syndrome are the most common sleep disturbances reported by pregnant women.

EDS, a symptom of diverse disorders and causes, is a disabling condition frequently described by pregnant women. An estimated 52–65% of women are affected by EDS at some point during their pregnancy, and its prevalence is thought to increase as the pregnancy progresses. According to the American Academy of Sleep Medicine, people with EDS are unable to stay awake and alert during major waking episodes of the day, inappropriately dozing off at times when they should be awake. This behavior repeats daily for a minimum of three months. In addition, patients may report severe tiredness, fatigue, and lack of energy. EDS is a sleep disturbance known to impair daily functioning in all aspects of life (school, work, interpersonal relationships), and to negatively affect the quality of life. Studies have shown that EDS in pregnancy is associated with adverse maternal and obstetric
Pregnant women with EDS and sleep apnea are more likely to develop gestational diabetes, suffer from clinical depression, postpartum depression, and undergo a cesarean section. The Epworth Sleepiness Scale (ESS), a self-reported questionnaire, is often used as an easy and reliable screening tool to assess daytime sleepiness in pregnant women. Studies have identified the following factors to be significantly associated with EDS in pregnant women: age (younger vs. older women), employment status (employed vs. unemployed), number of pregnancies (first pregnancy), restless leg syndrome, sleep-disordered breathing, and pre-eclampsia. EDS is frequently observed during all stages of pregnancy. However, some studies suggest its severity increases with pregnancy advancement and is more prevalent in the third trimester.

Obstructive sleep apnea (OSA) is a major cause of EDS. OSA is characterized by partial or complete upper airway collapse leading to airflow obstruction and repetitive episodes of breathing pauses and/or shallow breathing. Predominant symptoms of EDS are associated with obstructive OSA, but not all patients with OSA suffer from EDS. The gold standard for diagnosing OSA is polysomnography. However, this test is time-consuming and expensive. The Berlin Questionnaire (BQ) is a more rapid and less costly method of screening for OSA. The self-reported questionnaire evaluates the symptoms of OSA and categorizes the respondent into either high- or low-risk groups for OSA. Positive BQ reporting represents a high risk of OSA development. The prevalence of pregnant women being in the high-risk group for OSA has been reported as 20% in one study and 32.2% in another. Furthermore, pregnant women who are overweight or obese may have pre-eclampsia or suffer from chronic diseases (diabetes, hypertension, and chronic inflammation) and have a significantly higher risk for OSA compared to healthy pregnant women. OSA in pregnancy is associated with increased maternal risk of gestational diabetes and hypertension, pre-eclampsia, and preterm and cesarean delivery. Furthermore, they are at higher risk of low birth weight, being small for gestational age, and are frequently admitted to intensive care units.

In Saudi Arabia, to date, few studies are investigating the prevalence or correlates of EDS and OSA. In our previously published research about EDS and OSA among the general population, we found 31.9% at high risk of OSA when using the BQ. The risk of symptomatic OSA by combining BQ and EDS using ESS was 7.8%. To the best of our knowledge, no studies have assessed EDS and OSA among pregnant women in Saudi Arabia. EDS and OSA have been associated with poor maternal and neonatal health outcomes in pregnancy. Therefore, health care providers need to detect pregnant women at risk for these conditions early so that timely preventative interventions can be implemented. This is the first study to report the prevalence of OSA and EDS among pregnant women in Saudi Arabia. In addition, we hope to identify factors associated with the high risk for OSA and EDS using a validated Arabic version of the ESS and the BQ.

**METHODS**

We conducted a cross-sectional study between 1 June and 1 November 2014 in the department of Obstetrics and Gynecology (OB/GYN) at King Abdulaziz Medical City, Riyadh, Saudi Arabia. King Abdullah International Medical Research Center, Riyadh gave ethical approval for the study with protocol number RC13/106. The study sample was recruited from pregnant women who attended OB/GYN outpatient clinics for routine pregnancy checkups. Every year approximately 25 000 pregnant women visit the OB/GYN outpatient clinics, and this sample is calculated based on a confidence level of 95% with a margin of error of 5%, given a minimum sample size of 380 participants. We included all Saudi women who agreed to participate in the study, and we recruited an average of five participants every day during the study period. A consecutive sampling technique was performed on pregnant women who attended other obstetrics outpatient clinics at the hospital.

The survey included four sections. The first section assessed demographic data: age, education level, and coffee and tea intake. The second section assessed clinical and sleep characteristics: trimester, history of abortion, diabetes, depression, anemia, pain (abdominal pain due to uterine contraction), sleep duration (average hours of sleep per day), and insomnia. The third section assessed daytime sleepiness as measured by the Arabic version of the ESS. ESS is a method to measure the chances of falling asleep while engaged in eight different activities.
activities. An ESS value of 11 is considered EDS. The fourth section assessed the high risk for sleep apnea, as measured by the Arabic version of the BQ. The BQ is comprised of 10 items, including wake time, snoring behavior, fatigue, history of obesity, hypertension, and obesity (body mass index > 30). A score of 2 or more was classified as a high risk for OSA. Verbal consent for participation was obtained from all subjects included in the study. A total of 630 anonymous surveys were distributed, and 517 pregnant women consented and completed the questionnaire giving a response rate of 82.1%.

The data analysis was performed by SPSS Statistics (IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.). The sample characteristics were summarized by percentages [Table 1]. The overall prevalence of EDS, high risk of OSA, and both EDS and high risk of OSA were reported by percentage and 95% confidence interval (CI). We used the chi-square test to assess the associations between the sample characteristics across EDS, the high risk of OSA, and both EDS and high risk of OSA [Table 2]. After adjusting for the sample characteristics in Table 2, we used multiple logistic regression models to determine the association between the sample characteristics and the presence of EDS, high risk of OSA, and both EDS and high risk of OSA in our sample [Table 3]. P-values < 0.050 were considered significant.

**RESULTS**

A total of 517 pregnant Saudi women were included in the analysis. Of the sample, 72.3% were in the third trimester, 53.1% had university degrees, 44.8% had a history of abortion, and 6.8% had diabetes mellitus [Table 1]. The mean age of the sample studied was 30.1 ± 5.4 years, with an age range of 17–47 years.

The overall prevalence of EDS was 32.1% (166 of 517) with 95% CI: 28.10%–36.30%. Of the pregnant women studied, 37.1% (192 of 517) had a high risk of OSA with 95% CI: 33.00%–41.50%. The presence of both (EDS and high risk of OSA) was 14.9% (77 of 517) with 95% CI: 11.90%–18.30%.

The overall prevalence of insomnia was 28.2%, while the prevalence of EDS was significantly higher in pregnant women with insomnia than in those without insomnia (41.8% vs. 28.3%, p = 0.003) [Table 2].

| Table 1: Sample characteristics. |
|----------------------------------|
| Characteristics | n | % |
| Age, years          |    |   |
| < 25                | 77 | 14.9 |
| 25–36               | 372| 72.1 |
| > 36                | 67 | 13.0 |
| Third trimester     |    |   |
| No                  | 143| 27.7 |
| Yes                 | 374| 72.3 |
| University          |    |   |
| No                  | 236| 46.9 |
| Yes                 | 267| 53.1 |
| Coffee intake       |    |   |
| No                  | 128| 24.8 |
| Yes                 | 389| 75.2 |
| Tea intake          |    |   |
| No                  | 268| 51.8 |
| Yes                 | 249| 48.2 |
| History of abortion |    |   |
| No                  | 234| 55.2 |
| Yes                 | 190| 44.8 |
| Diabetes mellitus   |    |   |
| No                  | 482| 93.2 |
| Yes                 | 35 | 6.8 |
| Depression          |    |   |
| No                  | 502| 97.1 |
| Yes                 | 15 | 2.9 |
| Anemia              |    |   |
| No                  | 416| 80.5 |
| Yes                 | 101| 19.5 |
| Bronchial asthma    |    |   |
| No                  | 462| 89.4 |
| Yes                 | 55 | 10.6 |
| Sleep duration, hours |  |   |
| < 7                 | 302| 60.0 |
| 7–9                 | 154| 30.6 |
| > 9                 | 47 | 9.3 |
| Have pain per week  |    |   |
| None                | 142| 27.6 |
| Once                | 113| 21.9 |
| Twice               | 121| 23.5 |
| Three times and above | 139| 27.0 |
| Insomnia            |    |   |
| No                  | 371| 71.8 |
| Yes                 | 146| 28.2 |
| EDS                 |    |   |
| No                  | 351| 67.9 |
| Yes                 | 166| 32.1 |
| High risk for OSA   |    |   |
| No                  | 325| 62.9 |
| Yes                 | 192| 37.1 |
| EDS and OSA         |    |   |
| No                  | 440| 85.1 |
| Yes                 | 77 | 14.9 |

*EDS: excessive daytime sleepiness; OSA: obstructive sleep apnea.*
Table 2: EDS, high risk for OSA, and both EDS and high risk for OSA and their relation to the sample characteristics.

| Factors                              | EDS                  | High risk for OSA | EDS and high risk for OSA |
|--------------------------------------|----------------------|-------------------|---------------------------|
|                                      | No   | Yes  | Low risk | High risk | No   | Yes  | p    | No   | Yes  | Low risk | High risk | p    |
| Age, years                           | n    | %    | n     | %    | p    | n    | %   | n    | %   | p    | n    | %   | p    |
| < 25                                 | 49   | 63.6 | 28   | 36.4 | 0.097 | 54   | 70.1 | 23   | 29.9 | 0.028*  | 63   | 81.8 | 14 | 18.2 | 0.426  |
| 25–36                                | 249  | 66.9 | 123  | 33.1 | 0.237 | 63.7 | 135  | 36.3 | 316  | 84.9 | 56  | 15.1  | 0.544  |
| > 36                                 | 53   | 79.1 | 14   | 20.9 | 0.33  | 49.3 | 34   | 50.7 | 60   | 89.6 | 7   | 10.4  | 0.058  |
| Third trimester                      | No   | 99   | 69.2 | 44   | 30.8 | 0.687 | 96   | 67.1 | 47   | 32.9 | 0.214 | 127  | 88.8 | 16 | 11.2  | 0.143  |
|                                      | Yes  | 252  | 67.4 | 122  | 32.6 | 0.229 | 61.2 | 145  | 38.8 | 313  | 83.7 | 61  | 16.3  | 0.579  |
| Coffee intake                        | No   | 82   | 64.1 | 46   | 35.9 | 0.285 | 85   | 66.4 | 43   | 33.6 | 0.339 | 107  | 83.6 | 21 | 16.4  | 0.467  |
|                                      | Yes  | 269  | 69.2 | 120  | 30.8 | 0.240 | 61.7 | 149  | 38.3 | 333  | 85.6 | 56  | 14.4  | 0.002* |
| Tea intake                           | No   | 179  | 66.8 | 89   | 33.2 | 0.578 | 161  | 60.1 | 107  | 39.9 | 0.173 | 220  | 82.1 | 48 | 17.9  | 0.046*  |
|                                      | Yes  | 172  | 69.1 | 77   | 30.9 | 0.164 | 65.9 | 85   | 34.1 | 220  | 88.4 | 29  | 11.6  | 0.113  |
| History of abortion                  | No   | 162  | 69.2 | 72   | 30.8 | 0.684 | 152  | 65.0 | 82   | 35.0 | 0.544 | 205  | 87.6 | 29 | 12.4  | 0.694  |
|                                      | Yes  | 135  | 71.1 | 55   | 28.9 | 0.118 | 62.1 | 72   | 37.9 | 164  | 86.3 | 26  | 13.7  | 0.001* |
| Diabetes mellitus                    | No   | 326  | 67.6 | 156  | 32.4 | 0.643 | 311  | 64.5 | 171  | 35.5 | 0.004* | 412  | 85.5 | 70 | 14.5  | 0.380  |
|                                      | Yes  | 25   | 71.4 | 10   | 28.6 | 0.114 | 40   | 21   | 60.0 | 28   | 80.0  | 7   | 20.0  | 0.380  |
| Depression                           | No   | 341  | 67.9 | 161  | 32.1 | 1.000 | 317  | 63.1 | 185  | 36.9 | 0.431 | 428  | 85.3 | 74 | 14.7  | 0.477  |
|                                      | Yes  | 10   | 66.7 | 5    | 33.3 | 0.008 | 53.3 | 7    | 46.7 | 12   | 80.0  | 3   | 20.0  | 0.001* |
| Anemia                               | No   | 282  | 67.8 | 134  | 32.2 | 0.919 | 261  | 62.7 | 155  | 37.3 | 0.907 | 355  | 85.3 | 61 | 14.7  | 0.765  |
|                                      | Yes  | 69   | 68.3 | 32   | 31.7 | 0.75  | 64   | 63.4 | 37   | 36.6 | 85   | 84.2 | 16  | 15.8  | 0.001* |
| Bronchial asthma                     | No   | 313  | 67.7 | 149  | 32.3 | 0.840 | 299  | 64.7 | 163  | 35.3 | 0.011* | 395  | 85.5 | 67 | 14.5  | 0.469  |
|                                      | Yes  | 38   | 69.1 | 17   | 30.9 | 0.26  | 47.3 | 29   | 52.7 | 45   | 81.8  | 10  | 18.2  | 0.006  |
| Sleep duration, hours                | < 7  | 204  | 67.5 | 98   | 32.5 | 0.925 | 183  | 60.6 | 119  | 39.4 | 0.590 | 251  | 83.1 | 51 | 16.9  | 0.427  |
|                                      | 7–9  | 106  | 68.8 | 48   | 31.2 | 0.97  | 97   | 63.0 | 57   | 37.0 | 133  | 86.4 | 21 | 13.6  | 0.058  |
|                                      | > 9  | 31   | 66.0 | 16   | 34.0 | 0.52  | 68.1 | 15   | 31.9 | 42   | 89.4  | 5   | 10.6  | 0.001* |
| Have pain per week                   | None | 110  | 77.5 | 32   | 22.5 | 0.001* | 109  | 76.8 | 33   | 23.2 | 0.001* | 129  | 90.8 | 13 | 9.2   | 0.058  |
|                                      | Once | 75   | 66.4 | 38   | 33.6 | 0.97  | 66.4 | 38   | 33.6 | 98   | 86.7  | 15 | 13.3  | 0.001* |
|                                      | Twice | 86   | 71.1 | 35   | 28.9 | 0.63  | 52.1 | 58   | 42.9 | 100  | 82.6  | 21 | 17.4  | 0.001* |
|                                      | Three times and above | 78   | 56.1 | 61   | 43.9 | 0.68  | 54.7 | 63   | 37.3 | 111  | 79.9  | 28 | 20.1  | 0.001* |
| Insomnia                             | No   | 266  | 71.7 | 105  | 28.3 | 0.003* | 251  | 67.7 | 120  | 32.3 | 0.001* | 327  | 88.1 | 44 | 11.9  | 0.002* |
|                                      | Yes  | 85   | 58.2 | 61   | 41.8 | 0.17  | 50.7 | 72   | 49.3 | 113  | 77.4  | 33 | 22.6  | 0.001* |

EDS: excessive daytime sleepiness; OSA: obstructive sleep apnea. *Significant at p < 0.050.

The prevalence of a high risk of OSA increases with age (29.9% in ≤ 24 years, 36.3% in 25–36 years, and 50.7% in ≥ 37 year olds, p = 0.028). The high risk of OSA was significantly higher in pregnant
## Table 3: Multivariate factors associated with EDS, high risk for OSA, and EDS and high risk for OSA.

| Factors                     | EDS | High risk for OSA | EDS and high risk for OSA |
|-----------------------------|-----|-------------------|---------------------------|
|                             | 95% CI for OR | 95% CI for OR | 95% CI for OR |
|                             | OR   | Lower  | Upper  | OR   | Lower  | Upper  | OR   | Lower  | Upper  |
| Age, years                  |      |        |        |      |        |        |      |        |        |
| < 25                        | 1.00 | 1.00   | 1.00   | 1.00 | 1.00   | 1.00   | 1.00 | 1.00   | 1.00   |
| 25–36                       | 0.731| 0.88   | 0.41   | 1.85 | 0.218  | 3.56   | 0.864| 0.92   | 0.33   | 2.49   |
| > 36                        | 0.249| 0.52   | 0.16   | 1.58 | 0.043* | 8.68   | 0.325| 0.47   | 0.10   | 2.12   |
| Third trimester             |      |        |        |      |        |        |      |        |        |
| No                          | 0.656| 0.89   | 0.52   | 1.50 | 0.905  | 1.62   | 0.776| 1.11   | 0.53   | 2.31   |
| Yes                         | 0.237| 0.75   | 0.47   | 1.20 | 0.380  | 1.92   | 0.998| 1.00   | 0.52   | 1.89   |
| Coffee intake               |      |        |        |      |        |        |      |        |        |
| No                          | 0.490| 0.83   | 0.48   | 1.41 | 0.655  | 1.50   | 0.380| 0.73   | 0.36   | 1.47   |
| Yes                         | 0.533| 0.87   | 0.55   | 1.36 | 0.124  | 1.09   | 0.029*| 0.50   | 0.26   | 0.93   |
| Tea intake                  |      |        |        |      |        |        |      |        |        |
| No                          | 0.387| 0.75   | 0.39   | 1.43 | 0.860  | 1.74   | 0.847| 1.09   | 0.46   | 2.52   |
| Yes                         | 0.904| 0.94   | 0.34   | 2.56 | 0.034  | 2.71   | 0.290| 1.89   | 0.58   | 6.12   |
| History of abortion         |      |        |        |      |        |        |      |        |        |
| No                          | 0.902| 1.08   | 0.32   | 3.63 | 0.753  | 3.93   | 0.641| 1.40   | 0.33   | 5.80   |
| Yes                         | 0.381| 1.29   | 0.72   | 2.29 | 0.300  | 2.34   | 0.152| 1.71   | 0.82   | 3.55   |
| Diabetes mellitus           |      |        |        |      |        |        |      |        |        |
| No                          | 0.818| 0.92   | 0.45   | 1.87 | 0.318  | 2.75   | 0.530| 1.33   | 0.54   | 3.22   |
| Yes                         | 0.837| 1.10   | 0.46   | 2.61 | 0.431  | 3.14   | 0.810| 0.85   | 0.23   | 3.13   |
| Sleep duration, hours       |      |        |        |      |        |        |      |        |        |
| < 7                         | 0.836| 1.06   | 0.63   | 1.76 | 0.932  | 1.68   | 0.867| 0.94   | 0.46   | 1.90   |
| 7–9                         | 0.837| 1.10   | 0.46   | 2.61 | 0.431  | 3.14   | 0.810| 0.85   | 0.23   | 3.13   |
| > 9                         | 0.003*| 2.59   | 1.38   | 4.83 | 0.003* | 4.81   | 0.144| 1.89   | 0.80   | 4.45   |
| Have pain per week          |      |        |        |      |        |        |      |        |        |
| None                        | 0.150| 1.64   | 0.83   | 3.20 | 0.041* | 3.87   | 0.648| 1.25   | 0.48   | 3.21   |
| Once                        | 0.995| 1.00   | 0.49   | 2.02 | 0.003* | 5.31   | 0.658| 1.24   | 0.47   | 3.21   |
| Twice                       | 0.003*| 2.59   | 1.38   | 4.83 | 0.003* | 4.81   | 0.144| 1.89   | 0.80   | 4.45   |
| Insomnia                    |      |        |        |      |        |        |      |        |        |
| No                          | 0.378| 1.11   | 0.88   | 1.38 | 0.355  | 1.37   | 0.563| 1.09   | 0.81   | 1.45   |
| Yes                         | 0.490| 0.91   | 0.68   | 1.19 | 0.361  | 1.14   | 0.973| 0.99   | 0.69   | 1.43   |

EDS: excessive daytime sleepiness; OSA: obstructive sleep apnea.

*Significant at p = 0.050.
women with diabetes mellitus (60.0% vs. 35.5%, $p = 0.004$), bronchial asthma (52.7% vs. 35.3%, $p = 0.011$), and insomnia (49.3% vs. 32.3%, $p = 0.001$) than those without these issues. The prevalence of EDS and the high risk for OSA was significantly higher in pregnant women who did not consume tea (17.9% vs. 11.6%, $p = 0.046$) and those with insomnia (22.6% vs. 11.9%, $p = 0.002$).

Both frequent pain (abdominal pain due to contractions) (aOR = 2.59; 95% CI: 1.38–4.83) and insomnia (aOR = 1.65; 95% CI: 1.00–2.71) increased the odds of EDS [Table 3].

Older age (≥ 37 years) (aOR = 3.00; 95% CI: 1.03–8.68), pain once a week (aOR = 1.99; 95% CI: 1.02–3.87), pain twice a week (aOR = 2.75; 95% CI: 1.42–5.31), and pain three times or more a week (aOR = 2.57; 95% CI: 1.36–4.81), and insomnia (aOR = 1.95; 95% CI: 1.20–3.16) increased the odds of a high risk of OSA.

**DISCUSSION**

Our study investigated the important issue of EDS and the risk of OSA based on eSS and BQ, respectively, in a cohort of pregnant Saudi women attending a tertiary care facility in Riyadh, Saudi Arabia. There is sparse data in this area of research, and our study has highlighted the prevalence and likely factors associated with EDS and the risk of OSA. To date, sleep disturbances have been associated with poor pregnancy outcomes. Our study reported a high prevalence of OSA and EDS during the pregnancy term. There is a need to establish proper management options to prevent OSA and EDS during pregnancy.

The gold standard for the diagnosis of sleep breathing disorders is polysomnography. However, it is more expensive, time-consuming, and needs more logistics when used as a screening tool in general populations. ESS and BQ are well-validated tools in identifying EDS and patients at high risk of OSA. A recent meta-analysis has shown the sensitivity and specificity of ESS (54% and 65%) and BQ (76% and 59%), respectively, for identifying the risk of OSA. A study by Signal et al. revealed that the prevalence of EDS in their cohort of pregnant women was 1.8-times higher than in the general population. Another study reported an EDS prevalence of 12.7% in their study cohort in middle- to low-income countries. The risk of OSA in pregnant women has a prevalence of 20–32% reported in the literature.

In our study, almost one in three women had either EDS or the risk of OSA based on the questionnaire survey, and 14.9% have both disorders, which is similar to published studies. However, the prevalence of OSA and EDS is much higher than the prevalence among the general Saudi population, which was 7.8%. It will be useful to see, in the future, whether other countries in the region have a similarly high prevalence of OSA in the pregnant cohorts.

The important factors identified in this study that are associated with EDS and the risk of OSA are insomnia, pain-related issues, increasing age, and medical comorbidities. Sleep disturbances, including insomnia, was 28.2% in our study. This is a well-known phenomenon in pregnancy and the incidence of insomnia increases as the pregnancy advances with reported incidences of 12% to 73.5%. Our finding of pain as a contributor to sleep fragmentation, and therefore EDS with the risk of OSA, has been recently published in a large-scale US study involving more than 2400 participants. Low education level, increasing maternal age, and the number of previous abortions were also important risk factors associated with EDS and risk of OSA as factors in other studies.

There are many limitations for our study, first, it uses a questionnaire, which may overestimate the prevalence of OSA. Second, it is a cross-sectional study with known limitations. For example, we could not measure the outcome of pregnancy among those with a high risk of OSA. Furthermore, there are many causes of EDS among pregnant women, which we did not address directly. These factors include poor sleep hygiene, medical problems, and psychosocial issues. The strength of our study is that it is a reasonably large sample and is the first study using validated tools among our population, which addresses major issues about sleep disorders among pregnant women.

**CONCLUSIONS**

Our study identified, for the first time in a cohort of pregnant Saudi women, the prevalence of EDS and the risk of OSA using validated tools. The results of this study would help health care professionals in looking actively for the presence of EDS and OSA in the care of these subjects. They should be diligent
in seeking the right involvement of the teams in education and identification of these symptoms in pregnant women so that the adverse effects of EDS and OSA on pregnancy can be averted.

**Disclosure**
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**REFERENCES**

1. Facco FL, Kramer J, Ho KH, Zee PC, Grobman WA. Sleep disturbances in pregnancy. Obstet Gynecol 2010 Jan;115(1):77-83.

2. Mindell JA, Cook RA, Nikolovski J. Sleep patterns and sleep disturbances across pregnancy. Sleep Med 2015 Apr;16(4):483-488.

3. Ko H, Shin J, Kim MY, Kim YH, Lee J, Kil KC, et al. Sleep disturbances in Korean pregnant and postpartum women. J Psychosom Obstet Gynaecol 2012 Jun;33(2):85-90.

4. Mindell JA, Jacobson BJ. Sleep disturbances during pregnancy. J Obstet Gynecol Neonatal Nurs 2000 Nov-Dec;29(6):590-597.

5. Tsai SY, Lee PL, Lin JW, Lee CN. Persistent and new-onset daytime sleepiness in pregnant women: A prospective observational cohort study. Int J Nurs Stud 2017 Jan;66:1-6.

6. Cai XH, Xie YP, Li XC, Qu WL, Li T, Wang SX, et al. The prevalence and associated risk factors of sleep disorder-related symptoms in pregnant women in China. Sleep Breath 2013 Sep;17(3):951-956.

7. Ohayon MM, O’Hara R, Vitiello MV. Epidemiology of restless legs syndrome: a synthesis of the literature. Sleep Med Rev 2012 Aug;16(4):283-295.

8. Bourjeily G, El Sabbagh R, Sawan P, Raker C, Wang C, Hott B, et al. Epworth sleepiness scale scores and adverse pregnancy outcomes. Sleep Breath 2013 Dec;17(4):1179-1186.

9. Bourjeily G, Raker C, Chalhoub M, Miller M. Excessive daytime sleepiness in late pregnancy may not always be normal: results from a cross-sectional study. Sleep Breath 2013 May;17(2):735-740.

10. Sarbreg M, Svabengor B, Etiréh Á, Josefsson A. Snoring during pregnancy and its relation to sleepiness and pregnancy outcome - a prospective study. BMC Pregnancy Childbirth 2014 Jan;14:15.

11. Facco FL, Grobman WA, Kramer J, Ho KH, Zee PC. Self-reported short sleep duration and frequent snoring in pregnancy: impact on glucose metabolism. Am J Obstet Gynecol. 2010;203(2):142.e1-145.e1.

12. Facco FL, Parker CB, Reddy UM, Silver RM, Koch MA, Louis JM, et al. Association between sleep-disordered breathing and hypertensive disorders of pregnancy and gestational diabetes mellitus. Obstet Gynecol 2017 Jan;129(1):31-41.

13. Tsai SY, Lin JW, Wu WW, Lee CN, Lee PL. Sleep disturbances and symptoms of depression and daytime sleepiness in pregnant women. Birth 2016 Jun;43(2):176-183.

14. Yu Y, Li M, Pu L, Wang S, Wu J, Ruan L, et al. Sleep was associated with depression and anxiety status during pregnancy: a prospective longitudinal study. Arch Womens Ment Health 2017 Oct;20(5):695-701.

15. Ruiz-Robledillo N, Canario C, Dias CC, Moya-Albiol L, Figuerredo B. Sleep during the third trimester of pregnancy: the role of depression and anxiety. Psychol Health Med 2015;20(8):927-932.

16. Okun ML, Hanusa BH, Hall M, Wisner KL. Sleep complaints in late pregnancy and the recurrence of postpartum depression. Behav Sleep Med 2009;7(2):106-117.

17. Okun ML. Sleep and postpartum depression. Curr Opin Psychiatry 2015 Nov;28(6):490-496.

18. Baumgartel KL, Tzirhorst L, Conley YP, Roberts JM. Psychometric evaluation of the Epworth sleepiness scale in an obstetric population. Sleep Med 2013 Jan;14(1):116-121.

19. Nakagome S, Kame Y, Itani O, Ikeda M, Ichinose A, Morioka H, et al. Excessive daytime sleepiness among pregnant women: An epidemiological study. Sleep Biol Rhythms 2014;12(1):12-21.

20. Suzuki K, Ohida T, Sone T, Takemura S, Yokoyama E, Miyake T, et al. The prevalence of restless legs syndrome among pregnant women in Japan and the relationship between restless legs syndrome and sleep problems. Sleep 2003 Sep;26(6):673-677.

21. Izei B, Martin SE, Dundas KC, Liston WA, Calder AA, Douglas NJ. Sleep complaints: snoring and daytime sleepiness in pregnant and pre-eclamptic women. Sleep Med 2005 Mar;6(2):163-169.

22. Leung PL, Hui DS, Leung TN, Yuen PM, Lau TK. Sleep disturbances in Chinese pregnant women. BJOG 2005 Nov;112(11):1568-1571.

23. Pien GW, Fife D, Pack AI, Nkwuo JE, Schwab RJ. Changes in symptoms of sleep-disordered breathing during pregnancy. Sleep 2005 Oct;28(10):1299-1305.

24. Netzer NC, Stoops RA, Netzer CM, Clark K, Strohl KP. Using the Berlin Questionnaire to identify patients at risk for the sleep apnea syndrome. Ann Intern Med 1999 Oct;131(7):485-491.

25. Karaduman M, Sari O, Aydoğan U, Akpak YK, Semiz A, Yıldanlıoğlu NC, et al. Evaluation of obstructive sleep apnea symptoms in pregnant women with chronic disease. J Matern Fetal Neonatal Med 2016 Oct;29(20):3379-3385.

26. Higgins N, Leong E, Park CS, Facco FL, McCarthy RJ, Wong CA. The Berlin Questionnaire for assessment of sleep disordered breathing risk in parturients and non-pregnant women. Int J Obstet Anesth 2011 Jan;20(1):22-25.

27. Ko HS, Kim MY, Kim YH, Lee J, Park YG, Moon HB, et al. Obstructive sleep apnea screening and perinatal outcomes in Korean pregnant women. Arch Gynecol Obstet 2013 Mar;287(3):429-433.

28. Rice JR, Larrabure-Torrevala GT, Luque Fernandez MA, Grande M, Motta V, Barrios YV, et al. High risk for obstructive sleep apnea and other sleep disorders among overweight and obese pregnant women. BMC Pregnancy Childbirth 2015 Sep;15:198.

29. Truong KK, Guillemaintault C. Sleep disordered breathing in pregnant women: maternal and fetal risk, treatment considerations, and future perspectives. Expert Rev Respir Med 2018 Mar;12(3):177-189.

30. Bourjeily G, Danilack VA, Bublitz MH, Lipkind H, Muri J, Caldwell D, et al. Obstructive sleep apnea in pregnancy is associated with adverse maternal outcomes: a national cohort. Sleep Med 2017 Oct;18:50-57.

31. Rajendiran S, Kumari AS, Nimesh A, Soundararaghavan S, Ananthanarayanan PH, Dhiman P. Markers of Oxidative Stress in Pregnant Women with Sleep Disturbances. Oman Med J, vol 35, no 3, May 2020.
36. Al-Jahdali H. Prevalence of sleep apnea and excessive daytime sleepiness in patients with end-stage renal disease on dialysis. Saudi J Kidney Dis Transpl 2012 Mar;23(2):251-261.

37. BaHammam AS, Alrajeh MS, Al-Jahdali HH, BinSaced AA. Prevalence of symptoms and risk of sleep apnea in middle-aged Saudi males in primary care. Saudi Med J 2008 Mar;29(3):423-426.

38. Enezi AA, Al-Jahdali F, Ahmed AE, Shirbini N, Harbi AA, Salim B, et al. Symptoms of daytime sleepiness and sleep apnea in liver cirrhosis patients. Saudi J Kidney Dis Transpl 2012 Mar;23(2):251-257.

39. Alruwaili H, Ahmed A, Fatani A, Al-Otaibi K, Al-Jahdali S, Ali Y, et al. Symptoms and risk for obstructive sleep apnea among sample of Saudi Arabian adults. Sleep Biol Rhythms 2015;13(4):332-341.

40. Ahmed AE, Fatani A, Al-Harbi A, Al-Shimemer A, Ali YZ, Baharoon S, et al. Validation of the Arabic version of the Epworth sleepiness scale. J Epidemiol Glob Health 2014 Dec;4(4):297-302.

41. Saleh AB, Ahmad MA, Awadalla NJ. Development of Arabic version of Berlin questionnaire to identify obstructive sleep apnea at risk patients. Ann Thorac Med 2011 Oct;6(4):212-216.

42. Al-Abri M, Al-Hamhami A, Al-Nabhani H, Al-Zakwani I. Validation of the Arabic version of the Epworth sleepiness scale in Oman. Oman Med J 2013 Nov;28(6):454-456.

43. Chiu H-Y, Chen P-Y, Chuang L-P, Chen N-H, Tu Y-K, Hsieh Y-J, et al. Diagnostic accuracy of the Berlin questionnaire, STOP-BANG, STOP, and Epworth sleepiness scale in detecting obstructive sleep apnea: A bivariate meta-analysis. Sleep Med Rev 2017 Dec;36:57-70.

44. Signal TL, Paine SJ, Sweeney B, Priston M, Muller D, Smith A, et al. Prevalence of abnormal sleep duration and excessive daytime sleepiness in pregnancy and the role of socio-demographic factors: comparing pregnant women with women in the general population. Sleep Med 2014 Dec;15(12):1477-1483.

45. Rice JR, Larrabure-Torrealva GT, Luque Fernandez MA, Grande M, Motta V, Barrios YY, et al. High risk for obstructive sleep apnea and other sleep disorders among overweight and obese pregnant women. BMC Pregnancy Childbirth 2015 Sep;15(1):198.

46. Wolyńczyk-Gmaj D, Rożafańska-Wałędziak A, Ziemiaś K, Ufnal M, Brzezińska A, Gmaj B, et al. Insomnia in pregnancy is associated with depressive symptoms and eating at night. J Clin Sleep Med 2017 Oct;13(10):1171-1176.

47. Fernández-Alonso AM, Trabalón-Pastor M, Chedraui P, Pérez-López FR. Factors related to insomnia and sleepiness in the late third trimester of pregnancy. Arch Gynecol Obstet 2012 Jul;286(1):55-61.

48. Okun ML, Buysse DJ, Hall MH. Identifying insomnia in early pregnancy: validation of the insomnia symptoms questionnaire (ISQ) in pregnant women. J Clin Sleep Med 2015 Jun;11(6):645-654.

49. Kuzilirmak A, Timur S, Kartal B. Insomnia in pregnancy and factors related to insomnia. ScientificWorldJournal 2012;2012:197093.