The Egyptian Journal of Hospital Medicine (July 2023) Vol. 92, Page 6621- 6627

Third Trimester Sleep Disturbance in Comparison with Non-Pregnant Women: A Cross-Sectional Study

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ABSTRACT

Background: Pregnancy causes mechanical, anatomic, and hormonal changes that impact sleep patterns and the pregnant woman's quality of life. **Objectives:** This study aimed to assess the sleep-related breathing disorders among pregnant women in the third trimester compared to non-pregnant women. **Patients and Methods:** The study was conducted in the Department of Obstetrics and Gynecology and the Department of Chest Diseases, Faculty of Medicine, Assiut University. A cross-sectional study was carried on 176 women, assigned into two groups, 88 women in their 3ed trimester of pregnancy and 88 non-pregnant women as a control group. All study participants had been evaluated as regards their sociodemographic characteristics, clinical data, maternal, neonatal outcome, STOP, STOP-Bang questionnaires and polysomnography parameters. **Results:** Regarding STOP and STOP-Bang questionnaires, the highest percentages were 60.2%, 50% in pregnant and non-pregnant women had snore loudly, respectively with no significant difference. There was significant difference between the two groups regarding feeling tired, BMI > 35 kg/m^2, and having neck circumference > 40 cm. There was a significant difference between pregnant and non-pregnant women in term of total snoring score (total score ≥ 3 in 42% of pregnant group, and 12.5% in non-pregnant group). **Conclusion:** As joint difficulties in the third trimester of pregnancy, sleep disruption and its accompanying sleep disorders are mostly ignored. Sleep quality or sleep-related breathing difficulties are closely linked to pregnancy-related medical issues such as preeclampsia and gestational hypertension. Poor sleep quality in the third trimester was associated with advanced maternal age, advanced gestational age, and multiparity.

Keywords: Sleep disturbance, STOP, STOP-Bang, Total snoring score.

INTRODUCTION

Sleep patterns and quality are impacted by the mechanical, anatomical, and hormonal changes that are brought on by pregnancy. Many studies have demonstrated associations between poor sleep and diseases like depression, diabetes, coronary artery disease, and hypertension [1]. The majority of these relationships have been proven in populations that are middle-aged and elderly. It makes biological sense that disturbed sleep patterns would be linked to pregnancy difficulties [2].

Changes in maternal sleep architecture and pattern, insomnia, excessive daytime sleepiness, and more specifically sleep-disordered breathing, which includes obstructive sleep apnea (OSA) and upper airway resistance syndrome, or restless legs syndrome (RLS), are the most significant sleep and vigilance disturbances seen during pregnancy [3].

This potential increased propensity for breathing abnormalities while pregnant may be noteworthy because sleep disruptions may be linked to risky pregnancy outcomes, such as greater chances of preeclampsia and fetal growth restriction [4]. Sleep-deprived women had a greater chance of preterm deliveries, and those who snored loudly in their third trimester were more likely to have newborns with foetal development restrictions [5, 6].

To provide a simple-to-use questionnaire for OSA screening in surgical patients, the STOP questionnaire was created in 2008. It is a four-question survey about snoring, daytime fatigue, halted breathing during sleeping, and hypertension. BMI, age, neck circumference, and gender are added to the STOP questionnaire as part of an alternate scoring model known as the STOP-Bang questionnaire. However, there are not many reports on these problems affecting pregnant upper Egyptian women [7, 8].

PATIENTS AND METHODS

This study was a cross-sectional study at Assiut Woman's Health Hospital in collaboration with the Department of Chest diseases, Assiut University, from January 2020 through January 2021.

Study tools: We classified the study participants into two groups, group I, patients visiting the outpatient clinic at Women Health Hospital who were pregnant in the third trimester. We counseled them to participate in our study.

Exclusion Criteria: Cases with intrauterine fetal death, women with history of neurological or mental disorder, sleep related breathing disorders (SRBD), respiratory infection. In addition to any other current ENT and or cardiac problems. We had also excluded anemic patients (hemoglobin <10.5gm/dl), thyroid diseases, dyslipidemia and patients under drugs that affect sleep quality, e.g., Antiarrhythmic, Beta-blocker, clonidine, corticosteroids.

Other study participants were in group II (Control group), who were non-pregnant middle-aged women

Received: 13/03/2023
Accepted: 10/05/2023

after exclusion of all above medical conditions and exclusion criteria.

All eligible participants and counseled to participate in our study, they gave oral consent interview questionnaires. Pregnant women (group I) subdivided into low and high risk for OSA, and the high-risk division were then subjected to complete sleep study polysomnography.

The STOP and STOP-Bang surveys were constructed in a simple yes/no style, with scores ranging from 0 to 4 and 0 to 8 for the STOP and STOP-Bang questionnaires respectively. Subjects are classified as "high risk" or "low risk" for obstructive sleep apnea (OSA) using both questionnaires. Answering yes to 2 or more STOP questionnaire questions and 3 or more STOP-Bang questionnaire questions was considered "high risk," whilst answering yes to fewer than 2 STOP questionnaire questions and less than 3 STOP-Bang questionnaire questions was considered moderate risk.

Patients who were classified as high risk based on the STOP and STOP-Bang questionnaires were exposed to a sleep examination called polysomnography. The term polysomnography (PSG) refers to the simultaneous and continuous assessment of numerous physiological parameters while sleeping. In practice, the term PSG has evolved to refer to a specific form of polysomnographic investigation in which measurements allow for the following: 1. Identification of sleep stage. 2. Cardiopulmonary function monitoring. 3. Tracking of body motions while sleeping. This research is often conducted at night in a sleep laboratory in order to determine, as accurately as feasible given the unique situation.

Ethical approval: The Ethics Committee of Assiut University's Faculty of Medicine granted the study approval (IRB number 17101061). All participants signed an informing consent after a thorough explanation of the goals of the study. The Helsinki Declaration was followed throughout the study's conduct.

Statistical analysis

The acquired data were coded, processed, and analysed using SPSS V. 24. The Shapiro Walk test was employed to determine whether the data had a normal distribution. To represent qualitative data, frequencies and relative percentages were employed. To compare the differences between two or more sets of qualitative variables, the Chi square test (2) was utilised. Quantitative data's mean ± SD (standard deviation) was utilised. The independent samples t-test was used to compare two independent groups of normally distributed variables (parametric data). $P \leq 0.05$ was regarded as significant.

RESULTS

There was a non-significance difference between groups ($P > 0.05$) as regards age, residence, education and employment. However, there was significant difference concerning height, weight, and BMI (Table 1).

Table (1): Third-trimester pregnant women's demographics compared to a control group of non-pregnant women

Items		Group				p value
		Pregnant Group (N=88)		Non-pregnant Group (N=88)		
Age mean ± SD (years)		28.69 ±5.6		28.53 ±5.9		0.865#
Gestational age mean ± SD (weeks)		35.56 ±3.1		.		
Height mean ± SD (Cm)		158.32 ±5.8		160.64 ±5.5		**0.007##***
Wight mean ± SD (Kg)		79.45 ±10.1		68.52 ±7.6		**<0.001##***
BMI mean ± SD (Kg/m^2)		31.79 ±4.4		26.54 ±2.7		**<0.001##***
		n	%	n	%	
Residence	Rural	42	47.7%	48	54.5%	0.381^
	Urban	46	52.3%	40	45.5%	
Education	Illiterate	32	36.4%	27	30.7%	0.131^
	Moderate	30	34.1%	39	44.3%	
	High	26	29.5%	22	25.0%	
Employment	Housewife	52	59.1%	42	47.7%	0.342^
	Working	36	40.9%	46	52.3%	
Parity	Primipara	49	55.7%	0	0.0%	
	Multipara	39	44.3%	0	0.0%	

Regarding feeling fatigued, a BMI > 35 kg/m^2, and a neck circumference > 40 cm, there was a very significant difference between the two groups. There was highly significant difference between pregnant and non-pregnant women in term of total snoring score, total score ≥ 3 was 42% in pregnant group, while more than 3 total snoring score in non-pregnant group was 12.5% (Tables 2 & 3 and figure 1).

Table (2): STOP and STOP-Bang questionnaires were administered to pregnant women in their 3rd trimester, as well as a matched control group of non-pregnant women.

Items	Group				P value
	Pregnant group (N=88)		Non-pregnant group (N=88)		
	n	%	n	%	
1. Snoring,	53	60.2%	44	50.0%	0.173
2. Tiredness.	50	56.8%	26	29.5%	**0.001**
3. Observed apnea.	28	31.8%	28	31.8%	0.871
4.Blood pressure.	25	28.4%	15	17.0%	0.071
5. BMI. BMI > 35 kg/m^2	21	23.9%	1	1.1%	**<0.001**
6. Age. Age >50 yr old?	0	0.0%	0	0.0%	
7. Neck circumference Adam's apple Neck circumference >40 cm	25	28.4%	11	12.5%	**0.009**
8. Male gender	0	0.0%	0	0.0%	

Table (3): Total STOP and STOP-Bang questionnaires scores and O. S. A risk in women in the 3rd trimester and matched control of non-pregnant women

Items		Group				P value
		Pregnant group (N=88)		Non-pregnant Group (N=88)		
		n	%	n	%	
Stop-bang	0	17	19.3%	22	25.0%	**<0.001^^***
	1	23	26.1%	20	22.7%	
	2	11	12.5%	35	39.8%	
	3	12	13.6%	10	11.4%	
	4	10	11.4%	1	1.1%	
	5	6	6.8%	0	0.0%	
	6	9	10.2%	0	0.0%	
Obstructive sleep Apnea risk score	High risk	37	42.0%	11	12.5%	**<0.001^***
	Low risk	51	58.0%	77	87.5%	

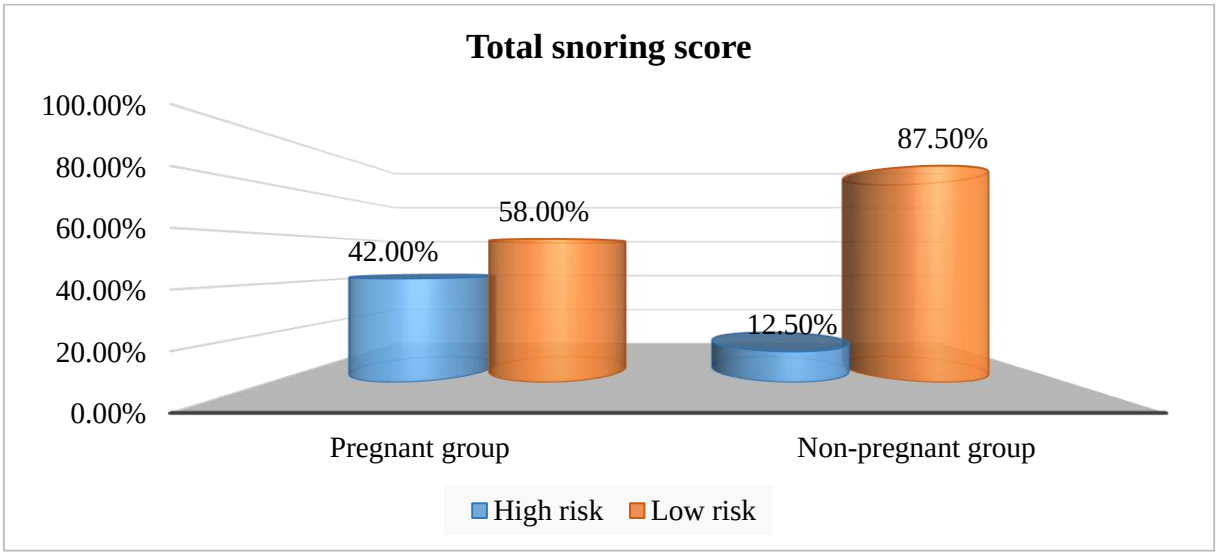

Figure (1): Total snoring score

No statistically significant difference was seen in terms of height, residence, and education. Concerning, age, gestation age, weight, BMI, employment, systolic BP, diastolic BP, employment, and parity, they were much higher in the high-risk pregnant group than the low-risk pregnant group (Table 4 & figure 2).

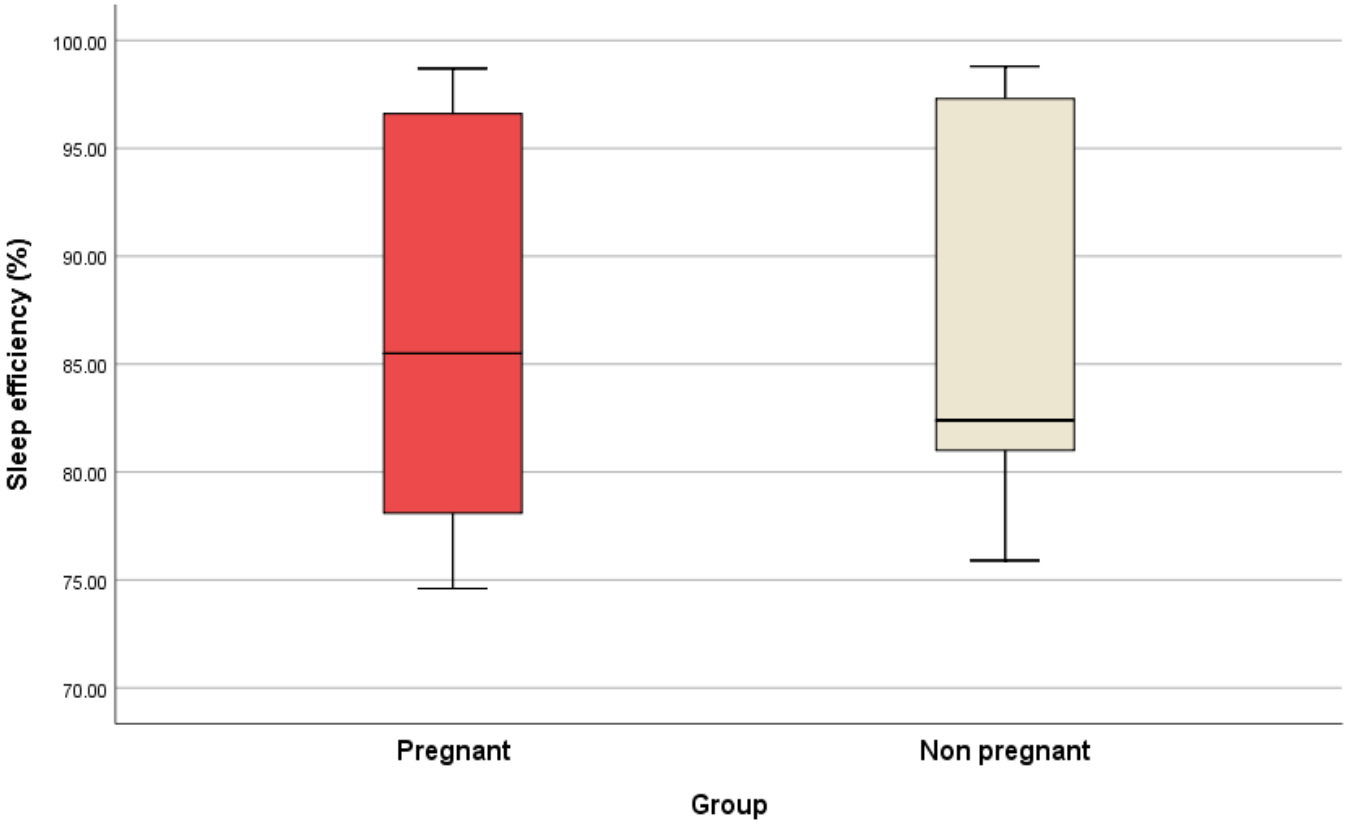

Figure (2): Sleep efficiency (%) in the study groups.

Table (4): Demographic Data of pregnant women according to STOP Bang Questionnaire**.**

Items		Group				p value
		Pregnant group (High risk) (N=37)		**Pregnant group (Low risk) (N=51)**		
Age mean ± SD (Years)		30.9 ±5.8		27.6 ±5.4		**0.003#***
Gestational age mean ± SD (Weeks)		36.86 ±2.5		34.42 ±3.2		**0.035##***
High mean ± SD (Cm)		157.03 ±6.3		158.90 ±5.5		0.496##
Wight mean ± SD (Kg)		83.55 ±10.8		76.62 ±7.1		**0.001##***
BMI mean ± SD (Kg/m^2)		33.81 ±4.6		30.32 ±3.6		**0.001##***
		n	**%**	**n**	**%**	
Residence	Rural	21	56.8%	21	41.2%	0.149^
	Urban	16	43.2%	30	58.8%	
Education	Illiterate	16	43.2%	16	31.4%	0.516^
	Moderate	11	29.7%	19	37.3%	
	High	10	27.0%	16	31.4%	
Employment	Housewife	36	75.0%	58	45.3%	**0.007^***
	Working	12	25.0%	70	54.7%	
Parity	Primipara	16	43.2%	33	64.7%	**0.045^**
	multipara	21	56.8%	18	35.3%	

Concerning demographic and clinical data, there was no statistically significant difference regarding height, residence, and education. Regarding age, gestation age, weight, BMI, employment, systolic BP, diastolic BP, employment, and parity were significantly increased in pregnant high-risk group than in pregnant low risk group (Table 5).

Table (5): Clinical Data of pregnant women according to STOP Bang Questionnaire

Items	Group				p value
	Pregnant group (High risk) (N=37)		**Pregnant group (Low risk) (N=51)**		
Pulse (B/m)	91.08 ±6.2		90.35 ±5.6		0.342#
Systolic BP (mmHg)	132.72 ±19.4		115.29 ±9.7		**<0.001##***
Diastolic BP (mmHg)	85.45 ±12.6		77.82 ±5.4		**0.003##***
Respiratory rate	19.79 ±0.6		19.86 ±0.5		0.791#
Temperature (°C)	36.88 ±0.33		36.93 ±0.43		0.402##
HB level (gm/dl)	11.13 ±0.8		10.82 ±0.9		0.056##
AFI	9.2 ±1.0		10 ± 1.5		0.140#
EFW (gm)	2307.4 ±353.5		2288.5 ±332.6		0.996#
	n	**%**	**n**	**%**	
Hypertension or pre-eclampsia	7	18.9%	0	0.0%	**0.001^^***
Gestational diabetes mellitus	6	16.2%	0	0.0%	**0.003^^***

According to the STOP questionnaire, the univariate logistic regression analysis revealed that only age, gestational age, weight, BMI, systolic blood pressure, and diastolic blood pressure were linked to the occurrence of sleep difficulties. For a more thorough study, all the aforementioned variables that had statistical significance in the univariate analysis were included to the multivariate logistic regression model. The findings revealed that age, diastolic blood pressure, and non-employment, were the independent causes of sleep disorders (Table 6).

Table (6): Logistic regression study of STOP Questionnaire variables impacting the incidence of sleep issues

	Univariable Odds ratio	**95% C.I**		**P value**	**Multivariable Odds ratio**	**95% C.I**		**P value**
		lower	**upper**			**lower**	**upper**	
Age (years)	1.113	1.020	1.214	**0.016**	1.498	1.076	2.084	**0.017**
Gestational age (Weeks)	1.262	1.022	1.558	**0.031**	1.507	.964	2.357	0.072
Wight (Kg)	1.078	1.019	1.141	**0.009**	1.052	.887	1.248	0.560
BMI (kg/m^2)	1.198	1.051	1.366	**0.007**	1.111	.703	1.756	0.651
Systolic BP (mmHg)	1.067	1.025	1.111	**0.002**	.882	.709	1.098	0.263
Diastolic BP (mmHg)	1.113	1.043	1.187	**0.001**	1.356	.955	1.923	**0.048**
Employment (housewife vs working)	6.000	2.047	17.58	**0.001**	29.77	1.201	37.786	**0.038**
Parity (primipara vs multipara)	3.98	0.979	6.987	0.456				

A significant positive correlation between hypertension or preeclampsia, gestational diabetes mellitus and each of obstructive apnea index, respiratory disturbance index, periodic limb movement index, and snoring index. While, there was a significant negative correlation between hypertension or pre-eclampsia, gestational diabetes mellitus and sleep efficiency (%) (Table 7).

Table (7): Correlation between complication and Polysomnography parameters (Sleep efficiency (%), Obstructive apnea index, Respiratory Disturbance Index, Periodic limb movement index and Snoring index)

Spearman's rho		Hypertension or pre-eclampsia	Gestational diabetes mellitus
Sleep efficiency (%)	r value	-0.551	-0.680
	P value	**0.051**	**0.011**
Obstructive apnea index	r value	0.783**	0.637
	P value	**0.002**	**0.019**
Respiratory Disturbance Index	r value	0.584*	0.344
	P value	**0.036**	**0.249**
Periodic limb movement index	r value	0.866*	0.866
	P value	**0.012**	**0.012**
snoring index	r value	0.815**	0.744
	P value	**0.001**	**0.004**
Hypertension or pre-eclampsia	r value	1.000	0.822
	P value	-	**0.001**

DISCUSSION

Our participants maternal ages were of 28.69 ± 5.6 and 28.53 ±5.9 years respectively for pregnant & non-pregnant. pregnant women demonstrated significantly higher BMI (31.79 ±4.4 vs 26.54 ±2.7) as compared to non-pregnant control. These results corroborate the ideas of **El-Helbawy *et al.*** [8] who suggested that on 30 pregnant cases and 30 age-matched controls, with mean maternal ages of 30.4 ± 8.07 & 31.47 ± 6.96, respectively. Prospective research was conducted, the mean gestational age, however, was lower than our research (23.03 ± 8.88). Based on BMI, pregnant women had a mean BMI of 30.2 (range: 22–24) while non-pregnant women had a mean BMI of 27 (range: 26.77–2.43). The findings of the STOP and STOP-Bang questionnaires revealed that there was a statistically significant difference between the groups in terms of the parameters of total snoring score, neck circumference, and incidence of feeling fatigued. Snoring, observed blood pressure, and age > 50 years, however, showed no statistically significant difference.

A questionnaire cannot be used to objectively diagnose any form of sleep disturbance. Contrarily, picking a reliable and objective diagnostic procedure like polysomnography for high-risk cases in pregnant and non-pregnant women for diagnosis of sleep breathing disorder. From this data, obstructive apnea index, respiratory disturbance index, periodic limb movement index, and snoring index were higher in pregnant high-risk group than in non-pregnant high-risk group, except sleep efficiency (%) were decrease in pregnant high-risk group than in non-pregnant high-risk group. In contrast it was found that there was no statistically significant difference with total sleep time (hour) O_2 saturation parameters, body position analysis, and the heart rate between two groups.

Wilson *et al.* [9] found that third-trimester pregnant women had less efficient sleep, more awakenings, less stage 4 sleep, more N1 sleep, and less REM sleep minutes than the control group. The habitual sleep efficiency was reported to be ≥ 85% in 19.2% and < 65% in 17.5% of the research subjects, showing a similar pattern of findings. Changes in sleep structure during pregnancy seem to have the biggest effects during the third trimester of pregnancy, which is characterised by shorter sleep duration and more disrupted sleep, with an increased number of awakenings and superficial sleep stages, as well as a reduction in SWS and REM sleep. It is interesting to note that greater progesterone levels were associated with higher WASO and arousals in third-trimester women. However, they have lately been confirmed in the same people that were documented at early and late GA. These results are more pronounced when pregnant women are compared to controls who are not pregnant[10].

In addition, we reported that it estimated mean of OAI 35.01 ±27.92 in pregnant high-risk group and 16.03 ± 13.26 in non-pregnant high-risk group. From the results, we reported that it estimated mean of RDI was 54.05 ± 42.00 in pregnant high-risk group and 25.45 ±14.41 in non-pregnant high-risk group. Furthermore, the present work reported that that it estimated mean of snoring index of 22.29 ± 7.07 in pregnant high-risk group and 13.20 ± 4.71in non-pregnant high-risk group. **El-Helbawy *et al.*** [8] reported that snoring index range was (0–32.9 vs 0–9) in cases and control group respectively. An explanation for these results may be that the polysomnography was formed to high-risk patients according to STOP questionnaire in both groups, but in other study formed to patients not related to questionnaire results.

Moreover, the current study reported a mean of periodic limb movement index of 22.41 ± 6.72 in pregnant high-risk group and 8.19 ± 5.36 in non-pregnant high-risk group. A possible explanation for this might be that a study included 10 pregnant women with restless legs syndrome and 9 without restless legs syndrome around the 36th week of gestation and 12 weeks postpartum. Women with restless legs syndrome showed more periodic leg movements during sleep index before and after delivery and in stage 2 sleep. Interestingly, compared to controls, individuals with restless legs syndrome also exhibited greater blood levels of oestrogen during pregnancy [10].

According to results of STOP, STOP-Bang questionnaires score and polysomnography; patients were divided into subgroups high and low risk pregnant in case they had sleep disorder breathing. Concerning demographic and clinical data, it was found that there was no statistically significant difference regarding height, residence, and education. While, regarding gestation age, weight, BMI, employment, systolic BP,

diastolic BP, employment, and parity, there was significantly increase in pregnant high-risk group than in pregnant low risk group.

Tantrakul *et al.* [11] reported that age (33.4 ± 6.8 compared to 33.1 ± 4.3, p = 0.9) and gestational age (33.7 ± 3.1 versus 31.5 ± 3.0, p = 0.09) did not significantly differ across groups, however OSA was present in 8 (32%) of them. Pregnant women had higher BMIs (30.7±2.4 versus 26.3±3.9 kg/m^2, p = 0.003) compared to the non-OSA group.The univariate logistic regression analysis in our study revealed that the age, gestational age, weight, BMI, systolic BP, diastolic BP and non-employment were more associated with occurrence of sleep problems according to of STOP questionnaire. Consequently, in the multivariate logistic regression, all the aforementioned variables that had statistical significance in the univariate analysis were included. This finding is consistent with that of **Tantrakul *et al.*[11].**

In pregnant high-risk group versus pregnant low risk group, hypertension or preeclampsia was found in 7 women (18.9%). Gestational diabetes was present in 6 (16.2%) women. Obesity (40.23% vs. 7.87%) and chronic hypertension (11.28% vs. 1.65%) were more prevalent in pregnant women with SDB. Gestational hypertension (10.53% vs. 6.87%), gestational diabetes (22.93% vs. 9.39%), and preeclampsia (14.66% vs. 5.45%) were also shown to occur at considerably greater rates in women with SDB[12, 13].

In our study the univariate logistic regression analysis found that the age, gestational age, weight, BMI, systolic BP, diastolic BP and non-employment were more associated with occurrence of sleep problems according to STOP questionnaire. Consequently, the multivariate logistic regression included all the aforementioned variables with statistical significance in the univariate analysis. In a major advance several variables were discovered to have an independent impact on the incidence of sleep difficulties. In the **Smyka *et al.* [14]** study, it diminishes during pregnancy. The 2nd and 3rd trimesters of pregnancy showed a notable drop in the quality of sleep when compared to the first.

Most pregnant women evaluated in this study were housewives, which supports the idea that being a housewife and sleep disruption during pregnancy have a beneficial relationship. In a similar vein**, Osman Bakr *et al.* [15]** who investigated the quality of life in Egyptian pregnant women with sleep problems revealed that employment was not linked to sleep disruption during pregnancy.

CONCLUSION

Pregnant women often underappreciate sleep problems and disturbances. Preeclampsia and prenatal hypertension are two pregnancy-related medical issues that have a significant link to poor sleep or breathing problems during sleep. Poor sleep quality was associated with multiparity, advanced maternal age, and advanced gestational age in the third trimester.

Sponsoring financially: Nil.
Competing interests: Nil.

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