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PREVALENCE AND ASSOCIATED RISK FACTORS OF OBSTRUCTIVE SLEEP APNEA AMONG PREGNANT WOMEN

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Abstract

Background: *Obstructive sleep apnea, marked by repeated upper airway blockage during sleep, often goes undetected in pregnancy due to inadequate history-taking and exams, leading to complications for both mother and baby.*

Objective: *To assess the prevalence of high risk of obstructive sleep apnea and to assess the risk of obstructive sleep apnea and find out its association associated factors among pregnant women.*

Methodology: *A Cross-sectional analytical study was conducted with a simple size of 144 pregnant women in Shaikh Zayed hospital of Lahore, Pakistan. Data was collected with help of Berlin Questionnaire to assess obstructive sleep apnea risk. Data was analyzed with help of SPSS 27 using a chi square test with p less than 0.05.*

Results: *All participants were pregnant women aged 19–40 years, with an average height of 1.66 m and weight of 86.74 kg; most had two or more children. The prevalence of high-risk OSA was 52.08%, with significant associations found between OSA risk and height, weight, BMI, diabetes, gestational age, and number of children ($p<0.05$). No significant associations were observed for age, blood pressure, or residential area; 68, 63, and 50 women tested positive for OSA in categories 1, 2, and 3, respectively.*

Conclusion: *The study found a 52.08% prevalence of high-risk OSA among pregnant women, significantly linked to BMI, diabetes, gestational age, and number of children. Early screening during routine visits is essential to reduce OSA-related complications.*

INTRODUCTION

Obstructive sleep apnea (OSA) is a major physiological cause of chronic sleep fragmentation, characterized by intermittent upper airway obstruction, leading to hypoxia, fatigue, and excessive daytime sleepiness (1). Pregnancy-related physiological changes such as upper airway edema, hormonal fluctuations, and increased oxygen demands can heighten the risk of developing OSA, especially in the third trimester (2). Studies from China report rising OSA prevalence in pregnant women, from 10.5% in the first trimester to 26.7% in the third (3) with most cases being mild. Gestational OSA, often triggered by hormonal and anatomical

changes, differs from chronic OSA and may coexist with conditions like gestational diabetes or hypertension (4).

Obesity is a well-established modifiable risk factor for OSA. With rising rates of maternal obesity globally, the burden of OSA during pregnancy is expected to increase, particularly due to its associations with preeclampsia and gestational diabetes (5). In addition, disrupted sleep patterns and daytime sleepiness especially later in pregnancy are common due to hormonal shifts (6). Cigarette smoking also contributes to OSA severity, as indicated by STOP-Bang assessments (7). Given OSA's wide-ranging health impacts including metabolic, cardiovascular, and cognitive disorders understanding its prevalence and associated risk factors is vital for prevention and intervention efforts (8). This study aims to assess OSA prevalence and identify contributing factors in pregnant women to inform future healthcare strategies and improve maternal outcomes.

Material and Methods: This analytical cross-sectional study was conducted over four months at Sheikh Zayed Hospital, Lahore, following approval from Shalamar College of Nursing. The study targeted pregnant women attending OPD for routine antenatal visits, with a sample size of 144 calculated using Cochran's formula based on a 10.5% anticipated prevalence of obstructive sleep apnea (OSA). Convenience sampling was employed, with inclusion criteria covering pregnant women aged 15–45 with regular antenatal follow-ups, while excluding those with respiratory or sleep disorders, drug use, or communication barriers. Data were collected using a structured questionnaire comprising demographic variables and the Berlin Questionnaire, which classified OSA risk as high or low based on symptom categories and BMI. Informed consent was obtained, and responses were kept confidential. Data were digitized in Excel or SPSS and analyzed using SPSS version 21. Descriptive statistics (mean, SD, frequency) and inferential statistics (Chi-square test, $p < 0.05$) were used to assess the prevalence and associated risk factors of OSA among pregnant women.

Results:

Table no.1: Height in meters and Weight in kilograms of Pregnant women

	Mean	S.D	Min	Max
Height in Meters	1.66	0.10	1.40	1.95
Weight in Kg	86.74	14.61	60.00	122.00

Analyzed by mean (X) , Std. Deviation (S.D), minimum (min) and maximum (max)

Table 1 presents the height and weight of pregnant women, with an average height of 1.66 m and weight of 86.74 kg. The standard deviations were 0.10 m for height and 14.61 kg for weight, indicating variation in the data. Heights ranged from 1.40 m to 1.95 m, and weights from 60 kg to 122 kg.

Table no.2: Number of children and Body mass index (BMI) of pregnant women

		n	%
Number of children	1	31	21.5
	2	40	27.8
	3	33	22.9
	> 3	40	27.8
	Total	**144**	**100.0**
Body mass index (BMI)	18.5-24.9	13	9.0
	≥25.00	54	37.5
	≥30.00-35.00	59	41.0
	>35-40	14	9.7
	≥40	4	2.8

	Total	**144**	**100.0**
Analyzed by frequency 'n' and percent '%'			

Table 2 shows the number of children and BMI of pregnant women. Most women (57.8%) had 2 or 3 children, while the fewest (21.5%) had only 1 child. A majority (78.5%) had a BMI above 25, with the largest group (41%) in the 30.00–35.00 range and only 2.8% above 40.

Table No 3: Diabetes mellitus and Neck diameter of Pregnant Women			
		n	%
Have Diabetes Mellitus	Yes	50	34.7
	No	69	47.9
	Don't know	25	17.4
Neck diameter	> 16	68	47.2
	<16	45	31.3
	16	31	21.5
	Total	**144**	**100.0**
Analyzed by frequency (n) and percent (%)			

Table 3 shows diabetes status and neck diameter of pregnant women. Nearly half (47.9%) had no diabetes, 34.7% were diagnosed, and 17.4% were unsure. Most women (47.2%) had a neck diameter greater than 16, while 31.3% had less than 16, and 21.5% had exactly 16.

Table No 4: Gestational age, Residential area of Pregnant women			
		n	%
Gestational Age	12weeks	3	2.1
	24 weeks	6	4.2
	> 24 weeks	135	93.8
Residential Area	Rural	49	34.0
	Urban	95	66.0
	Total	**144**	**100**
Analyzed by frequency (n) and percent (%)			

Table 4 presents gestational age and residential area of pregnant women. Most (93.8%) were in their third trimester (>24 weeks), with very few in earlier stages. The majority (66%) lived in urban areas, while 34% resided in rural areas.

Table No 5: Blood pressure category of pregnant women			
		n	%
Blood Pressure Category	<120/<80 mm of Hg	52	36.1
	120-129/<80 mm of Hg	24	16.7
	130-139/80-89 mm of Hg	18	12.5
	140>/90> mm of Hg	34	23.6
	>180/>120mm of Hg	16	11.1
	Total	**144**	**100**
Analyzed by frequency (n) and percent (%)			

Table 6 shows blood pressure categories of pregnant women. Most (36.1%) had normal BP (<120/<80 mmHg), while 37.8% had elevated or high readings. The fewest (11.1%) had severely high BP (>180/>120 mmHg).

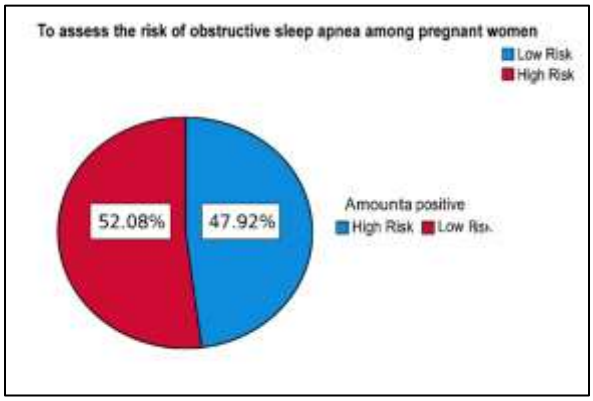

Figure 3: To assess the risk of obstructive sleep apnea among pregnant women

Figure 4: this pie chart represents the prevalence of high risk of OSA among pregnant women 52.08% followed by low risk of OSA 47.92%.

Table No 06: Comparison between high Risk and low risk OSA category 1					
Variable		OSA category 1		Total	P-value
		Negative	Positive		
Risk of obstructive sleep apnea among pregnant women	Low Risk	39(84.8)	7(15.2)	46	0.000
	High Risk	30(30.6)	68(69.4)	98	
	Total	69(47.9)	75(52.1)	144	
Statistically analyzed by chi-square test with p less than 0.05					

Table 6 presents Berlin Questionnaire Category 1 results, showing that 75 participants were at high risk for OSA, while only 7 (15.2%) were at low risk. The difference was statistically significant ($p < 0.05$), indicating a strong association between OSA risk and Category 1 scores.

Table No 07: Comparison between high Risk and low risk OSA category 2					
Variable		OSA category 2		Total	P-value
		Negative	Positive		
Risk of obstructive sleep apnea among pregnant women	Low Risk	54(81.8)	12(18.2)	66	0.000
	High Risk	15(19.2)	63(80.8)	78	
	Total	69(47.9)	75(52.1)	144	
Statistically analyzed by chi-square test with p less than 0.05					

Table 8 shows Berlin Questionnaire Category 2 results, where 75 participants were at high risk for OSA and only 12 (18.2%) at low risk. A significant difference ($p < 0.05$) indicates that 80.8% were positive for OSA, confirming a strong association between Category 2 scores and OSA risk.

Table No 08: Comparison between high Risk and low risk OSA category 3				
Variable	**OSA category 3**		**Total**	**P-Value**
	Negative	**Positive**		

Risk of obstructive sleep apnea among pregnant women	Low Risk	64(71.9)	25(28.1)	89	0.000
	High Risk	5(10)	50(90)	55	
	Total	**69**	**75**	**144**	
Statistically analyzed by chi-square test with p less than 0.05					

Table 8 presents Berlin Questionnaire Category 3 results, showing 75 participants at high risk for OSA and 25 at low risk. The difference was statistically significant ($p < 0.05$), indicating a strong association between Category 3 scores and the risk of developing OSA.

Table No 9: To assess the risk of obstructive sleep apnea among pregnant women with patient's weight					
Associated factor		**Low Risk**	**High Risk**	**Total**	**P-value**
Patients Weight in kg	51-70	15(71.4)	6(28.6)	21	0.025
	71-90	29(43.3)	38(56.7)	67	
	91-110	24(50)	24(50)	48	
	111-131	1(12.5)	7(87.5)	8	
	Total	**69**	**75**	**144**	
Statistical test chi-square with a confidence interval 95% and p<0.05					

Table 9 highlights the association between weight and OSA risk, showing a significant correlation ($p < 0.05$). Most participants with higher weight (87.5% of those weighing 111–131 kg) were at high risk for OSA, confirming that increased weight is strongly linked to elevated OSA risk.

Table No 10: To assess the risk of obstructive sleep apnea among pregnant women with Age					
Associate Factor		**Low Risk**	**High Risk**	**Total**	**P-Value**
Age in Years	19-26	21(58.3)	15(41.7)	36	0.351
	27-33	30(44.1)	38(55.9)	68	
	34-40	18(45)	22(55)	40	
	Total	**69**	**75**	**144**	
Statistical test chi-square with a confidence interval 95% and p<0.05					

Table 10 examines the association between age and OSA risk, showing no significant correlation ($p > 0.05$). Although higher age groups (27–33 and 34–40) had more participants at high risk, the results indicate that increasing age does not directly increase the risk of OSA.

Table No 11: To assess the risk of obstructive sleep apnea among pregnant women with BMI					
Associated Factor		**Low Risk**	**High Risk**	**Total**	**P-Value**
Body Mass Index	18.5-24.9	13(100)	0(0)	13	0.000
	≥25	26(48.1)	28(51.9)	54	
	≥30-35	24(40.7)	35(59.3)	59	
	>35-40	2(14.3)	12(85.7)	14	
	≥40	0(0)	4(100)	4	

	Total	**65**	**79**	**144**	
Statistical test chi-square with a confidence interval 95% and p<0.05					

Table 11 shows a significant association between BMI and OSA risk ($p < 0.05$). All participants with a BMI >40 (100%) and most with BMI 35–40 (85.7%) were at high risk, indicating that higher BMI is strongly linked to increased OSA risk.

Table No 12: To assess the risk of obstructive sleep apnea among pregnant women with DM					
Associated Factor		**Low Risk**	**High Risk**	**Total**	**P-Value**
DM	Yes	15(30)	35(70)	50	0.002
	No	36(52.2)	33(47.8)	69	
	Don't Know	18(72)	7(28)	25	
	Total	**69**	**75**	**144**	
Statistical test chi-square with a confidence interval 95% and p<0.05					

Table 12 shows a significant association between diabetes mellitus and OSA risk ($p < 0.05$). About 70% of participants with known diabetes were at high risk, compared to 47.8% of those unaware of their status, indicating that diabetes significantly increases the likelihood of developing OSA.

Table No 13: To assess the risk of obstructive sleep apnea among pregnant women with neck diameter					
Associated Factor		**Low Risk**	**High Risk**	**Total**	**P-Value**
Neck Diameter	Less than 16	37(82.2)	8(17.8)	68	0.000
	Equal to 16	23(33.8)	45(66.2)	45	
	Greater than 16	9(29)	22(71)	31	
	Total	**69**	**75**	**144**	
Statistical test chi-square with a confidence interval 95% and p<0.05					

Table 13 shows a significant association between neck diameter and OSA risk ($p < 0.05$). High risk was observed in 71% of participants with a neck diameter of 16 and 66.2% with a diameter greater than 16, indicating that increased neck diameter raises the likelihood of OSA.

Table No 14: To assess the risk of obstructive sleep apnea among pregnant women with Gestational Age					
Associated factor		**Low Risk**	**High Risk**	**Total**	**P-Value**
Gestational Age	12weeks	0(0)	3(100)	3	0.012
	24 weeks	0(0)	6(100)	6	
	≥24 weeks	69(51.1)	66(48.9)	135	
	Total	**69**	**75**	**144**	
Statistical test chi-square with a confidence interval 95% and p<0.05					

Table 14 shows a significant association between gestational age and OSA risk ($p < 0.05$). All participants at 12 weeks gestation (100%) were at high risk, compared to 48.9% of those beyond 24 weeks, indicating that lower gestational age increases the likelihood of OSA.

Table No 15: to assess the risk of obstructive sleep apnea among pregnant women with Residential Area

Associated factor		Low Risk	High Risk	Total	Value
Residential Area	Rural	18(36.7)	31(63.3)	49	0.054
	Urban	51(53.7)	44(46.3)	95	
	Total	**69**	**75**	**144**	
Statistical test chi-square with a confidence interval 95% and p<0.05					

Table 15 shows no significant association between residential area and OSA risk ($p > 0.05$). While 63.3% of rural and 46.3% of urban residents were at high risk, the difference was not statistically significant, indicating that OSA risk is similar across both settings.

Discussion: This study found that 52.08% of pregnant women were at high risk for obstructive sleep apnea (OSA), while 47.92% were at low risk. The average height and weight of participants were 1.66 meters and 86.74 kilograms, respectively. Most women fell within the 71–90 kg weight range and had a BMI between 25.00–35.00 kg/m², indicating a considerable prevalence of overweight and obesity. These findings align with the study by Nahar and colleagues, who reported excessive weight gain during pregnancy among rural women in Bangladesh (9). Similarly, Silva and colleagues in 2022 found that participants with moderate OSA had significantly higher BMI and waist-hip ratios, reinforcing the association between obesity-related parameters and OSA risk (10).

The present study also revealed that 57.8% of participants had two or three children, suggesting a potential association between parity and OSA. This is consistent with findings by Volk and colleagues in 2021, who noted that 18.3% of North American women had two or more children, highlighting parity as a possible risk factor (11). Chen and colleagues in 2018 reported that in some countries, more than 50% of pregnant women were overweight or obese, such as Nigeria (55.4%) and Tanzania (59.3%), emphasizing the global relevance of maternal weight as a health concern (12).

Further analysis demonstrated a significant relationship between increased neck diameter and OSA risk. A majority of women (47.2%) had a neck diameter greater than 16 cm, and this was strongly associated with higher OSA prevalence. These findings are in line with Duan and colleagues in 2022, who also identified neck circumference as a predictive factor for OSA. Additionally, diabetes mellitus was another significant predictor, with women who had diabetes showing increased odds of high OSA risk (13). This supports Botros and colleagues in 2019, who reported a linear trend linking OSA severity with the risk of developing diabetes (14).

Interestingly, while the majority of participants were in their third trimester, gestational age showed a significant inverse relationship with OSA risk—lower gestational age was associated with higher risk. This finding echoes the work of Izci Balserak and colleagues in 2020, who identified associations between OSA and complications such as gestational hypertension, diabetes, and preeclampsia (15).

Although blood pressure and residential area were not significantly associated with OSA in this study, elevated blood pressure was noted in 37.8% of participants, suggesting the need for continued monitoring. While urban residents made up 66% of the sample, rural women showed a slightly higher trend toward OSA risk, although this difference was not statistically significant. This contrasts with findings by Veluthat and Souza in 2021, who observed higher OSA severity in urban populations, potentially due to lifestyle and environmental factors (16).

Educational background also varied, with "Matric" level being the most common among participants (27.8%), which parallels Wondie and colleagues in 2022 findings where 39.2% had secondary education. These sociodemographic variables could influence health awareness and access to care, indirectly affecting OSA risk (17).

Age was not significantly associated with OSA in this study, despite the largest age group being 27–33 years. This finding is supported by Fietze and colleagues in 2019, who noted that OSA in women tends to

increase after the age of 30, suggesting a potential age threshold beyond which risk may rise (18). The Berlin Questionnaire was used to assess OSA risk, and significant high-risk prevalence was found across all three categories: 69.4% in Category 1 (snoring), 88.8% in Category 2 (daytime sleepiness), and 90% in Category 3 (BMI/hypertension), all with p-values < 0.05. These findings mirror those of Cepeda and colleagues in 2019, who reported similar high-risk patterns in patients with moderate to severe OSA (19).

Conclusion: This study revealed a high prevalence of obstructive sleep apnea (OSA) risk among pregnant women. On average, participants had a height of approximately 1.66 meters and a weight around 86.74 kilograms, with notable variation in both measures. Most women had two or three children, and a significant proportion had a body mass index above 25, particularly in the 30.00–35.00 kg/m² range. Participants varied in weight, height, age, and education levels. The study found significant associations between OSA risk and several factors, including increased weight, body mass index, neck diameter, and the presence of diabetes mellitus. Lower gestational age was also linked to a higher OSA risk. Although no significant association was found between residential area and OSA risk, more women from rural areas appeared to be in the high-risk category. Overall, the findings suggest that higher physical measures and certain health conditions are linked to greater risk of OSA in pregnancy.

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