AMJ Australasian Medical Journal [AMJ 2021;14(12):291-296]

Risk of obstructive sleep apnea in patients with type 2 diabetes mellitus in Jeddah, Saudi Arabia

Mahmoud Abdullah Al-Zahrani, Hatem Eissa Alkhamisi, Sarah Eissa Alkhamisi, Abdulaziz Abdulelah Abu Alnasr*, Ahmed Fauzy Allehyani, Khulood Abdullah Al Siary

King Abdulaziz Medical City, Ministry of National Guard WR, Jeddah, Sadia Arabia

RESEARCH

Please cite this paper as: Al-Zahrani MA, Alkhamisi HE, Alkhamisi SE, Alnasr AAA, Allehyani AF, Al Siary KA. Risk of obstructive sleep apnea in patients with type 2 diabetes mellitus in Jeddah, Saudi Arabia. AMJ 2021;14(12):291-296.

Corresponding Author:
Abdulaziz Abdulelah Abu Alnasr
Paediatric resident,
Saudi National Guard Health Affairs,
Saudi Arabia.
azizabualnasr@gmail.com

ABSTRACT

Background

Obstructive sleep apnea (OSA) is a sleep related breathing disorder defined as repeated episodes of upper airway collapse during sleep. One of the major risk factors of obstructive sleep apnea is obesity.

Aim

To assess the risk of obstructive sleep apnea among type 2 diabetic patients at National Guard Hospital in Jeddah, Saudi Arabia.

Methods

The STOP-BANG sleep apnea screening questionnaire was used in this study. The sample size is of 171 participants. A cross-sectional study was performed at National Guard Hospital in Jeddah, Saudi Arabia. A study sample of 171 was included. A STOP-BANG questionnaire formed of eight questions was used to assess the risk of OSA among type 2 diabetic patients. Score of the questionnaire was divided into three groups: Low risk (from 0 to 2 points), intermediate risk (from 3 to 4 points) and high risk (from 5 to 8 points).

Results

Of all patients with type 2 diabetes mellitus in the study, 9.4 per cent had low risk, 18.7 per cent had intermediate risk and 71.7 per cent had high risk for OSA. There was no significant correlation between the score and last fasting blood sugar and HbA1c's level, with *p-values* of 0.554 and 0.335, respectively. There was a significant relationship between the type of treatment and the risk of developing OSA ($p<0.001$). Percentage of patients with severe risk was significantly higher in those taking both insulin and oral drugs than those taking insulin alone or oral drugs alone.

Conclusion

Patients with type 2 diabetes mellitus have high risk of developing obstructive sleep apnea. Screening programs for obstructive sleep apnea in patients with type 2 diabetes need to be implemented as part of the routine screening in patients with type 2 diabetes.

Key Words

Type 2 diabetes mellitus, Obstructive sleep, Family medicine

Background

Obstructive sleep apnea (OSA) is a sleep related breathing disorder defined as repeated episodes of upper airway collapse during sleep[1-3]. OSA occurrence is due to pharyngeal collapses that lead to low airflow to the lungs and causes blood gas disturbances[4]. Snoring, daytime sleepiness, and restless sleep are common symptoms for OSA[5]. Several risk factors have been associated with the development of OSA such as age and gender[6].

Some studies showed high prevalence of OSA associated with specific diseases such as diabetes type 2. The nature of insulin resistance in type 2 diabetes contributes to the development of OSA without the interference of any other confounder such as obesity[7-9]. In addition, 83 per cent of patients with type 2 diabetes develop OSA in their course of life. On the other hand, OSA can also be a risk factor for developing type 2 diabetes. The exact mechanism for developing OSA in patients with type 2 diabetes is still unclear[10]. A similar study conducted in Taif, showed higher risk of OSA in diabetic population compared to their peers with no diabetes. Furthermore, there was no difference in risk of OSA between patients who are on insulin therapy in compared to patients on oral hypoglycaemic[1].

Therefore, this study was formulated to assess the risk of

developing OSA in patients diagnosed with Type 2 diabetes in Jeddah, Saudi Arabia. Moreover, to participate in the contribution to the literature of patients with type 2 diabetes in Saudi Arabia and to increase the awareness regarding this chronic disease. Finally, based on our knowledge, there are few studies in Saudi Arabia that focus on measuring risk of OSA in type 2 diabetic patients.

Methodology

We aimed to evaluate the risk of OSA among type 2 diabetic patients hospitalized at National Guard Hospital in Jeddah, Saudi Arabia.

Study design

This study was a cross-sectional observational study.

Study sample

Inclusion criteria included patients treated or hospitalized at National Guard Hospital in Jeddah, Saudi Arabia and diagnosed with type 2 diabetes mellitus. Any patient diagnosed with type 1 diabetes was excluded.

Non-probability convenience sampling technique was used in this study for the selection of respondents that will be based on the set eligibility criteria. A questionnaire was distributed among type 2 diabetes patients at National Guard Hospital in Jeddah, Saudi Arabia.

Data Collection

This study used STOP-BANG sleep apnea screening questionnaire consist of eight dichotomous (yes/no) questions related to the clinical features of sleep apnea (snoring, tiredness, observed apnea, high blood pressure, BMI, age, neck circumference and male gender) (Table 1). These questions, offer an easy method to assess the risk of obstructive sleep apnea in type 2 diabetic patients. The scoring scale is categorized into three groups: Low (0-2), intermediate (3-4) and high (5-8), respectively. The answers were yes (=1) and no (=0) and the total score was 8. Also, other variable will be collected such as heart failure, stroke, hypertension, coronary heart disease or other co-morbidities. And, oral medication, insulin injection, HbA1c and last fasting blood sugar will be collected.

Results

Among the 171 study participants who came from the Ministry of National Guard Health Affairs health care centres, of whom (24 per cent) attend Al-Waha Specialized Clinic, (26.9 per cent) attend Bahra Clinic, and (49.1 per cent) attend the Iskan primary health clinic. We also noted that nearly two thirds of participants (62 per cent) were male and (38 per cent) were female. The mean age was (57) years with a standard deviation of (12.5) years. (Figure 1 and Table 2)

Table 3 shows the assessment of the risk of sleep-disordered breathing among patients with type 2 diabetes, where we note that 86.5 per cent of patients suffer from loud snoring, 84.2 per cent often feel tired, exhausted or sleepy during the day, 79.5 per cent suffocate during sleep, 55.6 per cent suffer from high blood pressure, 26.9 per cent have a body mass index of more than 35 kg/m^2, 70.8 per cent are over 50 years old, 61.4 per cent have a large neck, and 62 per cent are male.

Figure 2 showed that 71.9 per cent of the patients had a high probability of having obstructive apnea, 18.7 per cent of them had a medium probability of having obstructive apnea, and 9.4 per cent had a low probability of having obstructive apnea.

Table 4 shows that 56.1 per cent of patients suffer from high blood pressure, 2.3 per cent have had a stroke, 9.9 per cent have coronary heart disease, and 1.2 per cent has heart failure.

Table 5 shows that 55.6 per cent of patients are treated using oral medications only, 7.6 per cent are treated using insulin injections only, and 36.8 per cent are treated using both oral medications and insulin injections.

Table 6 shows the minimum and maximum, mean and standard deviation of the last readings of (fasting blood sugar, HbA1c, and random blood sugar), where the minimum value of the last readings of fasting blood sugar was (4.3) and the maximum was (24.8), and it reached Its mean is (8.9) with standard deviation (3.49). As for the last readings of HbA1c, the minimum value was (5.2) and the maximum (13.8), and its mean was (8.08) with a standard deviation (1.64). As for the last readings of random blood sugar, the minimum value was (3) and the maximum (25.3) and its mean were (10.26), with a standard deviation (4.92).

Table 7 shows the relationship between the risk of obstructive apnea and comorbidities, where the results of the Chi^2 test showed a relationship between the risk of obstructive apnea and high blood pressure (p=0.00<0.05), while the results did not show any relationship between Risk of obstructive apnea and any of: stroke (p=0.450>0.05), coronary heart disease (p=0.232>0.05), and cardiac arrest (p=0.674>0.05).

Table 8 shows the relationship between risk of OSA and [age, type of treatment, HbA1c], where the results of the Chi2 test showed a relationship between the age and OSA (p=0.00<0.05), while did not show relationship between the type of treatment and OSA (p=0.241>0.05), and no relationship between the HbA1c and OSA (p=0.218>0.05).

Discussion

The present cross-sectional observational study included an overall 171 Type 2 diabetes mellitus patients. It was

designed to estimate the risk of obstructive sleep apnea among type 2 diabetic patients in Jeddah, Saudi Arabia. The mean age was 57 years and 62 per cent of participants were male. The STOP-BANG questionnaire was applied in this study to examine the risk of OSA. According to the scores of the patients, 71.9 per cent of patients had a high risk, 18.7 per cent of them were at medium risk, and 9.4 per cent had a low risk of having obstructive apnea.

Saad, Ahmad MJ, et al. estimated the prevalence of OSA among 1143 patients with T2DM, they found that 48.5 per cent of DM2 patients were at high risk for OSA and 51.5 per cent were low risk for OSA[11]. Another recent study from Saudi Arabia was performed to assess the risk of OSA among Type 2 diabetes patients. They also applied the STOP-BANG questionnaire. Their results showed that 57.9 per cent of diabetic patients with mild risk, 26.9 per cent had moderate risk, and 15.2 per cent had a severe risk for OSA[1].

As noted above, we got a higher risk of obstructive sleep apnea. A few explanations may account for these differences; the majority of the participants in our study are male, which may raise the risk of the disease in our patients since males have higher prevalence to develop OSA[12]. Furthermore, the enhanced chance for obstructive sleep apnea in the current study may be somewhat attributable to the prevalence of obesity in the study population since 26.9 per cent have a body mass index of more than 35 kg/m^2.

Regarding the type of treatment, the authors[1] tested the relation between the treatment type of diabetes and its correlation to the risk of developing OSA, they found that patients with high risk were more in those receiving both insulin and oral drugs than those receiving insulin only or oral drugs only. In contrast with the previous study, the present study results did not show an association between the type of treatment and the risk of OSA.

With regard to the complications of the disease, we found that OSA risk significantly associated with the high blood pressure (p=0.00<0.05). While, the results did not show any relationship between Risk of obstructive apnea and any of stroke (p=0.450>0.05), coronary heart disease (p=0.232>0.05), and cardiac arrest (p=0.674>0.05). The data from the present study are in agreement with Iftikhar IH et al., who stated that hypertension has a principal role in the relation between OSA and diabetes-related complications[13]. While in contrast to us, Stadler, Stefan, et al. found that in patients with T2DM, sleep disorders are significantly associated with cardiovascular heart disease[14].

Our study found that there was no significant relationship between the HbA1c and OSA risk (p=0.218>0.05). The authors[1] were in line with what we got where found that was no significant difference in HbA1c levels and the risk of OSA.

The findings of our study showed an association between age and OSA risk. These results were comparable to the outcomes of another study, where they found that OSA risk significantly increased with age[11].

Our study has several limitations: the cross-sectional nature of the study. Additionally, most of the patients were males (two third), there are beliefs that there are disparities in the OSA risk between each gender. Furthermore, obesity is a risk determinant for OSA so; obesity acts as a confusing matter in our study. Future investigation is required to discuss these limitations and allowance for examining the impact of external factors such as medications, diet, and lifestyle.

The strengths of the present study are: the study population was collected from three primary healthcare centers. We were able to mark clinically meaningful data on symptoms related to OSA, medication applied for diabetes, diabetes complications.

Conclusion

We conclude that patients with type 2 diabetes mellitus have high risk of developing obstructive sleep apnea. Moreover, Questionnaires are subject to recall bias which could have influenced this study. The study was limited to National Guard Centers in Jeddah, Saudi Arabia. As a result, the study population might not represent all type 2 diabetic patients at risk of OSA in this region. Therefore, further studies in the same field are needed to generalize the results. Finally, screening programs for obstructive sleep apnea in patients with Type 2 diabetes need to be implemented as part of the routine screening in patients with Type 2 diabetes.

References

1. Kalakattawi RMN, Kalakattawi AMN, Alsuqati FA, et al. Risk of obstructive sleep apnea assessment among patients with Type 2 diabetes in Taif, Saudi Arabia. J Clin Med Res. 2017;9(12):1002. doi: 10.14740/jocmr3189w.
2. Sarokhani M, Goli M, Salarvand S, et al. The Prevalence of Sleep Apnea in Iran: A Systematic Review and Meta-Analysis. Tanaffos. 2019;18(1):1-10.
3. Wali SO, Alsharif MA, Albanji MH, et al. Prevalence of obstructive sleep apnea among patients with coronary artery disease in Saudi Arabia. J Saudi Heart Assoc. 2015;27(4):227-233. doi: 10.1016/j.jsha.2015.03.004.
4. Eckert DJ, Malhotra A. Pathophysiology of adult obstructive sleep apnea. Proc Am Thorac Soc. 2008;5(2):144-153. doi: 10.1513/pats.200707-114MG.

5. Garbarino S, Scoditti E, Lanteri P, et al. Obstructive sleep apnea with or without excessive daytime sleepiness: Clinical and experimental data-driven phenotyping. Front Neurol. 2018;9:505. doi: 10.3389/fneur.2018.00505.
6. Ahmad AN, McLeod G, Al Zahrani N, et al. Screening for high risk of sleep apnea in an ambulatory care setting in Saudi Arabia. Int J Environ Res Public Health. 2019;16(3):459. doi: 10.3390/ijerph16030459.
7. Foster GE. Sleep apnea in obese adults with type 2 diabetes: baseline results from sleep AHEAD study. Sleep. 28,A204(2005).
8. Fogel RB, Malhotra A, Pillar G, et al. Increased prevalence of obstructive sleep apnea syndrome in obese women with polycystic ovary syndrome. J Clin Endocrinol Metab. 2001;86(3):1175-1180. doi: 10.1210/jcem.86.3.7316.
9. Logan AG, Perlikowski SM, Mente A, et al. High prevalence of unrecognized sleep apnoea in drug-resistant hypertension. J Hypertens. 2001;19(12):2271-2277. doi: 10.1097/00004872-200112000-00022.
10. Pamidi S, Tasali E. Obstructive sleep apnea and type 2 diabetes: Is there a link? Front Neurol. 2012;3:126.
11. Saad AMJ, Hiyasat D, Jaddou H, et al. The prevalence of high-risk obstructive sleep apnoea among patients with type 2 diabetes in Jordan. Diabetes Res Clin Pract. 2019;152;16-22. doi: 10.1016/j.diabres.2019.04.035.
12. Young T, Palta M, Dempsey J, et al. The occurrence of sleep-disordered breathing among middle-aged adults. N Engl J Med. 1993;328(17):1230-1235. doi: 10.1056/NEJM199304293281704.
13. Iftikhar IH, Valentine CW, Bittencourt LR, et al. Effects of continuous positive airway pressure on blood pressure in patients with resistant hypertension and obstructive sleep apnea: A meta-analysis. J Hypertens. 2014;32(12):2341-2350. doi: 10.1097/HJH.0000000000000372.
14. Stadler S, Jalili S, Schreib A, et al. Association of sleep-disordered breathing with severe chronic vascular disease in patients with Type 2 diabetes. Sleep Med. 2018;48:53-60. doi: 10.1016/j.sleep.2018.05.001.

Figures and Tables

Table 1: STOP-BANG sleep apnea screening questionnaire.

STOP-BANG questions	Yes	No
Do you snore loudly (louder than talking or loud enough to be heard through closed doors)?	1	0
Do you often feel tired, fatigued, or sleepy during daytime?	1	0
Has anyone observed you stop breathing during your sleep?	1	0
Do you have or are you being treated for high blood pressure?	1	0
BMI more than 35 kg/m^2?	1	0
Age over 50 years old?	1	0
Neck circumference >16 inches (40cm)?	1	0
Gender: Male?	1	0

Figure 1: STOP-BANG sleep apnea screening questionnaire.

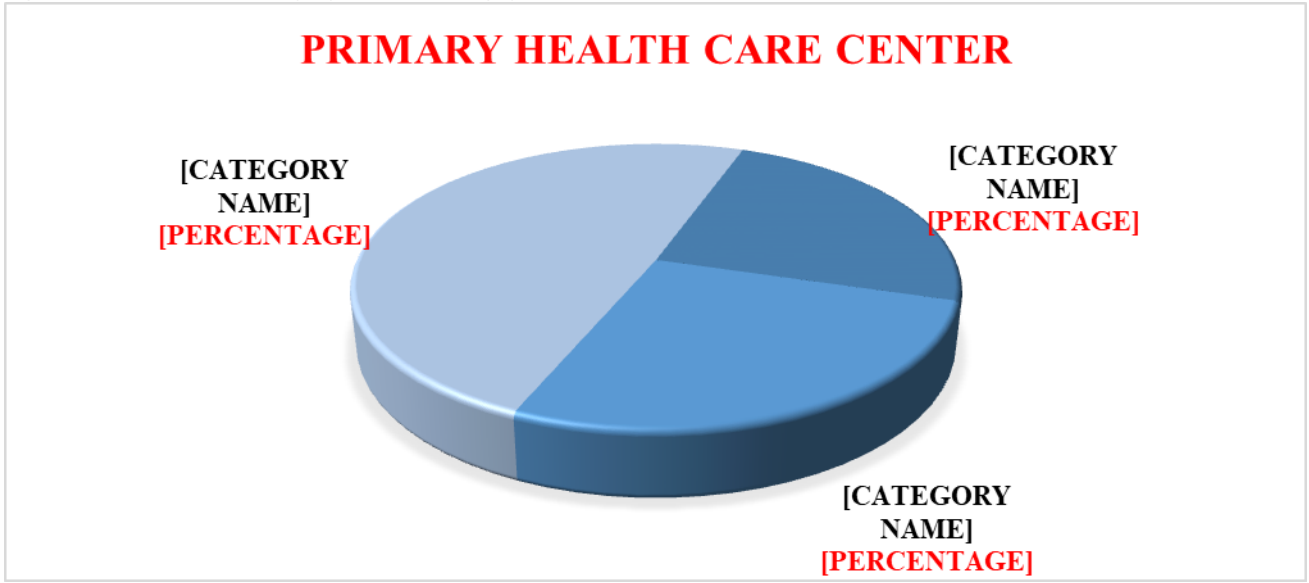

Table 2: Percentage of male and female participants with their mean age and standard deviation.

Age	**Mean±SD**	57.1±12.5
Gender	**Frequency**	**Per cent**
Male	106	62.0
Female	65	38.0
Total	**171**	**100.0**

Table 3: Assessment of the risk of sleep-disordered breathing among patients with type 2 diabetes.

Stop-Bang questionnaire	**No**	**Yes**	***p*-value**
	N (%)	**N (%)**	
Do you Snore Loudly (loud enough to be heard through closed doors or your bed-partner elbows you for snoring at night)?	23 (13.5%)	148 (86.5%)	0.000**
Do you often feel Tired, Fatigued, or Sleepy during the daytime (such as falling asleep during driving or talking to someone)?	27 (15.8%)	144 (84.2%)	0.000**
Has anyone Observed you Stop Breathing or Choking/Gasping during your sleep?	35 (20.5%)	136 (79.5%)	0.000**
Do you have or are being treated for High Blood Pressure?	76 (44.4%)	95 (55.6%)	0.146
Body Mass Index more than 35 kg/m^2?	125 (73.1%)	46 (26.9%)	0.000**
Age older than 50?	50 (29.2%)	121 (70.8%)	0.000**
Neck size large? (Measured around Adams apple) For male, is your shirt collar 17 inches/43 cm or larger? For female, is your shirt collar 16 inches/41 cm or larger?	66 (38.6%)	105 (61.4%)	0.003**
Gender=Male?	65 (38.0%)	106 (62.0%)	0.002**
Chi-square test: ***p-value* is significant at 0.01 level.			

Figure 2: Risk of having obstructive apnea.

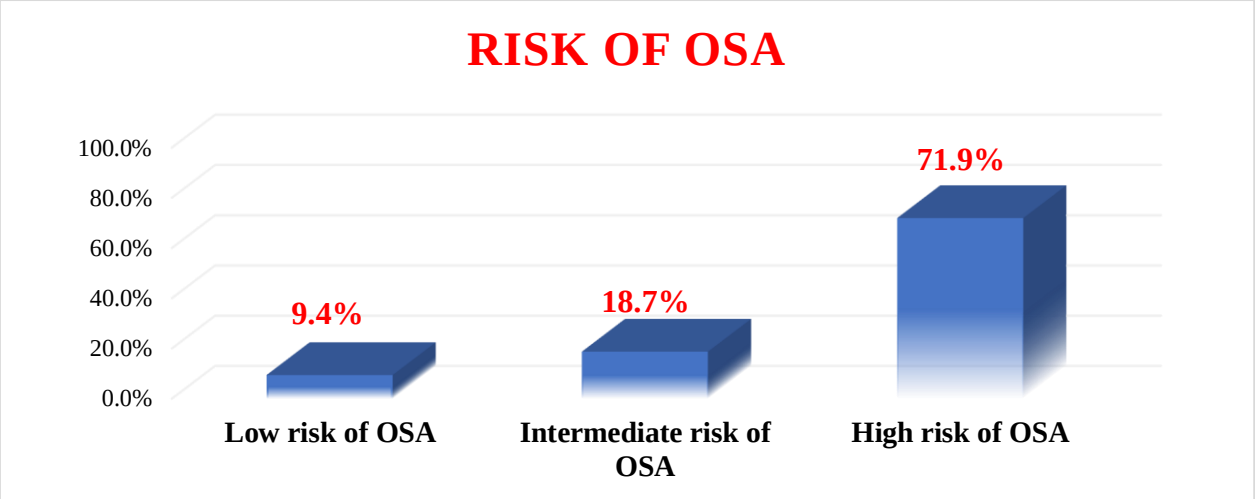

Table 4: Patients suffering from various diabetes complications.

Diabetes complications	**No**	**Yes**	***p*-value**
	N (%)	**N (%)**	
Do you have hypertension?	75 (43.9%)	96 (56.1%)	0.108
Do you have stroke?	167 (97.7%)	4 (2.3%)	0.000**
Do you have coronary heart diseases?	154 (90.1%)	17 (9.9%)	0.000**
Do you have heart failure?	169 (98.8%)	2 (1.2%)	0.000**
Chi-square test: ***p-value* is significant at 0.01 level.			

Table 5: Percentage of patients treated using oral medications, insulin injections or both.

Do you take oral medications or insulin injection or both?	Frequency	Per cent	*p*-value
Insulin injections	13	7.6	0.000**
Oral medications	95	55.6	
Both	63	36.8	
Total	**171**	**100.0**	
Chi-square test: ***p-value* is significant at 0.01 level.			

Table 6: Minimum, maximum, mean and standard deviation of the last readings of fasting blood sugar, HbA1c, and random blood sugar.

	Minimum	Maximum	Mean	Std. Deviation
Last Fasting Blood Sugar reading	4.30	24.80	8.90	3.491
Last HbA1c reading	5.20	13.80	8.08	1.637
Last Random blood sugar reading	3.00	25.30	10.26	4.918

Table 7: Relationship between the risk of obstructive apnea and comorbidities.

Diabetes complications		Low risk of OSA	Intermediate risk of OSA	High risk of OSA	*p*-value
hypertension	No	11 (6.4%)	23 (13.5%)	41 (24.0%)	0.000**
	Yes	5 (2.9%)	9 (5.3%)	82 (48.0%)	
stroke	No	16 (9.4%)	32 (18.7%)	119 (69.6%)	0.450
	Yes	0 (0.0%)	0 (0.0%)	4 (2.3%)	
coronary heart diseases	No	16 (9.4%)	27 (15.8%)	111 (64.9%)	0.232
	Yes	0 (0.0%)	5 (2.9%)	12 (7.0%)	
heart failure	No	16 (9.4%)	32 (18.7%)	121 (70.8%)	0.674
	Yes	0 (0.0%)	0 (0.0%)	2 (1.2%)	
Chi-square test: ***p-value* is significant at 0.01 level.					

Table 8: Relationship between risk of OSA and age, type of treatment, HbA1c.

		Low risk of OSA	Intermediate risk of OSA	High risk of OSA	*p*-value
Age	30 or less	0 (0.0%)	2 (1.2%)	0 (0.0%)	0.000**
	31 to 40	2 (1.2%)	5 (2.9%)	3 (1.8%)	
	41 to 50	9 (5.3%)	16 (9.4%)	15 (8.8%)	
	51 to 60	3 (1.8%)	6 (3.5%)	47 (27.5%)	
	more than 60	2 (1.2%)	3 (1.8%)	58 (33.9%)	
Type of treatment	Insulin injections	0 (0.0%)	1 (0.6%)	12 (7.0%)	0.241
	Oral medications	8 (4.7%)	22 (12.9%)	65 (38.0%)	
	Both	8 (4.7%)	9 (5.3%)	46 (26.9%)	
HbA1c	Normal	2 (1.2%)	2 (1.2%)	4 (2.4%)	0.218
	Prediabetes	0 (0.0%)	4 (2.4%)	8 (4.7%)	
	Diabetes	14 (8.2%)	25 (14.7%)	111 (65.3%)	
Chi-square test: ***p-value* is significant at 0.01 level.					