



The prevalence of risk for Obstructive Sleep Apnea among type 2 diabetes mellitus patients

Muddala Vara Prasanna Rao^{*1}, Vijay Kumar G¹, Chetlur HariPriya²

¹Department of Pharmacy Practice, School of Pharmaceutical Sciences, VISTAS, Pallavaram, Chennai – 600 117, Tamil Nadu, India

²Department of Safety Review, Accenture Solutions, Sholinganallur, Chennai – 600 119, Tamil Nadu, India

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ABSTRACT

Obstructive sleep apnea (OSA) is a common medical disorder and Type 2 Diabetes mellitus (T2DM) is an endocrine disorder where both of them commonly coexist. T2DM will disturb sleep patterns and disturbed sleep may predispose to insulin resistance resulting in T2DM. The study aim is to evaluate the prevalence of risk for Obstructive sleep apnea among T2DM patients based on patient demographic variables (age, gender and Body Mass Index (BMI)) and Berlin Questionnaire (BQ). In this cross-sectional study a total of 111 patients were included and the prevalence of risk was determined based on the BQ categories and the percentage was calculated accordingly. In BQ, Category 1 includes five questions based on snoring, category 2 includes three questions based on daytime somnolence and category 3 includes two questions based on BMI. These categories were marked as positive if the responses for snoring or daytime somnolence indicate persistent symptoms (> 3-4 times/week). Third category includes the patient's BMI greater than 30 kg/m² (obese) indicates positive score. In this study, the patients above 61 years (100%) and obese (94%) were at a higher risk for OSA. Based on the BQ, more positive (89.19%) responses were observed in category 1 (snoring) when compared to category 2 (40.54%) and 3 (74.77%) which concluded that T2DM patients are at a high risk (HR) for developing Obstructive Sleep Apnea.



*Corresponding Author

Name: Muddala Vara Prasanna Rao

Phone: +918124459393

Email: mvprasanna90@gmail.com

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INTRODUCTION

OSA is a common medical disorder which is characterized by upper airway instability while sleeping

which leads to recurrent episodes of airway obstruction (complete or partial). Recent studies indicated that prevalence of OSA as 17%–26% in men and 9%–28% in women (Young *et al.*, 2002). This was recognized as an important cause of increase in both morbidity and mortality (McNicholas and Bonsignore, 2007). The major risk factor for OSA is the global obesity increase (Tahrani, 2015); (Amin *et al.*, 2017), which in turn leads to increased diagnosis of this condition.

T2DM is an endocrine disorder affecting the beta cells in pancreas, and is commonly increasing worldwide reaching to epidemic proportion (Murray and Lopez, 1997). It was estimated that the prevalence of diabetes may increase in adults by 69% in developing countries and 20% increase in developed countries between 2010 and 2030 (Shaw *et al.*,

2010). T2DM will disturb sleep patterns and disturbed sleep may predispose to insulin resistance

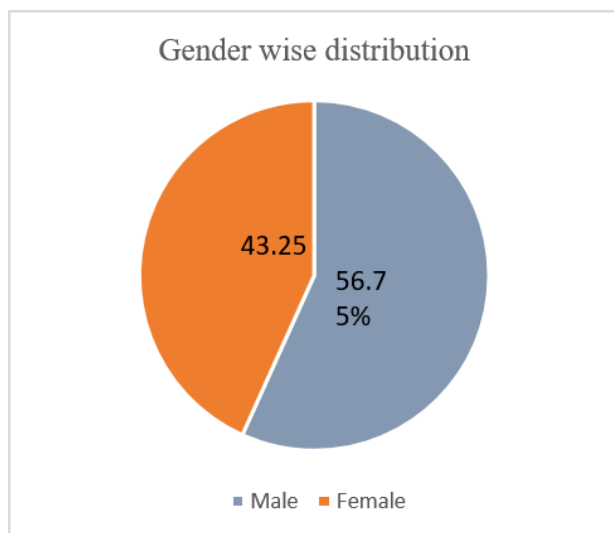


Figure 1: Gender wise distribution.

resulting in T2DM (Punjabi et al., 2002). Multiple studies have shown that increased insulin resistance and glucose intolerance are obesity independent (Aronsohn et al., 2010); (Punjabi, 2004). Various cross sectional studies have shown that T2DM and OSA commonly coexist (Tahrani, 2017); (Pamidi and Tasali, 2012). The patients with T2DM have more prevalence of sleep disturbances when compared to non-diabetic (West et al., 2006).

It is important to find the interrelation among T2DM and OSA patients as they are linked with cardiovascular diseases.

Table 1: Distribution based on Age

Age in years	No of participants (n=111)	Percentage (%)
30 – 40	25	22.52 %
41 – 50	38	34.23 %
51 – 60	36	32.43 %
61 and above	12	10.82 %

Aim

The study aim is to evaluate the prevalence of risk for Obstructive sleep apnea among T2DM patients.

A total of 111 participants with T2DM were selected and BMI was obtained. The risk and symptoms of OSA were examined using BQ, and was divided into 3 categories with a total of 10 questions. Category 1 includes five questions based on snoring, category 2 includes three questions based on day-

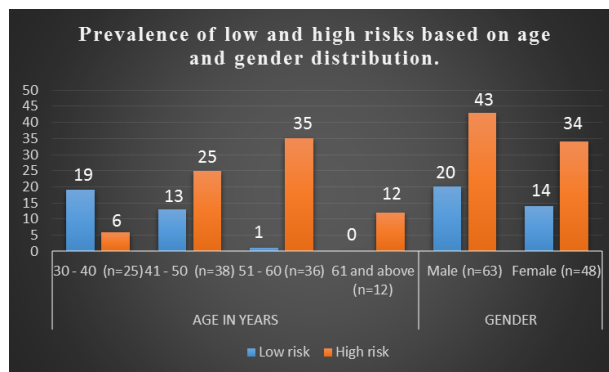


Figure 2: Prevalence of low and high risks based on age and gender distribution.

time somnolence and category 3 includes two questions based on BMI. As reported by Netzer et al, 1999, the BQ was scored. These categories (1 and 2) were marked as positive if the patient had persistent symptoms of snoring or daytime somnolence for > 3-4 times/week. Category 3 was marked as positive if the patients were Obese with BMI greater than 30 kg/m2. The patient is considered to be at a high risk if any of the two or more categories shows positive. Based on the percentage, high risk (HR) and low risk (LR) of Obstructive Sleep Apnea were calculated in T2DM patients.

RESULTS AND DISCUSSION

Among 111 participants, 25 were 30-40 years, 38 were 41-50 years, 36 were 51-60 years and 12 were above age of 61 (Table 1).

Out of 111 participants, the BMI for the patients with <18.5kg/m2 (underweight) were nil, 18.5 – 24.9kg/m2(normal) were 6 (5.40%), 25 – 29.9kg/m2 (overweight) were 55(49.55%) and > 30kg/m2 (Obese) were 50 (45.05%) (Table 2).

Table 2: BMI based distribution.

BMI (kg/m2)	No. Of participants (n=111)	Percentage (%)
<18.5 kg/m2	0	0%
18.5 kg/m2– 24.9 kg/m2	6	5.40%
25 kg/m2– 29.9 kg/m2	55	49.55%
> 30 kg/m2	50	45.05%

The prevalence of HR and LR were calculated based on the age and gender distribution of the participants involved in the study. Based on the age, 30-40 years (n=25) LR were 19 (76%) and HR were 6

Table 3: Prevalence of low and high risks based on age and gender distribution

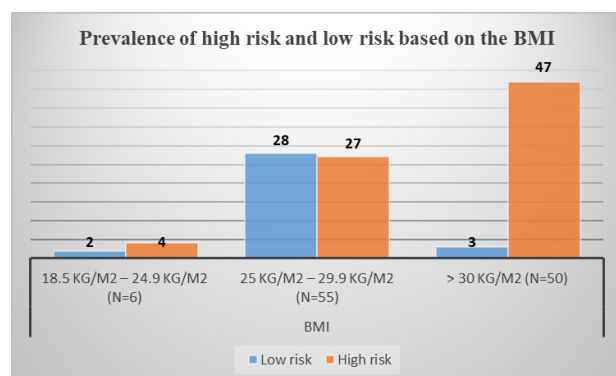
RISK	AGE IN YEARS				GENDER	
	30-40 (n=25)	41-50 (n=38)	51-60 (n=36)	61 and above (n=12)	Male (n=63)	Female (n=48)
Low risk	19	13	1	0	20	14
High risk	6	25	35	12	43	34
Low risk %	76%	34.21%	2.78%	0%	31.75%	29.17%
Highrisk%	24%	65.79%	97.22%	100%	68.25%	70.83%

Table 4: Prevalence of high risk and low risk based on the BMI.

RISK	BMI		
	18.5 kg/m ² -24.9 kg/m ² (n=6)	25 kg/m ² -29.9 kg/m ² (n=55)	> 30 kg/m ² (n=50)
Low risk	2	28	3
High risk	4	27	47
Low risk %	33.33%	50.91%	6%
High risk %	66.67%	49.09%	94%

Table 5: Distribution based on the BQ categories

	Category - 1		Category - 2		Category - 3	
	No. of participants (n=111)	Percentage (%)	No. of participants (n=111)	Percentage (%)	No. of participants (n=111)	Percentage (%)
Positive	99	89.19%	45	40.54%	83	74.77%
Negative	12	10.81%	66	59.46%	28	25.23%

**Figure 3: Prevalence of high risk and low risk based on the BMI.**

(24%), 41 - 50 years (n=38) LR were 13 (34.21%) and HR were 25 (65.79%), 51 - 60 years (n=36) LR were 1 (2.78%) and HR were 35 (97.22%) and 61 years and above (n=12) LR were 0 (0%) and HR were 12 (100%). Based on the gender, males (n=63) with LR were 20 (31.75%) and HR were 43 (68.25%) and females (n=48) with LR were 20 (31.75%) and HR were 43 (68.25%) (Table 3 and

Figure 2).

The prevalence of HR and LR percentages were calculated based on the BMI <18.5 kg/m² (n=0), 18.5 - 24.9 kg/m² (n=6) HR were (%) and LR were (%), 25 - 29.9 kg/m² (n=55) HR were (%) and LR were (%) and > 30 kg/m² (n=50) HR were (%) and LR were (%) (Table 4 and Figure 3).

All the 111 patients had responded to the BQ and were categorized accordingly. Among them, the total number of participants in Category 1 with positive were 99 (89.19%) and negative were 12 (10.81%), category 2 with positive were 45 (40.54%) and negative were 66 (59.46%) and category 3 with positive were 83 (74.77%) and negative were 28 (25.23%) (Table 5 and Figure 4).

In this study "The prevalence of risk for obstructive sleep Apnea among patients with type 2 diabetes mellitus", we found that the patients with T2DM have a HR for OSA based on BQ which was in agreement with Shim et al. and other studies (Shim et al., 2011); (Einhorn et al., 2007). For OSA, age is a contributing factor along with the diabetes and other

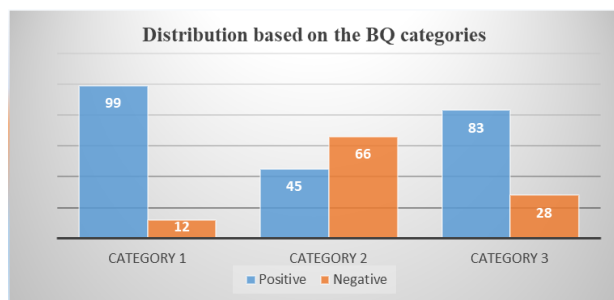


Figure 4: Distribution based on the BQ categories

comorbidities like hypertension and obesity which was also reported by (West *et al.*, 2006). The prevalence of OSA is more due to a worldwide surge in the aged populations and obesity (Usmani *et al.*, 2012). Few studies stated that male genders are the risk factor for OSA (Khassawneh *et al.*, 2009), but some studies found that there was no significant difference in the genders with respect to risk for OSA (Sokwalla *et al.*, 2017).

The major limitation of this cross-sectional study is its nature and the limited number of risk factors were examined. Moreover, no OSA tests were performed for the patients to confirm the OSA diagnosis. Hence further studies are required to address these limitations and confirm the same.

CONCLUSIONS

Our study concluded that the prevalence of high risk for Obstructive Sleep Apnea among T2DM patients were confirmed using the BQ. According to these, more positive responses were observed in category 1 (snoring) which confirmed that T2DM patients are at a high risk for developing OSA. Hence, further awareness among the health care professionals and the patients are required to prevent its prevalence and complications.

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Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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