



## PREVALENCE OF OBSTRUCTIVE SLEEP APNEA IN DIABETES MELLITUS TYPE 2

## Otolaryngology

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## ABSTRACT

**Aims:** To estimate the prevalence of Obstructive Sleep Apnoea [OSA] in individuals with Diabetes Mellitus type 2.

**Objectives :** To find the prevalence of obstructive sleep apnea in patient with Diabetes Mellitus Type 2. The purpose of this study was to estimate the proportion Diabetes Mellitus Type 2 patient with Obstructive Sleep Apnoea [OSA] in our hospital.

**Materials and Methods :** 50 patients with type 2 diabetes, aged 30 – 60 years, in a tertiary hospital centre (Saveetha medical college and hospital), were given the Berlin questionnaire and sleep study was done using Level 1 polysomnography.

**Results:** The prevalence rate in our study was found to be 38%.

**Conclusions:** Obstructive Sleep Apnoea [OSA] is highly prevalent in men with Diabetes Mellitus type 2, most individuals are undiagnosed.

## KEYWORDS

Obstructive sleep apnoea, polysomnography, diabetes mellitus type 2

## INTRODUCTION

Obstructive sleep apnoea (OSA) is common in the general population, affecting 1–5% of adult men and 1–2% of women<sup>[1,2]</sup> During sleep upper airway resistance is increased, which results in increased inspiratory flow limitation and obstruction causing snoring and apnea. In response to the obstruction, respiratory efforts are increased which causes arousals and terminates the apneic episode. These events occur due to increased sympathetic activity. Excessive daytime sleepiness is mainly due to frequent arousals and sleep fragmentation. If OSA is diagnosed as significant, successful treatment is given by using continuous positive airway pressure (CPAP)<sup>[3]</sup> Type 2 diabetes is a condition caused due to impaired glucose tolerance and insulin resistance which has a strong relationship with central obesity<sup>[4]</sup> OSA leads to insulin resistance, severe OSA groups are associated with greater insulin resistance, independent of general obesity.<sup>[5,6]</sup> The prevalence of OSA is high among impaired glucose tolerance and type 2 diabetes.<sup>[7]</sup> The prevalence of OSA among patients with type 2 diabetes has not, however, been investigated so far. This study estimates the prevalence of OSA in diabetes mellitus type 2. We have hypothesised in this study that OSA is highly prevalent among men with type 2 diabetes, more than in the general population. We also hypothesised that patients with OSA have higher glycosylated haemoglobin (HbA1c), reflecting poorer diabetic control. We therefore performed a study in patients with known diabetes mellitus type 2 to establish the prevalence of OSA with a screening questionnaire (Berlin's) and performed sleep studies type 1 polysomnography to confirm and categorize OSA. We also established whether there was any correlation between OSA severity and diabetic control measured by HbA1c.

## Materials and methods:

This study was a prospective cross sectional study of 50 patients with diabetes mellitus type 2, aged 30 – 60 years, attending saveetha medical college from January 2016-2017. Those who have been diagnosed by the Department of Internal Medicine, based on raised fasting blood glucose levels, postprandial blood glucose level and HbA1c level were given the Berlin questionnaire. The Berlin questionnaire contains questions regarding symptoms associated with OSA. The questions in the Berlin questionnaire are designed to screen for OSA, by determining, if people were in 'high' or 'low' risk for OSA, based on their answers. The Berlin questionnaire was published by Netzer et al in 1999 (Netzer 1999) which included five questions about snoring, volume of snoring and witnessed apnoeas and other three about daytime sleepiness, including one about sleepiness behind the wheel.

**ELEVEN ITEMS** covers three domains related to risk of OSA

1. snoring and sleep related symptoms
2. awake-time sleepiness and drowsiness

3. hypertension and/or BMI greater than 30.

Responses are coded present=1 for each and absent=0 for each category, final score range from 0 to 3. Who score > or=2 are classified as high risk and <2 as low risk. The patients with high risk Berlin Questionnaire were admitted in our hospital for sleep study by type 1 polysomnography, as sleep study is the gold standard for diagnosis of obstructive sleep apnea.

## Inclusion criteria:

All type 2 diabetes attending OPD.

## Exclusion criteria:

Patients who were prior diagnosed with OSA.

## Analysis

All the results were entered onto a MS Excel sheet and prevalence rate was calculated. The data were analysed using SPSS Version 22.0 and expressed as mean (SD, 0–100% range). Comparison of multiple groups was done by one way analysis of variance (ANOVA), with Duncan's multiple ranging for post hoc analysis. (Table 1)

## Observation and results:

Table 1. Demographic data

Characteristics	Data
Male	32 (64%)*
Age (years)	45.5 (5.79) **
Neck circumference (cms)	42.16 (1.71)**
Waist-Hip Ratio	1.23 (0.27)**
BMI (Kg/m <sup>2</sup> )	35.4 (4.07)**
OSA severity	6% - moderate OSA* 94% -severe OSA*
Average SPO2	89.2 % (3.45)**
Lowest SPO2	78.96 % (6.25) **
Fasting Blood Sugar (FBS)	206.6 (23.22) mg/dl **
Post Prandial Blood Sugar (PPBS)	301.9 (40.66) mg/dl **
HbA1c	9.88 (2.11) **
*Categorical data – number (percent)	
**Continuous data – mean (± SD)	

## Age distribution

The distribution of the age groups of candidates who enrolled for the study were between 30 – 60 years. The majority of OSA sufferers were

in the 41-50 years age group (64%), least in the 51-60 years age group (14%). (Fig. 1)

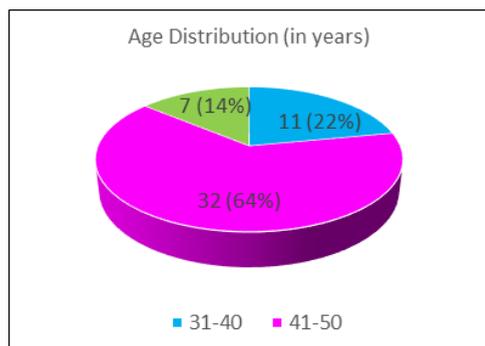


Figure 1. Age distribution

**Sex Distribution**

The male:female ratio in this study was 1.78:1. (Fig. 2)

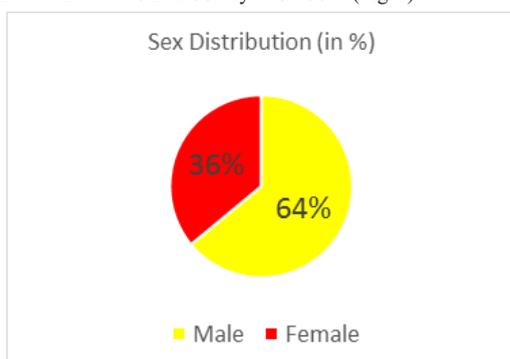


Figure 2. Sex distribution

**Neck Circumference**

The candidates for the study were within the range of 36 – 44 cms. The largest cluster was in the 44 cms (40%) and least was in 36 cms(2%). The observed distribution is depicted in (Fig. 3)

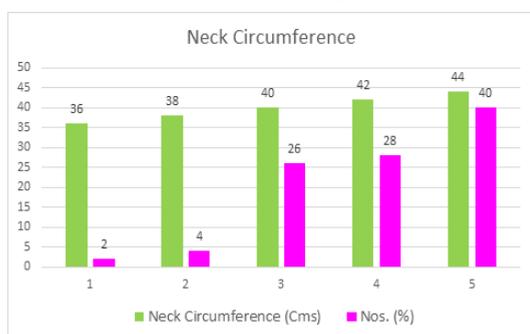


Figure 3. Neck Circumference

**Waist-Hip Ratio**

The observed range was between 0.9 - 1.6.

**Comparison of average and lowest SpO<sub>2</sub>**

The average SPO<sub>2</sub> and the lowest SPO<sub>2</sub> were 89.2 ± 3.45 % and 78.96 ± 6.25 % respectively. These patients were at high risk of developing cardio-pulmonary diseases than normal population. Probably, they also suffered from excessive daytime sleepiness, drowsiness, morning headaches, cognition deficits and defective neuromuscular in-coordination.

**Plasma Glucose levels**

The Fasting and Post-Prandial Blood Glucose values of all the candidates showed levels above 200 mg/dl though some of the patients were under medications for glycemic control. The loss in proper

control can be due to OSA which alters catecholamine and glucose metabolism thereby keeping sugar levels high. This may in effect be deleterious to multiple organs and reduce the organ's efficiency.

High HbA1c values in this cohort was also worrisome as this showed poor overall / past 3-month control of blood sugar levels.

The overnight PSG done at our institute's sleep lab showed that 38% of the candidates were having OSA. Remaining 62% of the study population were having AHI values below 5, The prevalence rate in our study was 38%.

**Discussion**

In this study, Berlin questionnaire and sleep study (type 1 polysomnography) showed OSA to be highly prevalent in population with type 2 diabetes, with estimated prevalence of 38%. **Ronksley et al., 2009**; calculated the prevalence estimates range from 15 to 30%, depending on the study population, the definition of OSA severity, and the methods used to diagnose type 2 diabetes

In this study there was a direct correlation between severity of OSA measured by AHI and HbA1c value. The mean HbA1c was 6.8% in mild OSA ,7.7 % in moderate OSA and 10.8% in severe OSA. **Pillai et al., 2011** cross-sectional study involving 52 consecutive patients recruited from a diabetes-obesity database. increased severity of OSA was associated with increased HbA1c levels. The adjusted mean values of A1c in each OSA category were 8.62% for no OSA, 9.36% for mild, 10.61% for moderate, and 9.91% for severe OSA.

The Fasting and Post-Prandial Blood Glucose values of all the candidates showed levels above 200 mg/dl though some of the patients were under medications for glycemic control. **Fendri et al., 2011** did a study of overweight and obese individuals with type 2 diabetes, nocturnal glycemia (as assessed by a continuous glucose monitoring sensor) was found to be 38% higher in those who had OSA, compared to those without OSA, independent of BMI. In my study FBS, PPBS and HbA1c value and BMI parameters were used in categorising OSA based on glycemic control. The loss in proper control can be due to OSA which alters catecholamine and glucose metabolism thereby keeping sugar levels high.

The prevalence of OSA among male was higher with a mean of 64%. **Celen et al., 2010** 168 middle-aged female patients, reported a significantly higher incidence of diabetes in patients with OSA compared to those without OSA in women which is contradictory to my study, 64% were men when compared to female who were 36%.

In this study it was found that 40 % of individuals had neck circumference of 44cms and was an indirect indicator for OSA.

**Celen et al., 2010**, used full polysomnography to diagnose OSA. The majority of studies used statistical adjustments for shared risk factors such as age, sex, body mass index (BMI) and various other parameters (e.g., neck and waist circumference). Overall, the cross-sectional analyses have shown a significantly higher prevalence of diabetes in patients with OSA as compared to those without OSA which is in accordance with my study.

**Kent BD et al.** study showed that T2DM prevalence increased with OSA severity, from 6.6% in subjects without OSA to 28.9% in those with severe OSA. Despite adjustment for obesity and other confounding factors, in comparison with subjects free of OSA, patients with mild, moderate, or severe disease had an OR (95% CI) of 1.33 (1.04-1.72), 1.73 (1.33-2.25), and 1.87 (1.45-2.42) (P < .001), respectively, for prevalent T2DM. Diabetic subjects with severe OSA had worse glycemic control, with adjusted mean HbA1c levels 0.72% higher in patients with severe OSA than in those without sleep-disordered breathing (analysis of covariance, P<.001).

**Warren et al** study, showed Increased severity of OSA was independently associated with worsening glycemic control following adjustment of various confounders, including insulin dosage. We would hypothesize therefore that identification and treating OSA among patients with T2D may confer benefits in improving glycemic control

**Conclusion**

The prevalence rate in our study was 38%. Obstructive Sleep Apnoea

[OSA] is highly prevalent in men with Diabetes Mellitus type 2, most individuals are undiagnosed. Diabetes Mellitus Type 2 may be a significant independent contributor to Obstructive Sleep Apnoea risk. Since the regional prevalence is higher than the global prevalence, better awareness programs should be planned to target the high risk population. More OSA screening programs should be conducted in Diabetes Mellitus type 2 individuals. In this study the most affected age group was found to be between 41-50 years. As their efficiency is affected it may indirectly affect the economy of the community.

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