ORIGINAL ARTICLE

Assessment of Snoring and obstructive sleep apnoea in a Nigerian university: Association with cardiovascular risk factors

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ABSTRACT

Background: Snoring remains under diagnosed in general population. It however has significant morbidity and mortality risk factors with multiple effects on the cardiovascular system. The Berlin questionnaire is a worldwide validated instrument to identify those at increased risk for obstructive sleep apnoea (OSA). **Materials and Methods:** In all, 206 workers of LAUTECH were invited to participate in the study. The Berlin questionnaire was used for this study. It was a cross-sectional study. Socio-demographic and clinical data were taken with a data form. Statistical Package for the Social Sciences software (SPSS 17.0) was used for statistical analysis. $P < 0.05$ was taken as statistically significant value. **Results:** The study participants consisted of 96 males (46.6%) and 110 (53.4%) females. The mean age was 45.3 ± 7.9 years. The mean body mass index was 28.5 ± 6.0 kg/m^2. The frequency of occurrence of snoring was 91 (44.2%) including 50 males (54.9% and 41 females (37.3 %, $P < 0.05$). Using the Berlin score, 63 (30.6%) including 34 females (30.9%) were assessed to be at high risk for OSA. Snorers were more likely to be at higher risk of OSA compared to non snorers: odd risk was 113.8, relative risk was 3.3. Snoring was most likely to be associated with obesity, elevated blood pressure and male gender in this study. **Conclusion:** We concluded that snoring and high risk for sleep apnoea is common among this unselected University population and they are closely related to many conventional cardiovascular risk factors. Appropriate interventional strategies are indicated to reduce the burden of the increased morbidity and mortality associated with sleep apnoea in our population.

Key words: High risk, Nigeria, obstructive sleep apnoea, sleep disordered breathing, snoring, University workers

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INTRODUCTION

Snoring and obstructive sleep apnoea (OSA) are very common medical disorders in the community but remain under diagnosed. They are associated with sleep disordered breathing (SDB) and excessive daytime somnolence.[1,2] They are both associated with grave clinical and morbidity consequences with impairment in quality of life and rising cost of management. Snoring and OSA are associated with many cardiovascular disorders including hypertension, coronary heart disease, congestive heart failure, stroke, erectile dysfunction and impaired glucose tolerance/diabetes mellitus.[3-5] Conversely, OSA and snoring have been shown to be highly prevalent among subjects with hypertension and heart failure.[6,7]

Akintunde *et al.* have also shown that OSA and snoring may be associated with impaired glucose tolerance and increased left ventricular mass among Nigerians.[6-8] The association between SDB and cardiovascular risk factors and diseases therefore may allow the use of OSA and snoring be used as a cardiovascular risk.[9]

As cardiovascular disease remain the number one cause of death worldwide with increasing frequency and severity in the developing economies, the prevalence of snoring and high risk for OSA may mirror the population burden of cardiovascular disease and used to identify people who will require more intensive drug and non-pharmacological based intervention to reduce their risk of cardiovascular death. The University workforce remains an important focus for a developing economy as a healthy workforce remains the only way to drive resource driven and goal oriented, problem solving

Access this article online

Quick Response Code:

Website: www.nigeriamedj.com

DOI: 10.4103/0300-1652.144698

researches from the various Universities. There are few data on the population prevalence of snoring and OSA in Africa.[10-13]

This study aimed at describing the prevalence of snoring and high risk for OSA among workers in a Nigerian University. It also aimed to determine whether snoring and high risk of OSA is closely related to conventional cardiovascular risk factors among the study participants.

MATERIALS AND METHODS

Two hundred and six workers (including academic and non academic staff of the Ladoke Akintola University of Technology, Ogbomoso (LAUTECH)), Nigeria were recruited for this study. It was a cross-sectional survey done between, November 2013 to January 2014. All participants completed the Berlin questionnaire after undergoing a complete physical examination. They also had 12-lead resting electrocardiography (ECG) done on them. Their demographic data including age at last birthday, gender, highest level of education, history of previous diagnosis of hypertension or diabetes, use of long-term medication, among others were taken. Their body weight, height and waist circumference were determined.

The Berlin questionnaire has been used previously to determine the presence of SDB and high risk for OSA in many population.[14,15] It consist of three sections: The first section asks responders, whether they snore and those who answer in the affirmative on how loud their snoring is, how often it occurs and whether it bothers other people. In the second section, the responders are asked on how often they feel tired or fatigued after waking up and whether they have ever fell asleep while driving. The third section asks for history of hypertension, height, weight, age and gender. A section was considered positive, if there were two affirmative answers in either section 1 or 2 or one affirmative response in section 3. Individuals who had positive scores in two or three sections were considered to have a high risk for OSA.

They also had laboratory investigations which included random blood sugar, serum lipid (including total cholesterol, triglycerides, high density lipoprotein cholesterol, and low density lipoprotein cholesterol). Histories of smoking and alcohol intake and quantity when present were also taken. The body mass index (BMI) was determined. Obesity was defined as BMI >30kg/m^2. Average systolic and diastolic blood pressures were taken using standardised protocols. A pretested data form was used to obtain all relevant information.

Statistical analyses were done using the Statistical Package for Social Sciences SPSS 17.0 (Chicago, IL.). Nominal variables were summarised as frequencies and percentages while continuous data were summarised as mean ± standard deviation. Categorical (Nominal) data were analysed using the Chi square test while continuous data were analysed using independent *t* test. $P < 0.05$ was taken as statistically significant value. Odd ratio and relative risk were also used appropriately.

RESULTS

The study population consisted of 110 females (53.4%) and 96 males (46.6%). The mean age was 45.3 ± 7.9 years. Majority of them were in the middle-aged group between 35 to 60 years of age. The mean body mass index was 28.5 ± 6.0 kg/m^2. The mean body mass index for females was significantly higher than males. Snoring was reported in 91 participants (44.2%). Using the Berlin questionnaire to assess the risk for OSA, 63 participants (30.6%) were assessed to be at high risk for OSA, most of them reported that they snore during sleep. This is shown in Table 1.

The clinical, demographic and laboratory differences between those who reported that they have snoring and those without are highlighted in Table 2. Snorers were likely to be older in age compared to non-snorers, although this was not statistically significant. Snorers were more likely to be males in this study. The mean BMI and waist circumference were significantly higher among snorers than non-snorers. (30.5 ± 6.1kg/m^2 and 94.7 ± 12.7 cm *vs.* 26.8 ± 4.8 kg/m^2 and 87.0 ± 9.6 cm, respectively).

Table 1: Clinical, laboratory and demographic parameters of study participants

Variables	Values
Mean age (years)	45.3±7.9
<35 years	16 (7.8%)
35-45 years	91 (44.2%)
46-60 years	91 (44.2%)
>60 years	8 (3.9%)
Gender (males)	96 (46.6%)
Mean BMI (kg/m^2)	28.5±6.0
>30 kg/m^2	79 (38.3%)
Mean WC (cm)	92.8±11.8
Visceral obesity (*n*)	92 (44.7%)
Frequency of snoring (*n*)	91 (44.2%)
High risk of OSA (*n*)	63 (30.6%)

BMI – Body mass index; WC – Waist circumference; OSA – Obstructive sleep apnoea

Table 2: Clinical, demographic and laboratory differences between snorers and non-snorers

Variables	Snorers (91)	Non snorers (115)	*P* value
Age (years)	46.5±6.8	44.2±6.5	0.085
Gender (males)	50 (54.9%)	41 (35.7%)	0.034*
Females (n)	41 (45.1%)	74 (64.3%)	
Mean BMI (kg/m^2)	30.5±6.1	26.8±4.8	0.001*
Mean WC (cm)	94.7±12.7	87.0±9.6	0.001*
Mean Total cholesterol (mmol/l)	5.6±1.3	5.5±1.2	0.634
Mean systolic blood pressure (mmHg)	137.7±22.4	133.3±18.0	0.801
Mean diastolic blood pressure (mmHg)	83.0±13.7	82.4±11.3	0.275
BMI >30 kg/m^2	48 (52.7%)	31 (27.0%)	0.0310*
Visceral obesity	46 (50.5%)	46 (40.0%)	0.0423*
High risk of OSA	43 (47.3%)	20 (17.4%)	0.000*

*statistically significant; BMI – Body mass index; WC – Waist circumference; OSA – Obstructive sleep apnoea

The frequency of visceral obesity, those with generalised obesity and those assessed to be at high risk of OSA using the Berlin questionnaire were significantly higher among snorers than non-snorers as shown in Table 2. Although mean systolic blood pressure, mean diastolic blood pressure and total cholesterol were significantly higher among snorers than non-snorers, they were not statistically significant.

Table 3 shows the clinical, laboratory and demographic variables between participants who were assessed to be at high risk for OSA using the Berlin questionnaire and those assessed to be at low risk are shown in Table 3. The mean age of those at high risk of OSA was significantly higher than those at low risk of OSA (47.7 ± 7.0 *vs*. 44.4 ± 6.4 years, $P < 0.05$ respectively). The mean systolic blood pressure and BMI were significantly higher among those at high risk of OSA compared with those at low risk (142.2 ± 24.5 mmHg and 33.2 ± 5.2 kg/m^2 *vs*. 132.2 ± 19.9 mmHg and 26.8 ± 5.2 kg/m^2, respectively, $P < 0.05$). Participants assessed to be at high risk of OSA were more likely to be hypertensive, had visceral obesity, elevated total cholesterol and generalised obesity than those assessed to be at low risk of OSA as shown in table 3. Mean total cholesterol and low density lipoprotein cholesterol were higher while high density lipoprotein were lower among those at high risk of OSA compared with those at low risk; however, they were not statistically significant. Clustering of cardiovascular risk factors was likely to be more common among those with high risk of OSA than those with low risk. The mean number of cardiovascular risk factors clustered together among those with high risk of OSA was significantly higher among participants assessed to be at high risk of OSA compare with those at low risk (3.7 ± 1.5 *vs*. 2.7 ± 1.7 CV risk factors respectively, $P < 0.05$)

Table 3: Clinical, laboratory and demographic differences between participants with high risk of OSA and low risk

Variables	High risk of OSA (63)	Low risk of OSA (143)	*P* value
Age (years)	47.7±7.0	44.4±6.4	0.014*
Visceral obesity (*n*)	45 (71.4%)	47 (32.9%)	0.001*
BMI >30 kg/m^2	49 (77.8%)	39 (27.3%)	0.000*
HTN (*n*)	38 (60.3%)	46 (32.2%)	0.001*
↑total cholesterol (*n*)	42 (66.7%)	80 (55.9%)	0.031*
Mean BMI (kg/m^2)	33.2±5.2	26.8±5.2	0.000*
Average sbp (mmHg)	142.2±24.5	132.2±19.9	0.023*
Average dbp (mmHg)	84.7±14.6	82.1±13.3	0.347
Mean total Cholesterol (mmol/l)	5.8±1.3	5.4±1.3	0.134
HDL (mmol/l)	1.08±0.31	1.2±0.32	0.117
LDL (mmol/l)	4.2±1.4	3.8±1.4	0.181
No of cv risk factors(*n*)	3.7±1.5	2.7±1.7	0.002*

*Statistically significant; BMI – Body mass index; HTN – Hypertension; SBP – Systolic blood pressure; DBP – Diastolic blood pressure; HDL – High density lipoprotein; LDL – Low density lipoprotein; CV – Cardiovascular; ↑ – increased

DISCUSSION

The most important findings in this study are that almost half of the participants reported a history of snoring, and almost one third were assessed using the Berlin questionnaire to be at high risk for OSA and these two factors are significantly associated with increased cardiovascular risk and other conventional cardiovascular risk factors in this population. The pattern of SDB, therefore, reflects the cardiovascular risk factors among these university workers. The main factors which appear to be driving the increased frequency of occurrence of SDB include increasing age and obesity. The presence of SDB also seems to be associated with the presence of more clusters of cardiovascular risk factors, increasing blood pressure and atherogenic dyslipidaemia.

The rising prevalence of SDB and association with increasing age and obesity has been known in the scientific literature.[16,17] Prevalence in this study is far higher than that reported among Abuja residents in a survey by Adewole *et al.*[11] In that study the prevalence of snoring was 31% whereas that of high risk for OSA was 19%. However, these two studies are similar in the fact that they both show that, those with high risk for OSA and /or snoring were more likely to be obese, and elderly had more medical conditions that those assessed to have low risk for OSA/ non snorers.[11,12]

This study further confirms that snoring and high risk for OSA are frequently common in the population and there seems to be a steady increase in pattern and frequency, possibly due to rising population prevalence of obesity and increased prevalence of cardiovascular risk factors. Obstructive sleep apnoea is increasingly being recognised as being associated with increasing cardiovascular morbidity and mortality and also a common cause of many medical conditions including hypertension, stroke, coronary heart disease and heart failure.[18,19] It is characterised by recurrent episodes of partial or complete collapse of the upper airway during sleep causing reduction in airflow and acute derangements in gas exchange and leading to snoring and recurrent arousal from sleep. Consequences of OSA include excessive daytime somnolence, cognitive dysfunction, impaired work performance and reduced quality of life;[20,21] all of which will be detrimental to the productivity of a university workforce. Although polysomnography is the diagnostic tool, it has many limitations including being time consuming, labour intensive and not readily available. The Berlin questionnaire has been validated and it is used worldwide to predict the risk for OSA in the population with good effect. The risk factors for OSA include increasing age, excess body weight, male gender, craniofacial abnormality, genetics, cigarette and alcohol intake. Other conditions that have been associated with increasing prevalence of OSA include polycystic ovarian syndrome, hypothyroidism and pregnancy.

The mechanism by which OSA is related to the presence and clusters of cardiovascular risk factors are varied. They include heightened sympathetic activity due to activation of chemoreceptors leading to peripheral vasoconstriction[22] increased production of endothelin and impaired endothelial function,[23] increased systemic inflammation, increased insulin resistance and elevated serum leptin level.[22-24] Treatment of OSA include use of continuous pressure airway pressure (CPAP) ventilation, weight reduction and sometimes but less effectively use of medications. Akintunde *et al*. have earlier shown that OSA seems to be associated with increased cardiovascular risk including poor blood pressure control, heart failure, impaired fasting glucose, metabolic syndrome and syndrome Z.[6-8] Therefore, it is important that subjects identified with SDB including snoring and high risk for OSA are already at increased cardiovascular risk . This is in agreement with the outcome of this study, where snorers and those with high risk for OSA had significantly higher mean blood pressure, frequency of dyslipidaemia and mean number of total number of cardiovascular risk factors clustered together. Many epidemiologic studies have also reported that snoring and sleep apnoea are more common among men. This may be due to distinctive symptom profile among males and females with women not reporting the classical symptoms such as loud snoring, nocturnal sorting or gasping and witnessed apnoea. Another possible reason may be due to the sex difference in anatomical and functional properties of the upper airway.[25,26]

African-Americans tend to have an increased prevalence of OSA, especially in the minority population where the frequency of obesity is often high.[27] This is in line with the high prevalence of SDB reported in this study compared to similar study from Caucasians.[28,29]

This study is not without its limitation. First, polysomnography was not done as this could have precisely diagnosed OSA in these patients. Also, it is based on self-report and there could be reporting bias from responders.

This study therefore concluded that SDB including snoring and high risk for OSA are very common among university workers in a Nigerian University setup and is closely related to increasing age, obesity, increased presence of multiple cardiovascular risk factors. Early identification and appropriate intervention are therefore essential in order to stem the tide of increased burden of cardiovascular disease among university workforce in Nigeria.

ACKNOWLEDGEMENTS

We wish to thank all the Residents in the Departments of Medicine and Chemical Pathology of LAUTECH Teaching Hospital, Ogbomoso and also the SIWES students from Physiology Department, LAUTECH who participated in the study.

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How to cite this article: Akintunde AA, Salawu AA, Opadijo OG. Assessment of Snoring and obstructive sleep apnoea in a Nigerian university: Association with cardiovascular risk factors. Niger Med J 2014;55:469-73.

Source of Support: The Authors gratefully acknowledge the financial support received from Ladoke Akintola University of Technology, Ogbomoso, Oyo State, Nigeria through Senate Research Grant LAU/SRG/13/001**, Conflict of Interest:** None declared.