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Comparative cross-sectional study for understanding the relations of risk for Obstructive Sleep Apnea and physical activity.

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Abstract:
Background*: Obstructive sleep apnoea is a significant non-communicable disease of public health importance. The burden of the disease is substantial and currently rising. Physical activity is associated with disease causation, severity and progression. Evidence suggests there is a link between physical activity and the risk for developing obstructive sleep apnoea (OSA). This study aims to establish the relationship of physical activity with the risk of OSA.*
Materials and Methods*: The study was a cross-sectionalsurvey; comparing the risk of OSA between hospital staff with low and high physical activity. At least 160 participants who are physically inactive and physically active were recruited for the study. The physical activity levels were assessed with the International Physical Activity Questionnaire (IPAQ). Each participant also had the risk for OSA assessed with the STOP-BANG questionnaire. The set data were analyzed with an SPSS version 21 software.*
Results*:A total of 325 participants were selected for the study. The selected participants were divided into two groups 164 for the high physical activity group and 161 for the low physical activity group: the mean age, body mass index and Gender of the study groups were evenly distributed with no statistical difference. The overall risk for obstructive sleep apnoea was higher in the low physical activity group. Forty-four people (26.8%) had a high risk of developing OSA while frequency in the HPA group is 32 (19.9%). The difference in the risk for OSA between the two is not statistically significant (p= 0.088).*
Conclusion:*physical inactivity is not associated with the risk of developing OSA*
Key Word:relation*, obstructive sleep apnoea, physical activity*

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I. Introduction

Obstructive sleep apnea (OSA) is a medical condition characterized by frequent episodes of upper airway collapse during sleep and is a significant health concern. OSA is associated with daytime fatigue and sleepiness, among others. These symptoms of OSA affect the quality of life and productivity of the sufferers.[1] Patients with OSA are more likely to have motor vehicle accidents, civil and criminal liabilities.[2] Also, they are prone to psychosocial disorders such as depression, memory problems, difficulty concentrating and slower reaction time. Besides, studies have also shown that OSA to be closely linked with the development of hypertension especially in older adult males, cardiovascular diseases like coronary artery disease and atrial fibrillation, as well as abnormalities of glucose metabolism.[3,4,56]

The global prevalence of OSA ranged between 9% and 38% in population-based studies.[7] OSA usually affects middle-aged men more than women; however, the prevalence of OSA may be equal or slightly higher after menopause.[8,9,10] The exact incidence of OSA in Nigeria is largely unknown, due to the unavailability of standard diagnostic tools. However, observational studies on the risk of the diseases have suggested that it may be on the increase, most of which remain underdiagnosed and undertreated.[11,12] Several factors increase the risk of developing OSA. Some are hereditary; others are as a result of age, obesity and lifestyle such as consumption of alcohol, especially at bedtime and cigarette smoking.[13]

World Health Organization (WHO) defines "physical activity as any bodily movement produced by skeletal muscles that require energy expenditure – including activities undertaken while working, playing, carrying out household chores, travelling, and engaging in recreational pursuits".[14] Regular physical activity has a significant benefit for health across all ages. Physical inactivity, on the other hand, is one of the leading risk factors for death worldwide and is on the rise in many countries.[14] The rise in physical inactivity is partly due to sedentary behaviour on the job and at home and inaction during leisure time.[14] Besides, some environmental factors linked to urbanization such as fear of violence and crime, lack of parks, sidewalks and sport/recreational

facilities contribute to the rising trend. Physical inactivity is a risk factor for weight gain and obesity, and also it contributes to OSA significantly. The evidence so far suggests that it is maybe an independent risk factor for developing OSA haven adjusted for other confounders). The many health benefits of regular physical activity underline the importance of this study, especially in this period when the prevalence of physical inactivity` in the population is increasing.[15]This study aims to check for the relationship of risk for OSA and physical activity

II. Material and Methods

Study design: a comparative cross-sectional study

Study population: this consists of hospital staff of the University of Abuja Teaching Hospital Gwagwalada. the hospital is a tertiary health facility with 350-bed spaces, located in one of the Federal capital territory (FCT)municipal council, gwagwalada

Sample size:

The sample size was determined using the formula comparative sample size.

n= 16P(1-P) / (Po-P1) where P=(Po+P1)/2

Po= proportion of risk for OSA in the physically inactive population (28%) 16

P1= proportion of risk for OSA in the general population (18%)

P= proportion of risk for OSA in physically inactive healthy individuals

Power (1-β) = 0.8

At least 160 subjects would be recruited each for physically active and inactive categories of the study.

Method: A questionnaire was used to obtain the general information of the study participant. The weight, height, neck circumference and blood pressure of each participant were measured and recorded.

The study participant's physical activity levels will be assessed with the International Physical Activity Questionnaire (IPAQ). The questionnaire has seven items, with open-ended questions surrounding individuals' last 7-day recall of physical activity. It was first developed in Geneva in 1998 but has been validated in several countries for use in young and middle-aged adults (15-69 years).

Interpretation of the IPAQ questionnaire; There are two forms of output from scoring the IPAQ. Results can be reported in categories (low activity levels, moderate activity levels or high activity levels) or as a continuous variable (MET minutes a week). MET minutes represent the amount of energy expended carrying out physical activity.Those who score HIGHon the IPAQ engages in Vigorous-intensity activity on at least 3 days OR 7 or more days of any combination of walking, moderate-intensity or vigorous-intensity activities a week. Those who score MODERATE onthe IPAQ engage in 3 or more days of vigorous-intensity activity and/or walking of at least 30 minutes per day OR 5 or more days of moderate-intensity activity and/or walking of at least 30 minutes per day. Scoring a Low-levelof physical activity on the IPAQ means that you are not meeting any of the criteria for either MODERATE or HIGH levels of physical activity. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal.

Each participant ~~will~~ also ~~have~~ hadthe risk for OSA assessed with the STOP-BANG questionnaire. The STOP-BANG questionnaire is a self-administered psychometric tool, which has been validated for use in screening of those at risk for obstructive sleep apnea. The questionnaire consists of 8 items related to the risk of having sleep apnea. Patients can be classified into High Risk, intermediate or Low Risk based on their responses to the individual items and their overall scores.

Ethical consideration: approval for the study was obtained from the ethics and research committee of the University of Abuja. The study was registered with the reference number UATH/HREC/PR/012. Informed and written consent was obtained from each of the participants before the commencement of the study.

Data analysis: The data obtained was coded on entering and analyzed using statistical package for social science (SPSS) statistical software, (SPSS 21.0, SPSS; Chicago, IL). The confidence interval was 95%, and the p-value was 0.05. The data represented; as mean, range and standard deviation for the set variables. A comparison between different groups was made using Fisher's exact test.

III. Result

The result from the study participants is presented below; a total of 325 participants were selected for the study. The study participants were divided into two groups base on the average level of activity at work and home for the final analysis.

Table 1 shows the general distribution of the study population; 79 (48.2%) were male, and 85 (51.8%) were female in the low physical activity group. In comparison, the high physical activity group had 82 (50.9%) and 79 (49.1%) of male and female, respectively. The difference between the two groups is not statistically significant.

The risk of snoring is more in the low physical activity group, 75 (%). When compared to the high activity group, fewer participants complain of snoring during sleep. The difference between the two groups is statically significant P = 0.016.

In terms of sleepiness at work or home; the group with low physical activity had more participant who was at risk of day time somnolence. Sixty-one participants representing (37.2%) complained of sleeping during work. The difference observed in the two groups is also statistically significant p-value is 0.011.

The overall risk for obstructive sleep apnoea was higher in the low physical activity group. Forty-four people (26.8%) had a high risk of developing OSA while frequency in the HPA group is 32 (19.9%). The difference in the risk for OSA between the two is not statistically significant (p= 0.088).

Table1:general distribution of study population into physical activity categories

	Low- PA n = 164 (%)	**High- PA n = 161 (%)**	**X**	**P-Value**
AGE (Years)				
40-45	55 (33.5)	63 (31.9)		
45 50	50 (30.5)	56 (34.8)	2.89	0.089
50-55	59 (36.0)	42 (26.1)		
Gender				
Male	79 (48.2)	82 (50.9)	0.658	0.349
Female	85 (51.8)	79(49.1)		
Risk of Snoring				
Yes	75 (45.7)	54 (33.5)	5.03	0.016
No	89 (54.3)	107 (66.5)		
Risk for sleepiness				
Yes	61 (37.2)	40 (24.8)	5.78	0.011
No	103 (62.8)	121 (75.2)		
BMI				
< 30 Kg/m^2	100 (61.0)	106 (65.8)	0.825	0.213
> 30Kg/m^2	64 (39.0)	55 (34.2)		
Risk for ROSA				
High risk	44 (26.8)	32 (19.9)	2.19	0.088
Low risk	120 (73.2)	129 (80.1)		

ROSA= Risk Obstructive Sleep Apnoea, BMI= Body Mass Index

Seventy-six subjects (23.4%) of the study population were at risk of developing OSA.The age distribution for the study population is greater for the participants at high risk of OSA than with low-risk OSA. The mean age for those at high risk and low for OSA is 47.4± 4.6 and 46.8±4.6 respectively. The difference between the groups was not statistically significant. The neck circumference for those at high risk for OSA was 41.1± 4.7 (cm). The neck circumference is 3.5cm more for those at high risk than that for those at low risk for OSA. The mean neck circumference of those at low risk was 37.8± 3.9 cm. The difference between the two groups was statistically significant, and the p-value is 0.001.Another factor associated with the risk for OSA is BMI. As can be seen in the table, the mean BMI for the low and high risk for OSA is 25.9±4.8 and 26.5±4.9, respectively. The difference between the categories was not statistically significant.The systolic blood pressure was 129.6± 21.7mmHg and 144.6± 21.1mmHg for the low and high risk for obstructive sleep apnoea, respectively. As shown, the mean SBD was higher for the high-risk OSA. The difference was statistically significant.A similar pattern was observed for the DBP—table 2 show full details of the data distribution for all the groups based on the risk of OSA.

Table-2: comparison of neck circumference and blood pressure of the study population at risk for OSA

Variables	Low-risk OSA (n = 249)	High-risk OSA (n = 76)	t	P-Value
AGE (Years)	46.8± 4.6	47.4± 4.6	0.95	0.34
BMI (Kg/m^2)	25.9±4.8	26.5±4.9	0.84	0.41
NC (cm)	37.8± 3.9	41.1± 4.7	6.04	0.014
Blood pressure SBP (mmHg)	129.6± 21.7	144.6± 21.1	5.37	0.01
DBP(mmHg)	79.2± 12.9	88.4± 14.8	5.46	0.01

BMI= Body Mass Index, SBP=Systolic Blood Pressure, DBP= Diastolic Bold Pressure, NC= Neck Circumference, OSA= Obstructive Sleep Apnoea

IV. Discussion

There is documented evidence on the role of physical activity in the causation and progression of diseases in humans. Physical inactivity (insufficient physical activity) is one of the leading risk factors for non-communicable diseases (NCD) and death worldwide. It has been demonstrated previously that compared to more active adult men and women, individual who are less active: are likely to have higher morbidity and mortality rates of non-communicable diseases. Similarly, weight-loss interventions mitigate the burden of OSA, and they are the target for the effective treatment of OSA. The objective of the present study was to establish if low physical activity is associated with an increased risk of developing obstructive sleep apnoea.

The frequency of the risk for developing obstructive sleep apnoea was higher in the low physical activity group compared with the participant with high physical activity: forty-four participant (26.8%) vs thirty-two (19.9%). However, the observed difference between the two groups was not statistically significant. This finding did not support the research hypothesis that individuals who were less active to be at increased risk of OSA haven adjusted for the other confounding variable. Also, our finding did not support the previous study by Evelien et al.: in a systematic review of several studies reported that low levels of physical activity are associated with higher odds of OSA.[17] In another study by Simpson and his colleagues, they demonstrated that relative to men and women in lower activity (sedentary) occupation, men and women in high activity occupation had fewer odds of developing OSA.[18] Most of the evidence supports low physical activity as an independent risk for OSA. The data from our study did not support solely low physical activity as a risk factor of OSA. The mechanism of how low physical activity could result in OSA is unclear, but it may act synergistically with obesity. There is sufficient evidence to support the role of obesity as a causal factor in the aetiology of obstructive sleep apnoea. The prevalence of OSA in an obese or severely obese patient is nearly twice that of normal-weight adults.[19,20] physical inactivity, on the other hand, is a modifiable key determinant of obesity. The mechanism by which obesity causes OSA is known. Obesity increase peri-pharyngeal fat deposition that offsets the maintenance of airway patency by the dilator muscles. The airway dilators are predisposed to collapsibility during sleep when there is a reduction in neuromuscular tone. Besides, central obesity reduces neuromuscular activity in the upper airway. Obesity also affects lung volumes by reducing the functional residual capacity. This reduction in FRC will accentuate pharyngeal collapsibility and subsequent loss in tracheal traction on the pharynx. Finally, a vicious cycle of sleep disruption leads to increase appetite, reduce physical activity levels, further weight gain.

In terms of the other risk factors for OSA: neck circumference, snoring, day time somnolence, systolic and diastolic blood pressure was found to be higher in the group with high risk for OSA compared to those with low risk. The mean neck circumference was 41cm (16 inches). The high-risk OSA group had higher systolic blood pressure and diastolic blood pressures compared to the low-risk group: (144.6 vs 129.6mm Hg and 88.4 vs 79.2 mmHg respectively). This finding is consistent with other previous studies that have documented similar findings.[21, 22]

Our study has some limitations. First evaluation of the physical activity was based on the study participants recall of their physical engagements over the past seven. An objective measure the activity level may further enhance the identification of the group at risk. Secondly, the assessment of Obstructive sleep apnoea was based on the psychometric tool: the STOP-BANG questionnaire. The result might be different if the determination of OSA was carried out by polysomnography. Finally, a large community-based study is further needed to validate our finding.

V. Conclusion

Obstructive sleep apnoea is a medical challenge of public health interest. Most of the cases of OSA are underrecognized and underdiagnosed. Physical activity is linked to the increased risk of developing OSA. The study did not show any significant association between low physical activity and the increase in the risk of developing OSA.

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