Tanzania Journal of Health Research
Volume 17, Number 1, January 2015
Doi: http://dx.doi.org/10.4314/thrb.v17i1.11

Prevalence and risk factors for obstructive sleep apnoea in Dar es Salaam, Tanzania

GRACE A. SHAYO* and FERDINAND M. MUGUSI
Department of Internal medicine, Muhimbili University of Health and Allied Sciences, P.O. Box 65001, Dar es Salaam, Tanzania

Abstract
Background: Obstructive sleep apnoea (OSA) is a common cause of daytime sleepiness, a condition associated with accidents, antisocial behaviour, mood disturbances, cognitive dysfunctions and inefficiency at work. This study was carried out to determine the prevalence and risk factors for obstructive sleep apnoea in Dar es Salaam, Tanzania.
Methods: Multistage random sampling of households was done. Eligible members were interviewed and underwent anthropometric measurements. Epworth sleepiness scale was used to asses one's likelihood of daytime sleepiness. OSA was defined as the presence of 2 of the following: symptoms of obstructive sleep apnoea, a Body Mass Index (BMI) ≥ 28 kg/ m^2 and a total Epworth score≥ 15.
Results: A total of 1249 people were involved in the study. Of these, 65.2% were females. Night snoring was reported by 9.3% of the respondents. The prevalence of OSA was 11.5% (144/1249). OSA was significantly more common among females (12.9%) (p = 0.038) than males. OSA prevalence increased significantly with increasing age (p <0.001) and increasing BMI (p- value < 0.001). Respondents with hypertension, central obesity and those who snored at night significantly presented with high prevalence of OSA, being 26.5%, 34% and 29.3%, respectively (p- value <0.001 for each). OSA was found in 26.3% of diabetics (p= 0.042). The odds of OSA were significantly higher among females, OR (95% CI) = 2.0 (1.2-3.2), among age group 45-54 years, OR (95% CI) = 2.2 (1.1-4.3), among those with central obesity OR (95% CI) = 3.4 (2.1- 5.4) and among night snorers OR (95% CI) = 2.8(1.7-4.6). Socio-economic status, cigarette smoking, alcohol consumption, hypertension and diabetes mellitus could not predict OSA.
Conclusions: OSA is prevalent among residents of Dar es Salaam and significantly associated with age 45 years or older, female gender, high socioeconomic status, obesity and overweight and night snoring. Predictors of OSA were female gender, age above 45 years, central obesity, and night snoring. Clinicians should therefore actively look for OSA in patients with these characteristics.

Keywords: sleep apnoea, obstructive, risk factors, prevalence, polysomnography, Tanzania

Introduction

Obstructive sleep apnoea (OSA) consists of nocturnal snoring interrupted by recurrent obstructive apnoea-hypopnoea episodes resulting into daytime hyper somnolence. Apnoea is a pause in respiration for more than 10 seconds while hypopnea refers to a reduction in ventilation by at least 50% resulting in a drop of arterial oxygen saturation of 4% or more (Isselbacher *et al*., 1996). OSA occurs as a consequence of upper airway obstruction seen in patients with increased adipose tissue in the neck as it is in obese people. It can also be a complication of craniomandibular abnormalities, hypothyroidism and acromegaly (Isselbacher *et al*., 1994; Olson *et al*., 2003). OSA is specifically more common in males, middle age of 40 to 65 years, cigarette smokers and in some disorders of muscles (Isselbacher *et al*., 1996; Olson *et al*., 2003). During sleep, muscle tone falls resulting in airway narrowing, snoring, hypoxemia, hypercapnia and elevation of blood pressure to as high as 250/150mmHg while arousal and sleep fragmentation have been reported to be up to 100 times per hour (Crummy *et al*., 2008; Marin *et al*., 2005).

* Correspondence E-mail: mundibilinga@yahoo.com

Doi: http://dx.doi.org/10.4314/thrb.v17i1.11

OSA is a common cause of daytime sleepiness (Crummy *et al.*, 2008). People with daytime sleepiness are at increased risk for accidents from machinery operations and motor traffic accidents (Olson *et al.*, 2003). They may become antisocial and inefficient at work. Mood disturbances and cognitive dysfunctions have also been reported (Olson *et al.*, 2003). Polysomnography is the gold standard tool for evaluation of this disorder. It records data on respiratory effort, airflow, oxygenation, sleep state, and other variables. Patients need to be admitted in a sleep laboratory for polysomnography and thus make the diagnosis very expensive (Terry *et al.*,1993). Epworth sleepiness scale, first published in 1991 is useful in making clinical diagnosis of OSA (Johns, 1991). Patients with Epworth scores of 11 or more and experiencing sleepiness during work or driving are regarded as having OSA (Johns, 1991).

OSA treatment requires lifestyle modification with weight reduction, moderation of alcohol intake and cessation of cigarette smoking. Treatment with continuous positive airway pressure (CPAP) is the treatment of choice though bariatric surgery can be curative in patients with morbid obesity (Sundaram *et al.*, 2005). There is no published data in Tanzania that addresses OSA as a health problem. This study, was therefore carried out to determine the prevalence of OSA and its associated risk factors in Dar es Salaam, Tanzania.

Materials and Methods

Study design, setting and population

This study was part of a cross sectional study conducted in Dar es Salaam from April 2007 to April 2008 to determine the prevalence of obesity, obesity related diseases and associated factors whose methodology have been published elsewhere (Shayo & Mugusi, 2011). In brief, a multistage random sampling was done. Kinondoni municipality was randomly selected from 3 municipalities of Dar es Salaam city, Tanzania. According to the 2002 National Census, the Kinondoni municipality had a population of 1,088,867 people, 42% of the residents were employees in both private and public sectors while 23.4% of the residents were self-employed, and 34.6% were involved in petty business, fisheries, livestock keeping and agriculture (Kinondoni Municipal Council., 2009). A total of 10 wards were randomly selected from 27 wards in the municipality. In each of the 10 wards, 2 streets were randomly selected making a total of 20 streets. From each street 1 ten-cell leadership was randomly selected and all the 10 houses that constituted a ten-cell leadership were studied, making a total of 400 houses. As the main study (Shayo & Mugusi, 2011) from which the present study emerged looked at the prevalence of obesity and its associated risk factors, we excluded pregnant women, mothers who were less than 2 months post-delivery, women who were on hormonal contraception and participants with oedema or wasting syndrome.

Data collection

We collected and recorded data on the age, sex, parity, marital status, level of education, occupation, weight, height, presence of hypertension and/or diabetes, random blood glucose, and waist circumference (WC). We also enquired for last normal menstrual period and date of last child birth for females. Respondents were asked to report if they were known diabetic or hypertension patients. Those who claimed to be known hypertensive or diabetic were required to show evidence for their hypertension or diabetes by showing the drugs they were using.

Epworth sleepiness scale was used to assess individual's daytime sleepiness. The Epworth Sleepiness Scale (ESS) is a simple questionnaire measuring the general level of daytime sleepiness in eight different situations and activities that are often part of everyday life. The 8 situations are sitting and reading, watching television, sitting inactive in a public place (e.g. a cinema or meeting, being a passenger in a car for > 1hour, lying down to rest in the afternoon when circumstances permit, sitting

Doi: http://dx.doi.org/10.4314/thrb.v17i1.11

and talking to a companion, sitting quietly after an alcohol-free lunch or being in a car, while stopped briefly in heavy traffic. The total ESS score is a measure of the average sleep tendency and the probability of falling asleep in those situations. The total ESS score is 24 with a range of 0-24. The upper limit of normal, based on a previous study on healthy adults, is estimated to be 10 (Johns, 1993). Participants in the present study were also asked to report if they experienced any of the symptoms of OSA namely choking while asleep, daytime sleepiness, morning headaches and a feeling of hangover though they consumed no alcohol in the previous night and if sleep partners have ever told them about witnessed apnoea at night. Participants were then classified as having or not having obstructive sleep apnoea by using a combination of the following: 1.Any of the symptoms for obstructive sleep apnoea 2. BMI ≥ 28 kg/ m² and 3. Total Epworth score≥ 15. Respondents who presented with any 2 of the 3 above were regarded as having OSA while those with 1 or none of the 3 were considered as not having OSA(Lim & Curry, 2000).

Participants reported their alcohol statuses and we categorized them into drinkers and non-drinkers. Only participants who were smokers at the time of the study conduction were considered smokers. Participants were categorized into 3 socioeconomic statuses (SES). Variables used to generate SES statuses were household income per month, possession of different properties and assets i.e. land, motorcycle, bicycle, car, a television set, house possession or house renting. The differences in the size of the house rented or owned in terms of the number of rooms were taken into consideration. The quality of the house was assessed basing on the quality of the building materials.

Physical examination

Waist circumference was measured using a non-stretchable tape measure at the level of the upper border of the superior iliac crest with the tape parallel to the ground and recorded to the nearest centimetre. Weight was measured using a bathroom scale (ADA, Germany) when participants wore only lightweight clothes and without shoes. Weight was recorded to the nearest 0.5 kg. Height was taken using a height measuring rod without shoes and recorded to the nearest centimeter. Height and weight were used to calculate body mass index (BMI) for each individual.

Data analysis

Data was entered and cleaned using EPI INFO version 3.3.2 and analysis was done using SPSS version 13.0. All categorical variables were analysed using frequencies. Cross tabulations and Pearson's Chi – square test were used to obtain the associations and strength of relationship between the independent and the dependent variables. SES of respondents was obtained by the use of factor analysis method whereby variables used to assess SES were converted into binary variables, their means, frequencies and standard deviations were calculated. Variables with low standard deviation were given a low weight considering a possibility that these variables were owned by almost all the households or not owned by any of the households rendering them poor discriminatory ability of the SES. Variables with high standard deviation were given a high weight.

A Principal Component Analysis (PCA) was then used to derive factor scores for every weighted variable. Variables that had a positive factor score were associated with a high SES while those with a negative factor score were associated with a low SES. These factor scores were analysed to generate 3 categories of SES(Vyas & Kumaranayake, 2006). Logistic regression analysis was used to control for confounding factors. In the regression model the dependent variable was presence or absence of OSA while the independent variables were factors that showed statistical significance on chi square test and on univariate analysis including; age groups, sex, marital status, Central obesity, night snoring, hypertension, diabetes mellitus and SES.

A BMI of < 18.5 kg/m² was used to define underweight, while normal weight was a BMI of 18.5 to 24.9 kg/m², overweight 25 to 29.9 kg/m² and obesity a BMI of ≥ 30 kg/m² (Crummy *et al.*, 2008).

Doi: http://dx.doi.org/10.4314/thrb.v17i1.11

General obesity was defined by BMI of ≥ 30 kg/m^2 while central obesity was defined as WC > 102cm for men and > 88 cm for women(Grundy *et al*., 2005). BMI was not put into the regression model because it was used to define an OSA case. A p-value of ≤ 0.05 was considered statistically significant.

Ethical considerations

Ethical clearance was obtained from the Research and Publication Committee of the Muhimbili University of Health and Allied Sciences. Permission to conduct the study in the district was obtained from the municipal authorities. Each participant gave a written informed consent to participate. Patients with suspected OSA were advised to reduce weight and alcohol consumption and were advised to consult a doctor for further management of OSA.

Results

We studied 1249 people, 65.2% (814/1249) were females. The mean age was 33.9±12.4 years, mean BMI was 25.3±5.7 kg/m^2. Night snoring was reported by 9.3% (116/1249) respondents. A total of 23.3% (291/1249) respondents reported daytime hyper somnolence, 21.9% (178/814) females and 26.0% (113/435) males. Central obesity was seen in 11.3% (141/1249) of respondents while general obesity was seen in 19.2 % (240/1249) respondents. There were 8.4% (105) smokers, 19.4% (242) alcohol drinkers, 9.4% (117/1249) hypertensive respondents and 1.4% (17/1249) diabetics. (Table 1).

Table 1: Socio-demographic and clinical characteristics of the respondents N=1249

Characteristic	Number (%)
Female sex	814 (65.2)
Night snorers	116 (9.3)
Daytime hyper somnolence	291(23.3)
Central obesity	141 (11.3)
General obesity	240 (19.2)
Cigarette smokers	105 (8.4)
Alcohol users	242 (19.4)
Known hypertension	117 (9.4)
Known diabetes mellitus	19 (1.5)

Generally, 11.5% (144/1249) individuals were considered having OSA. OSA was significantly more common among females (12.9%, 105/814) than (9%, 39/435) (p=0.038). Prevalence of OSA increased with increase in age. OSA was more prevalent in respondents aged 45 years or older, being 24.3% in age group 45-54 years and 20.7% in age group 55 years or older. Age group 18-24 years had the least prevalence (6.7%), (p value < 0.001). Prevalence of OSA increased with increase in BMI, being the highest among obese respondents (30.8%) and the least among underweight individuals (1.9%), (p value for trend < 0.001). Respondents with central obesity and those who snored at night significantly presented with high prevalence of OSA, being 34%, p<0.001 for central obesity and 29.3%, p < 0.001 for night snoring. A significantly high prevalence of OSA (26.5%) was seen among hypertensive respondents (p<0.001), among diabetics (26.3%) (p=0.042) and among respondents with high socioeconomic status (16.2%) (p=0.001). Alcohol drinking and cigarette smoking were not significantly associated with OSA (Table 2).

Doi: http://dx.doi.org/10.4314/thrb.v17i1.11

Table 2: Prevalence of OSA by socio-demographic and clinical characteristics (N=1249)

Characteristic	Category	Total Number	Number with OSA (%)	p-value
Sex	Male	435	39 (9.0)	
	Female	814	105 (12.9)	0.038
Age group (years)	18-24	330	22 (6.7)	
	25-34	413	30 (7.3)	
	35-44	251	34 (13.5)	
	45-54	144	35 (24.3)	
	55+	111	23 (20.7)	<0.001
BMI group (kg/m^2)	<18.5	54	1 (1.9)	
	18.5-24.9	654	28 (4.3)	
	25-29.9	301	41 (13.6)	
	≥ 30	240	74 (30.8)	<0.001*
Central obesity	Yes	141	48 (34.0)	
	No	1108	96 (8.7)	<0.001
Night snoring	Yes	116	34 (29.3)	
	No	1133	110 (9.7)	<0.001
Cigarette smoking	Yes	105	7 (6.7)	
	No	1144	137 (12.0)	0.103
Alcohol drinking	Yes	242	34 (14.0)	
	No	1007	110 (10.9)	0.172
Known hypertension	Yes	117	31 (26.5)	
	No	1132	113 (10.0)	<0.001
Known diabetes	Yes	19	5 (26.3)	
	No	1230	139 (11.3)	0.042
Socio-economic status	Low	53	5 (9.4)	
	Medium	775	71 (9.2)	
	High	421	68 (16.2)	0.001

*p value for trend

Females had a 2 fold increased odds for OSA than were males, OR (95% CI) = 2 (1.2-3.2), P= 0.005. Age group 45-54 years had a 2.2 times increased odds for OSA than was age group 18-24 years, OR(95% CI) = 2.2(1.1-4.3); p = 0.02. Central obesity was associated with a 2.8 fold increased odds for OSA compared to respondents without central obesity, OR (95% CI) = 2.8(1.7-4.6); p <0.001. Night snorers had a 2.8 fold increased odds for OSA than were non snorers, OR (95% CI) = 2.8(1.7-4.6); p< 0.001. Smoking cigarette, alcohol drinking, SES, Diabetes mellitus and hypertension could not predict OSA (Table 3).

Discussion

OSA was prevalent among residents in Dar es Salaam. Basing on polysomnographic studies, a population based study in Spain among people aged 30–70 years found a prevalence as high as 21%, although the mean BMI (25.8 kg/m^2) was comparable to that of the respondents in the present study (Durán *et al*., 2001). In the present study night snoring was common but we could not distinguish simple snoring from pathological. We also found OSA or risk for OSA to be more common among females than males. This is in contrary to other studies that have found OSA or risk for OSA to be more common among males (Terry *et al.*, 1993; Adewole *et al*., 2008). This could partly be explained by the fact that in the present study females had higher prevalence of obesity than males (Shayo & Mugusi, 2011). In a study in Nigeria both OSA and obesity were more prevalent in men than in women (Adewole

Doi: http://dx.doi.org/10.4314/thrb.v17i1.11

et al., 2008). This finding supports the fact that increased adiposity predisposes people to OSA (Isselbacher *et al*., 1996; Olson *et al*., 2003), and probably sex has nothing to do with it.

Table 3: Predictors of OSA by logistic regression among the study participants (N=1249)

Risk factor	Category	Univarite analysis OR (95% CI)	p-value	Multivariate analysis OR (95% CI)	p-value
Sex	Male	1		1	
	Female	1.5(1.0-2.2)	0.039	2.0 (1.2-3.2)	0.005
Age group (years)	18-24	1		1	
	25-34	3.7(1.9-6.9)	<0.001	0.9(0.5-1.5)	0.590
	35-44	3.3(1.8-6.0)	<0.001	1.3(0.7-2.38)	0.444
	45-54	1.7(0.9-3.0)	0.086	2.2(1.1-4.3)	0.020
	55+	0.8(0.4-1.5)	0.499	1.6(0.7-3.4)	0.250
Socio-economic status	Low	1		1	
	Medium	1.8(0.7-4.8)	0.208	1.0(0.4-2.8)	0.990
	High	1.9(1.3-2.7)	<0.001	1.1(0.4-3.0)	0.889
Central obesity	No	1		1	
	Yes	5.4(3.6-8.2)	<0.001	2.8 (1.7- 4.6)	<0.001
Nigh snoring	No	1		1	
	Yes	3.9(2.5 -6.0)	<0.001	2.8(1.7-4.6)	<0.001
Cigarette smoking	No	1	1		
	Yes	0.5 (0.4-1.2)	0.109	0.7 (0.3-1.7)	0.780
Known hypertension	No	1		1	
	Yes	3.3 (2.1 -5.1)	<0.001	1.6(0.9 -2.7)	0.111
Known diabetes	No	1		1	
	Yes	2.8 (1.0 -7.9)	0.051	1.2 (0.4 -3.7)	0.780

In the present study OSA was more prevalent among respondents aged 45 years or older; the same age presented with the highest prevalence of obesity (Shayo & Mugusi, 2011). This is in keeping with other studies which found OSA to be more prevalent among people aged 40 years or older (Durán *et al.*, 2001). Although OSA was common among hypertensive and diabetic respondents, the two conditions could not predict OSA. Hypertensive and diabetic respondents in the present study also presented with high rates of obesity. Other studies (Grote *et al.*, 2000; Peretz Lavie & Paula Herer, 2000; Durán *et al.*, 2001; Shayo & Mugusi, 2011) have reported higher rates of cardiovascular diseases especially hypertension in OSA patients. Excess hypertension cases among respondents with OSA might be a consequence of OSA itself and not the vice versa.

In conclusion, OSA is prevalent in Dar es Salaam. Female respondents, those who aged 45 years or older, obese or overweight, and those with high SES and who snored at night significantly showed high prevalence of OSA. Clinicians should therefore actively look for OSA in patients with these characteristics and treat accordingly.

Competing interests

Authors declare no conflict of interest.

Doi: http://dx.doi.org/10.4314/thrb.v17i1.11

Authors' contributions

GAS designed the study, supervised data collection and entered and analyzed the data. FM designed the study and eventually all the authors participated in the manuscript write up.

Acknowledgements

We are grateful to National Institute for Medical Research for partly funding the study. We acknowledge the support from the staff of all levels of the Kinondoni Municipality and the cooperation we received from the participants.

References

Adewole, O. O., Adeyemo, H., Ayeni, F., Anteyi, E. A., Ajuwon, Z. O., Erhabor, G. E., & Dewole, T. T. (2008). Prevalence and correlates of snoring among adults in Nigeria. *African Health Sciences* 8, 108–113.

Crummy, F., Piper, A. J., & Naughton, M. T. (2008). Obesity and the lung: 2. Obesity and sleep-disordered breathing. *Thorax* 63, 738–746.

Duràn, J., Esnaola, S., Rubio, R., & Iztueta, Á. (2001). Obstructive Sleep Apnea–Hypopnea and Related Clinical Features in a Population-based Sample of Subjects Aged 30 to 70 years. *American Journal of Respiratory and Critical Care Medicine* 163, 685–689.

Grote, L., Hedner, J., & Peter, J. H. (2000). Sleep-related breathing disorder is an independent risk factor for uncontrolled hypertension. *Journal of Hypertension* 18, 679–685.

Grundy, S. M., Cleeman, J. I., Daniels, S. R., Donato, K. a, Eckel, R. H., Franklin, B. A, , Gordon D.J., Krauss R.M., Savage P.J., Smith S.C. Jr, Spertus J.A. & Costa, F. (2005). Diagnosis and management of the metabolic syndrome: an American Heart Association/National Heart, Lung, and Blood Institute Scientific Statement. *Circulation* 112, 2735–2752.

Isselbacher, K. J., Braunwald, E., Wilson, J. D., Martin, J. B., Fauci, A. S., & Kasper, D. L. (1994). *Harrison's Principles of Internal Medicine*, 13th edition. McGraw-Hill, New York, NY.pp 1236–1238

Johns, M.W. (1991). A new method for measuring daytime sleepiness: The Epwoth sleepiness scale. *Sleep* 14, 540–545.

Johns, M. W. (1993). Daytime sleepiness, snoring, and obstructive sleep apnea. The Epworth Sleepiness Scale. *Chest* 103, 30–36.

Kinondoni Municipal Council. Municipal profile 2009. Retrieved from www.kinondonimc.go.tz

Lavie P., Herer, P. & Hoffstein V. (2000) Obstructive sleep apnoea syndrome as a risk factor for hypertension: population study. *British Medical Journal 320*, 479-482

Lim, P.V. & Curry, R. (2000) The role of history, Epworth Sleepiness Scale Score and body mass index in identifying non-apnoeic snorers. *Clinical Otolaryngology and Allied Sciences* 25, 244–248.

Marin, J.M., Carrizo, S.J., Vicente, E. & Agusti, A.G.N. (2005) Long-term cardiovascular outcomes in men with obstructive sleep apnoea-hypopnoea with or without treatment with continuous positive airway pressure: an observational study. *Lancet* 365, 1046–1053.

National Heart Lung and Blood Institute (NHLBI), NIH.What Is Sleep Apnea? http://www.nhlbi.nih.gov/health/health-topics/topics/sleepapnea/ (retrieved June 03, 2014)

Olson, E.J., Moore, W.R., Morgenthaler, T.I., Gay, P. C. & Staats, B.A. (2003) Obstructive sleep apnea-hypopnea syndrome. *Mayo Clinic Proceedings* 78, 1545–1552.

Shayo, G. A., & Mugusi, F. M. (2011) Prevalence of obesity and associated risk factors among adults in Kinondoni municipal district , Dar es Salaam Tanzania. *BMC Public Health* 11: 365.

Doi: http://dx.doi.org/10.4314/thrb.v17i1.11

Sundaram S, Bridgman SA, Lim J, L. T. (2005). Surgery for obstructive sleep apnoea. *Circulation* 112, 2735-2752

Young T, Palta M, Dempsey J, Skatrud J, Weber S & Badr S. (1993). The occurence of sleep -disordered breathing among middle -aged adults. *New England Journal of Medicine* 328, 1230–1235.

Vyas, S. & Kumaranayake, L. (2006) Constructing socio-economic status indices: how to use principal components analysis. *Health Policy and Planning* 21, 459–468.